

Foam Core Construction

Tools

X-Acto knife and blades

Your most important tool for working with foam core will be an X-Acto knife with plenty of sharp blades. When choosing a knife, get one with replaceable blades and a large diameter grip. #11 blades are good for general cutting with paper, foam core, cardboard and similar materials. Ideally you should change blades often when cutting foam core as they dull quickly. Having a sharp blade is vital to good craftsmanship, and generally makes the designer's life a lot easier. One expert designer once recommended, only partially joking, that you should change blades after every cut! A sharp blade is also safer than a dull one, since it's less likely to slip and result in an injury. Sharp blades will also result in a faster healing injury if you do get cut. For all of these reasons, X-Actos are recommended over other knives. They generally provide more control than matte knives when making a cut, and it is significantly easier to change their blades.

Metal straightedge

Long, heavy straightedges are useful because they don't slip, but most any straightedge will do if used with attention. Hold the straightedge in such a way that it will be held firmly for the entire length of the cut as they often tend to rotate at the end of the cut. Cork backs are good for preventing slippage. Be wary of cutting using plastic or wooden rulers, as the knife blade can easily catch on them and ruin your cut. T-squares and other draftsmen's tools such as plastic triangles can also be useful for squaring up your straightedge, as well as for other layout work. Placing weights on straightedges is also a

useful way to ensure the straightedge doesn't slip on critical cuts, especially if you don't have a heavy straightedge. Circle templates and compasses are also useful for cutting circles but aren't absolutely necessary for most design projects.

Cutting surface

Choose a workspace that enables your material to be maneuvered and lay flat on a non-precious surface. The most important considerations when choosing a cutting surface are (1) is it cut proof, and (2) will it dull your blades quickly? Invest in a self-healing cutting mat if possible; they provide a useful surface to cut into and also greatly increase the lifetime of your blades. They also have rulers and grids printed on them that can greatly simplify your work. Cardboard, old magazines, or the back of a large pad of paper are all excellent alternatives to a cutting mat, but if you plan do to serious work with foam core purchasing a nice large mat is highly recommended.

Adhesives

There are numerous methods for affixing foam core joints, including hot glue, traditional glues, and a wide variety of tape. A glue gun is required for working with hot glue. Any cheap one will work, although they do make fancy industrial guns with adjustable temperature settings. Multipurpose adhesive and Elmer's glue are both good alternatives to hot glue. They are easier to work with and have some nice properties, such as easy cleanup, and they provide more time to realign your work if you set it wrong.

Tips and Tricks

Cutting techniques and safety

Cut with your straightedge protecting the "good" surface of foam core; mistakes will then occur on unwanted side of cut. Use the whole blade of your knife, not just tip. The blade will last longer if you use all of it, which can be accomplished by lowering the angle of the knife as you cut. Most importantly, don't try to cut all the way through the material at once. Rather, make three shallow cuts: a light score on the surface to guide the blade, a second score penetrating into the foam, and a final cut clean through the opposite side. Make sure fingers are out of the cutting path. If using force, be aware of the potential blade trajectory if your hand should slip. Never kneel on the end of the ruler to hold it while cutting, as your knee will inevitably get cut. Also be aware of the "knife rolls off the table" trick—wear shoes! Finally, many X-Actos come with plastic caps to protect the blade when not in use. These caps should be used whenever possible. If a cap is not available, the blade can also be removed from the handle of the knife and re-inserted with the blade pointing inward.

Joining techniques

Numerous joining techniques can be used with foam core, including butt joints, 45 degree folded joints (both sharp and beveled), lap joints (in which the paper from one piece of foam core overlaps the edge of the other), and beveled edges with larger, more curving radii. Each of these techniques is illustrated

Rolf A. **Faste Foundation** for Design Creativity

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in the following pages. To create a folded edge with a soft bevel, for example, various amounts of foam can be removed from the inside of an edge, leaving paper on the outside to form a curve. A sharpie can be a powerful and convenient tool for scoring foam core in order to bend sharp corners of this nature. To do so, make a straight partial cut without cutting completely through, then score the partial cut with a sharpie, and then bend over the scored cut. Large radius curves can be formed by creating multiple parallel cuts, and then wrapping the form around a shaped brace on the inside of the curve. You can also make smooth curved pieces with regular paper and then apply packing tape to hold them in place.

Gussets, hinges, and holes

Gussets can be used to reinforce stress points. A variety of hinges can also be created, the most basic of which is a “living hinge,” in which the foam core is scored through one side leaving the paper to hinge away from the cut. A more complicated hinge involves inserting a wooden dowel through holes in the foam core to articulate a rotating joint. Holes are cut neatly with sharpened hollow tubing. If you need to make lots of holes, bevel the edges of brass tubing the same size as the desired hole and use it as a drill bit in a power drill. It is also possible to cut freehand circles... give it a try!

Gluing techniques and management

Traditional glues come in white, clear, and yellowish colors. Elmer’s glue is very good and dries clear, and although it takes longer to dry than other alternatives it generally yields better craftsmanship over all. When using white glue, projects can be manipulated for more construction within two hours but avoid

loading or testing projects until the glue has dried for at least 24 hours. When using white glue, map pins or long push pins are often required to hold the joint. The first set of pins should go in at right angles to locate the joint. A second set of pins should go in at angles to help prevent separation as the glue dries. Remove the pins when the glue has dried, and the holes will be negligible.

Hot glue is preferred by many designers for foam core. It’s very versatile and holds well, and is acceptable and good technique for people with experience. The downsides of hot glue include: it sets quickly, can leave a mess, and will burn your fingers if you aren’t careful! Because hot glue is messy in the hands of beginners, it is recommended to have a surface to place the hot glue gun (and collect drips) that is separate from your work. This should be easily discarded when your gluing is done. Avoid using your fingers to wipe off excess glue (it’s hot!). REPEAT, do be aware of the hot glue: it burns. Finally, before the glue dries completely it is possible to cut it off with a sharp X-Acto blade. Have a cutting surface handy as you are gluing your joints.

Surface treatment, found objects, and beyond

Foam core is useful for basic shapes but sometimes it nice to add details to your work such as textures and other surface treatments. Elmer’s glue can be layered on foam core or other materials and then sanded it to achieve different types of surface finishes and contours. Adding detail graphics to foam core can also be easily accomplished with pens, markers, and paper “skins.” Chartpak graphic tape is useful for adding details such grills, or accentuating edges to make them “pop.”

It is also worth experimenting with combining other non-foam core elements such as found or purchased objects. Often it’s easier and more effective to just go to a store and buy a component for a prototype rather than building it completely from scratch. For example, if you are prototyping a table with wheels out of foam core, consider purchasing some coaster wheels from Home Depot and gluing them onto your foam core table. Playing around with found objects is a great way to “physically sketch” and enhance your prototype iterations. Cardboard can also be used as a much cheaper substitute for foam core, and it has many of the same properties that make foam core appealing.

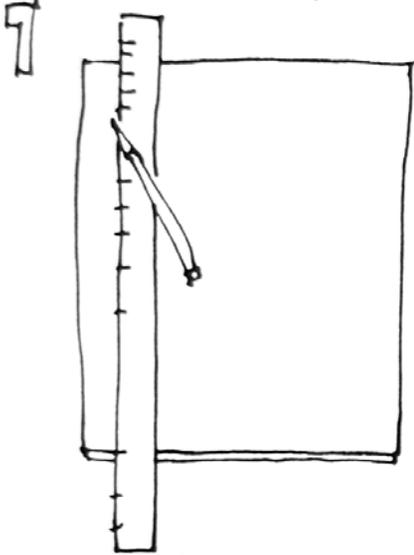
Finally, whatever material you use, be prepared to protect your prototypes from damage, especially rain. Have garbage bags ready in case it does rain.

Acknowledgements

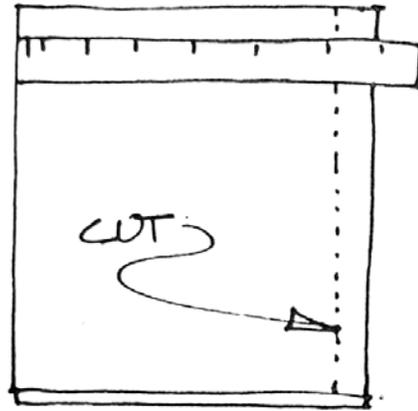
Originally compiled by Rolf Faste and Nancy, a Stanford TA, in the late 1980s. Drawings by Peter MacDonald, 1992. Additional content by James Pierce and Haakon Faste, updated and edited 2011.

▶ START OUT SQUARE !!!!

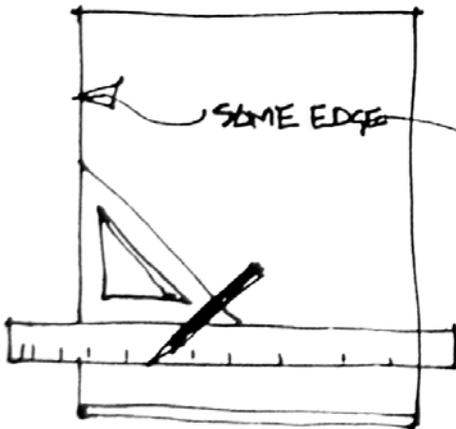
1 CUT ONE EDGE



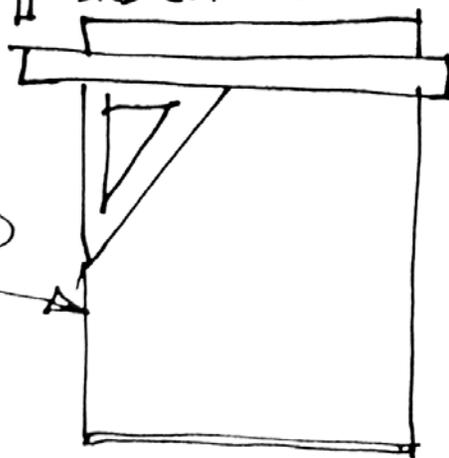
2 MEASURE OVER 2 POINTS AND MAKE A PARALLEL CUT



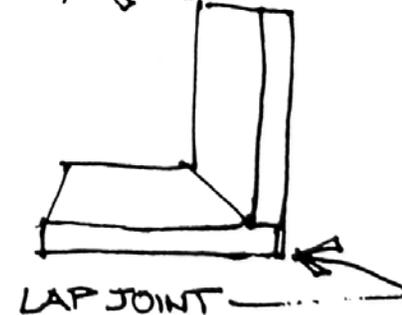
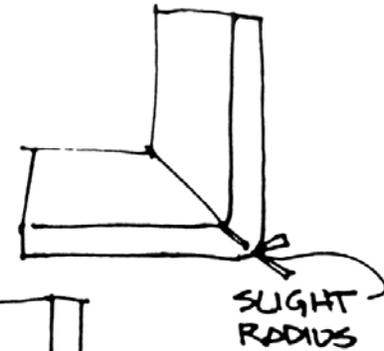
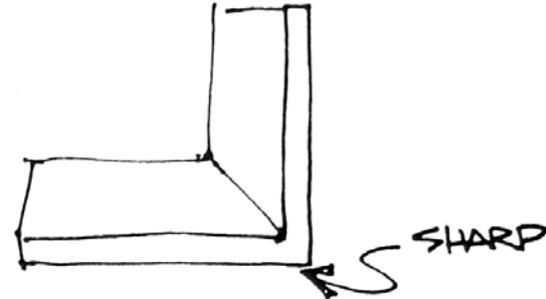
3 PICK TOP BOTTOM EDGE AND CUT 90° TO IT WITH A LARGE TRIANGLE



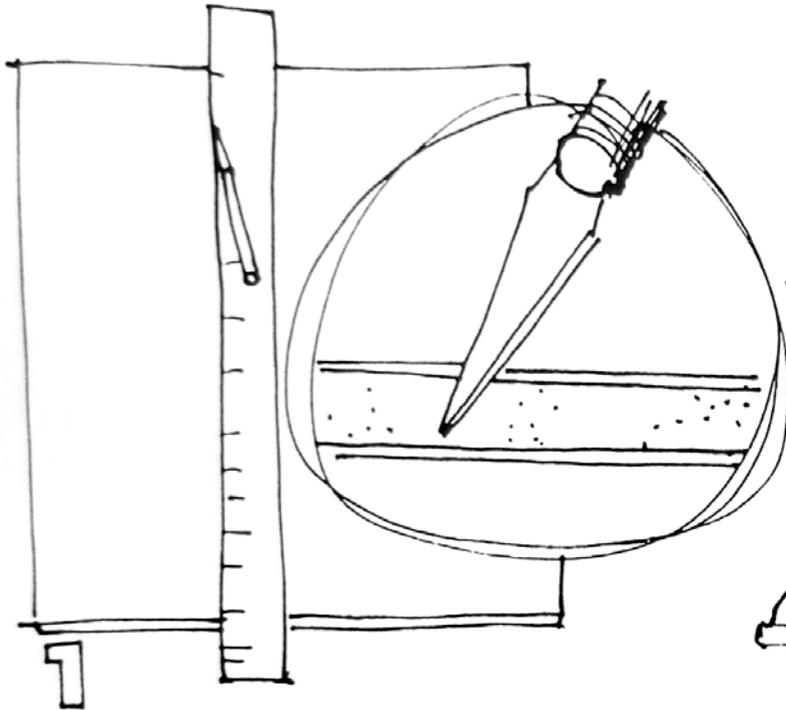
4 USE THE SAME EDGE AND CUT OTHER SIDE



▶ JOINTS



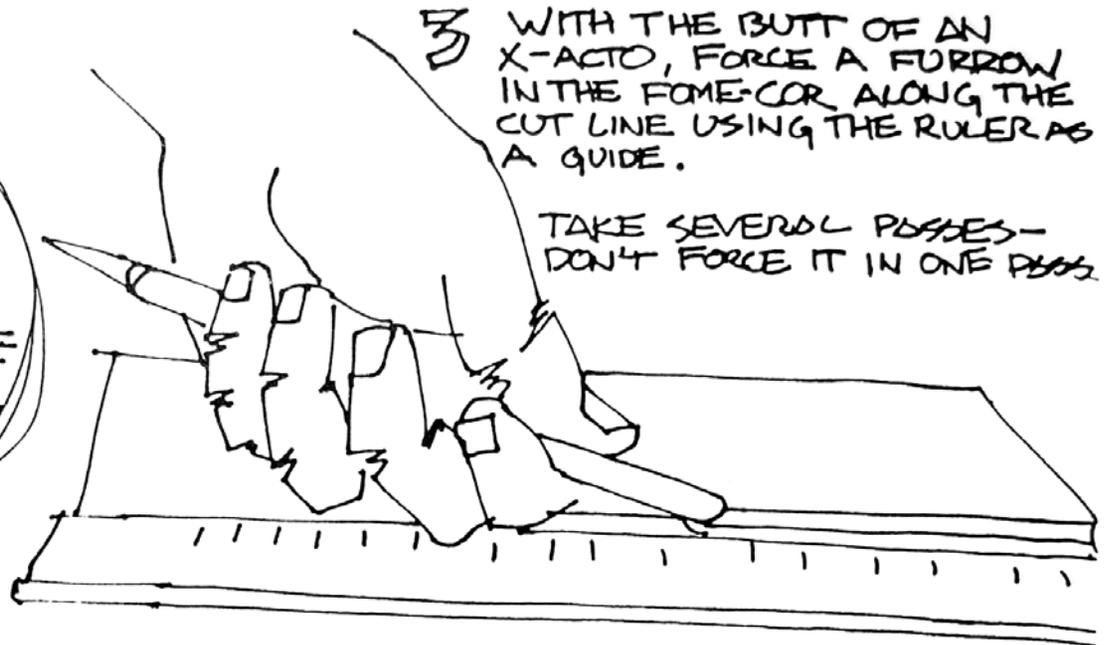
▶ JOINTS: SHARP



1 CUT DOWN TO, BUT NOT THROUGH THE 2ND SHEET OF PAPER

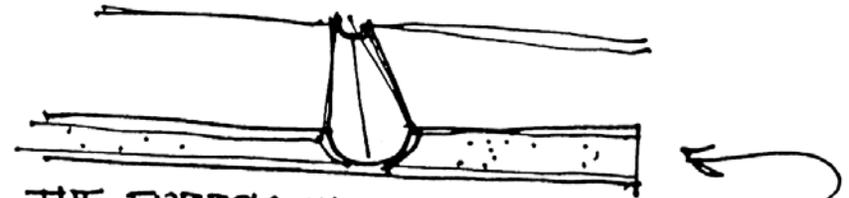


2 BEND SHEET BACK ON ITSELF.



3 WITH THE BUTT OF AN X-ACTO, FORCE A FURROW IN THE FOAM-COR ALONG THE CUT LINE USING THE RULER AS A GUIDE.

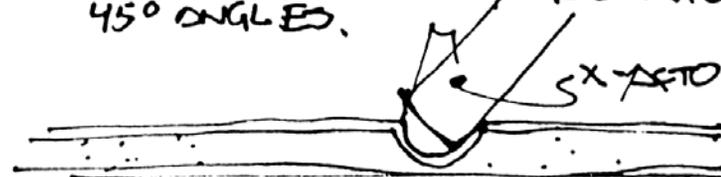
TAKE SEVERAL PASSES - DON'T FORCE IT IN ONE PASS.



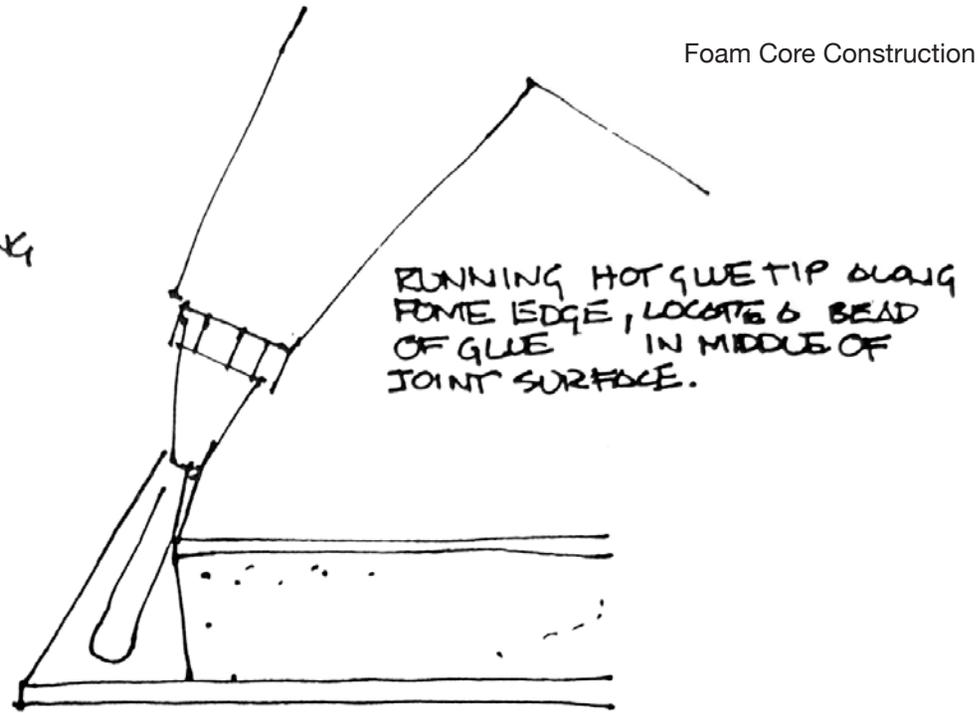
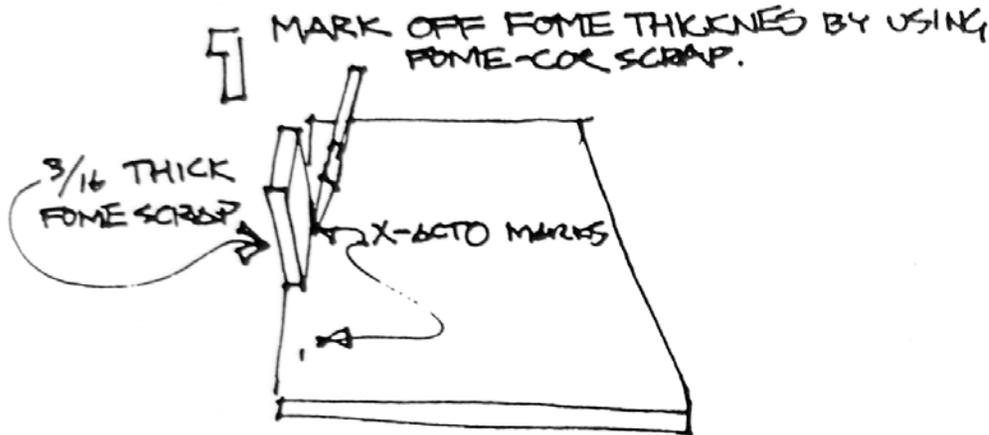
THE FURROW SHOULD LOOK LIKE THIS. NOTE THAT THE FURROW IS THE DEPTH OF THE FOAM.

4

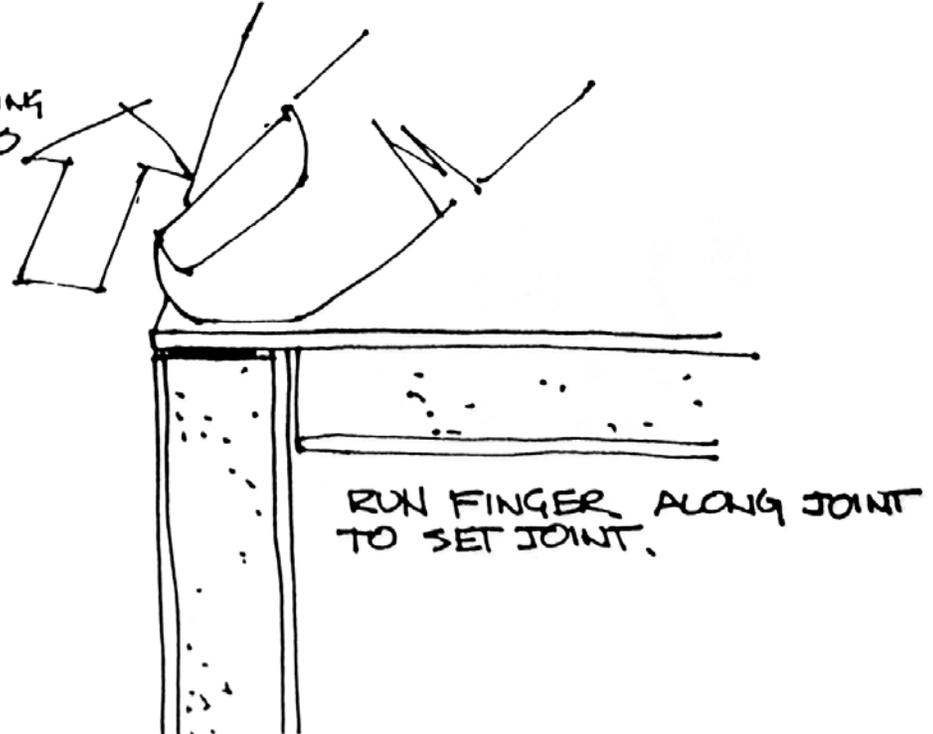
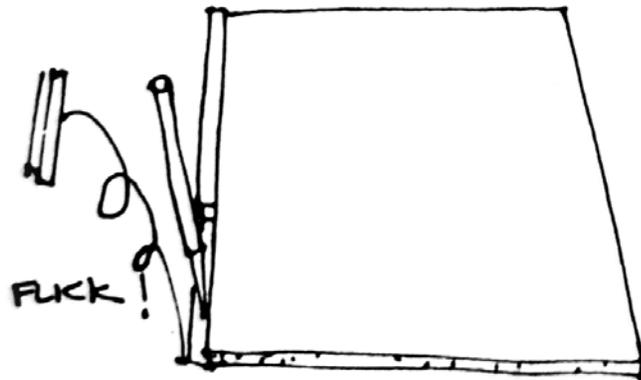
USE THE EDGE OF THE X-ACTO TO BREAK FURROW EDGES INTO 45° ANGLES.



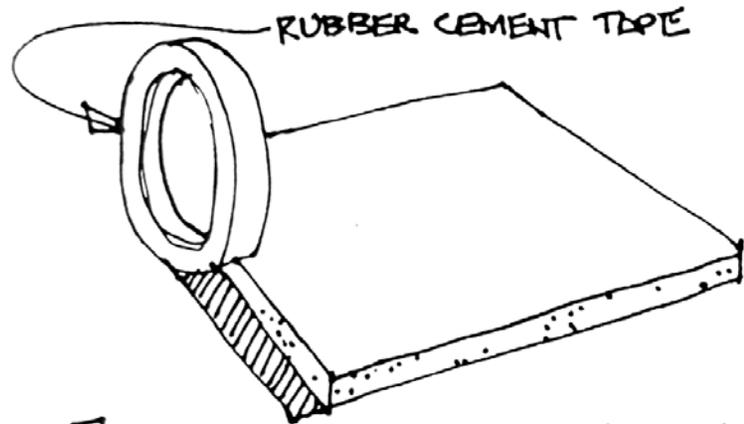
▶ JOINTS: LAP JOINT



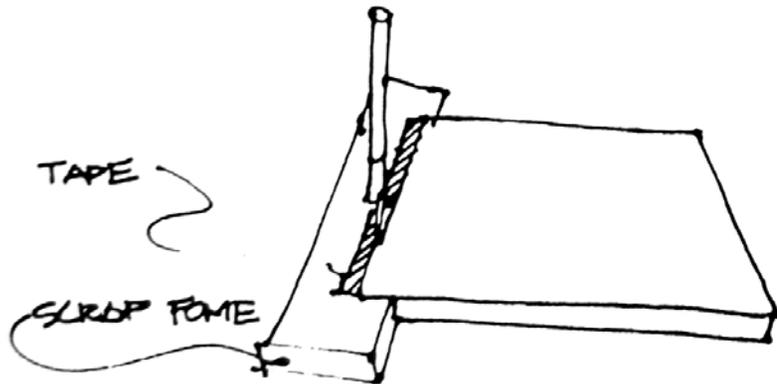
2 FLICK OFF 3/16" PIECE OF
FOAM AND PAPER. A QUICK FLICKING
ACTION SHOULD ONLY REMOVE EXCESS
FOAM AND VENT PAPER IN TACK. IF
FOAM REMAINS, CLEAN OFF.



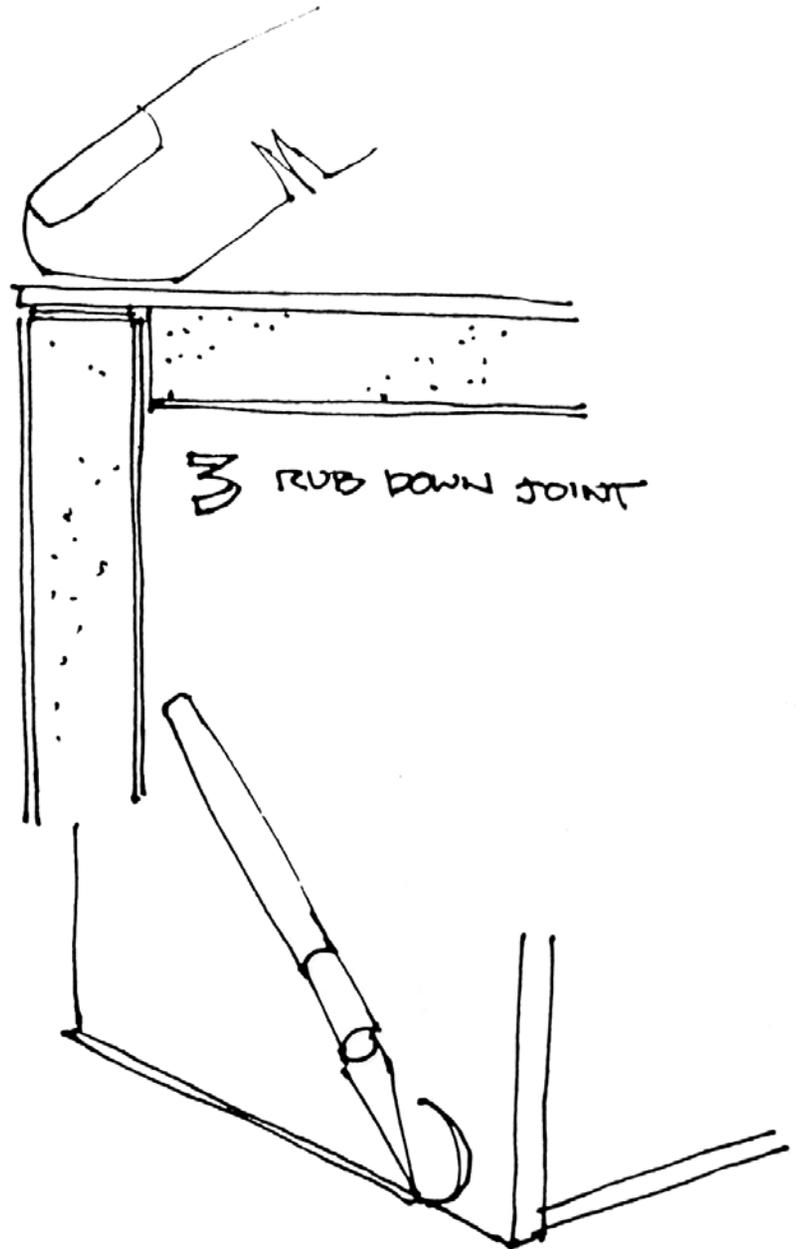
▶ JOINTS : LAP JOINT WITH RUBBER CEMENT TAPE



1 LAY DOWN RUBBER CEMENT TAPE ALONG JOINT EDGE



2 CUT THROUGH ADHESIVE BUT NOT THROUGH TAPE BACKING. REMOVE BACKING TO LEAVE ADHESIVE ON JOINT.

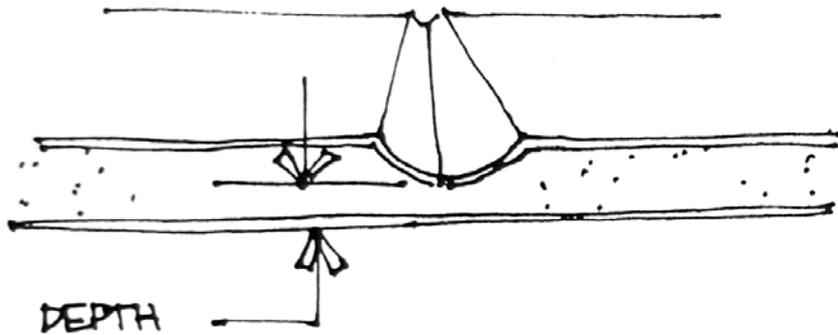


4 EDGE OVERHANG MAY REQUIRE TRIMMING.

▶ JOINTS: SLIGHT RADIUS

1 CUT DOWN TO BUT NOT THROUGH 2ND SIDE OF PAPER. DO NOT BEND SHEET BACK ON ITSELF.

2 SCORE FURROW WITH BUTT OF X-ACTO BUT CAREFULLY CONTROL THE DEPTH OF THE FURROW.

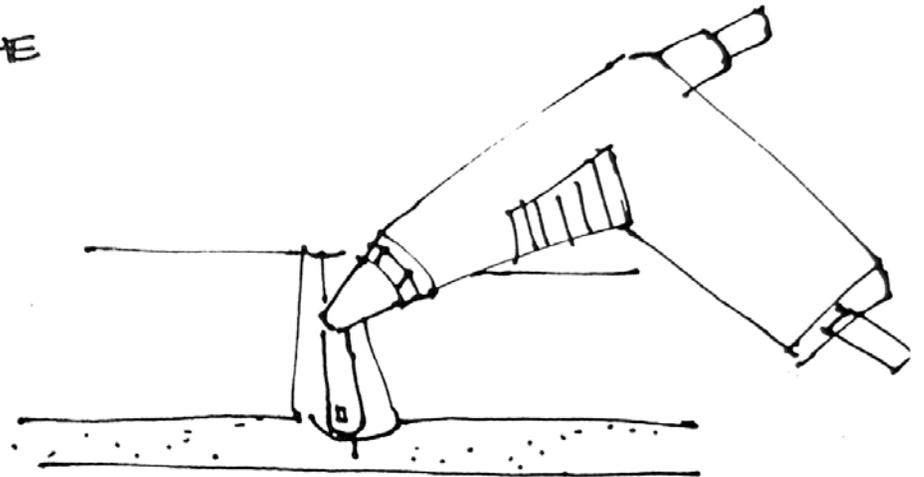


3 THE DEPTH OF THIS FURROW WILL DETERMINE THE CHARACTER OF THE RADIUS

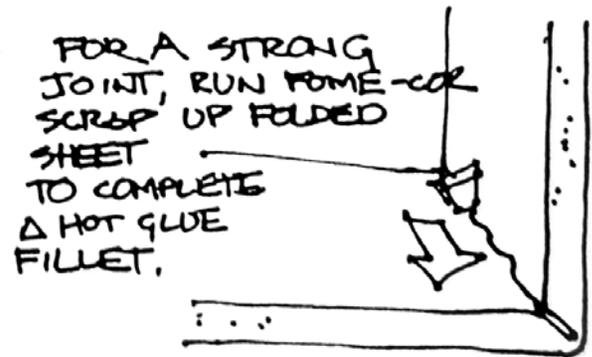
DEEPER = SHARPER

SHALLOW = SOFTER

4 CAREFULLY BREAK EDGES TO 45° ANGLES MAKE SURE YOU DON'T FORCE THE FURROW DEEPER. IF YOU DON'T BREAK THESE EDGES, THE RADIUS WILL DISTORT.

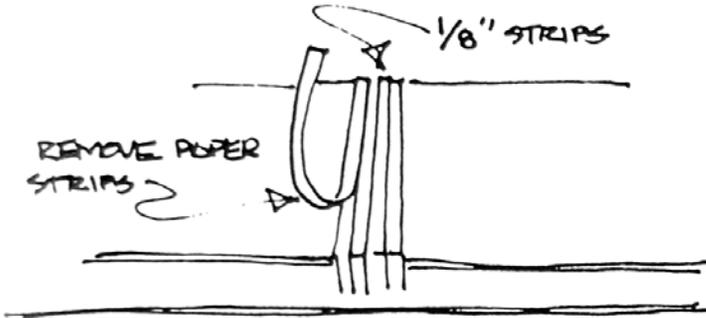


5 RUN A BEAD OF HOT GLUE IN COMPLETED FURROW.



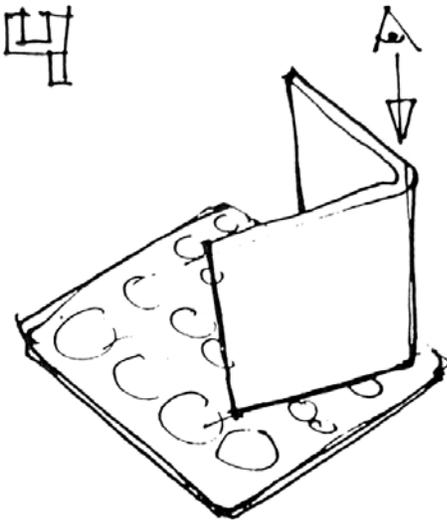
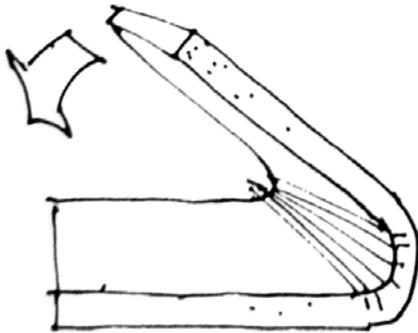
▶ JOINTS: LARGER RADIUS

1 CUT 1/8 INCH STRIPS THROUGH FIRST LAYER OF PAPER AND ABOUT 1/2 WAY THROUGH FOME.



2 STRIP OFF THE 1/8" STRIPS OF PAPER, STRIP BY STRIP. THIS IS HARDER THAN IT SOUNDS BECAUSE THE PAPER TENDS TO PE-LAMINATE AS IT IS STRIPED OFF. DO THE BEST YOU CAN WITHOUT DAMAGING FOME.

3 BEND THE SHEET GOING PAST THE INTENDED ANGLE OF THE FINAL JOINT. (THIS RELIEVES STRESS ON THE JOINT)



CHECK RADIUS BY EYEING ON A CIRCLE TEMPLATE.

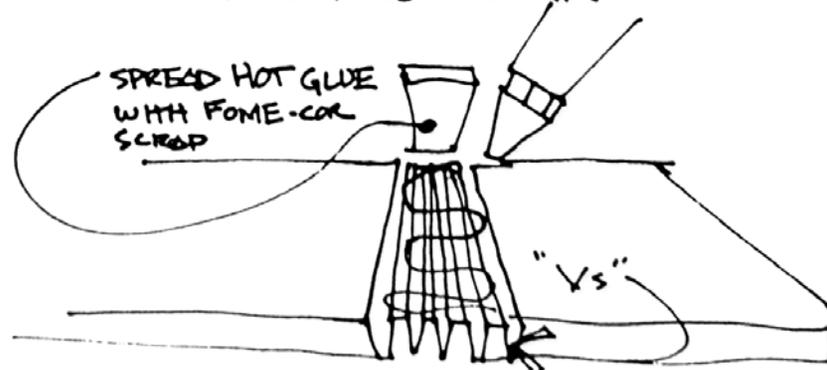
IT MAY TAKE SEVERAL TRIES TO GET THE RIGHT SIZE RADIUS.

ADJUST SIZE BY MAKING MORE OR LESS 1/8 SLOTS.

WRITE DOWN FINAL NUMBER OF STRIPS FOR REFERENCE.

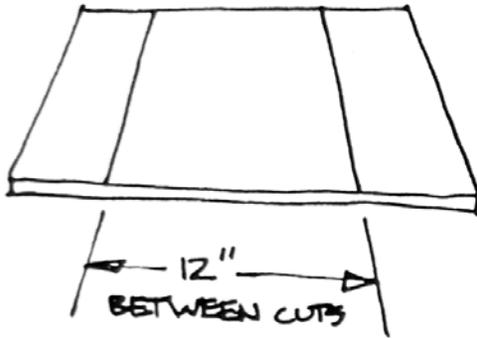
5 IF STABILITY OF THE JOINT IS REQUIRED OR YOU ARE GOING TO CUT CLOSE TO THE RADIUS DO THE FOLLOWING.

NOTICE THAT AFTER BENDING THE RADIUS THE FLATTENING OUT THE FOME HAS BEEN DEFORMED INTO "V" SHAPE GROVES. BY FORCING HOT GLUE INTO THESE "V's" AND FOLDING THE SHEET YOU WILL END UP WITH A STRONG, STRUCTURAL JOINT.

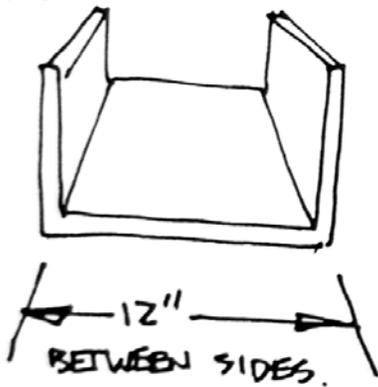


MEASURING

IN THEORY, IF YOU HAVE



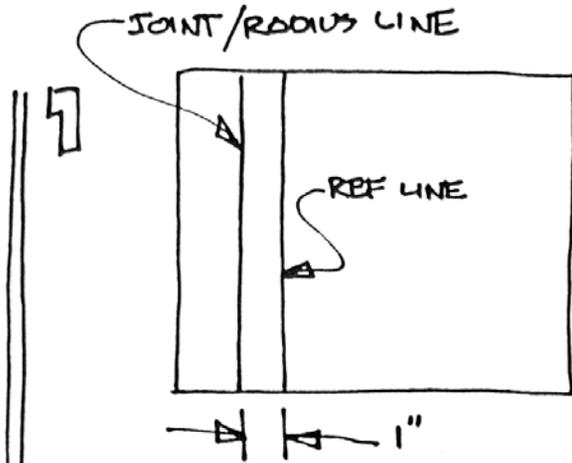
THEN YOU'LL HAVE



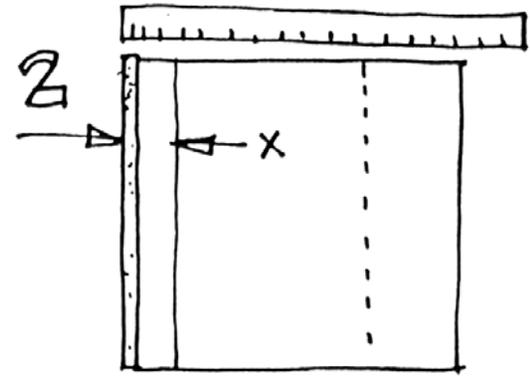
NOT QUITE!!!

JOINTS ALWAYS PICK UP SOME DIMENSION WHEN YOU FOLD THEM UP.

YOU MUST EXPERIMENT AND LEARN TO SUBTRACT THE DIMENSION GAINED.



SCORE OR DRAW A REFERENCE LINE
BEND THE JOINT UP TO 90°

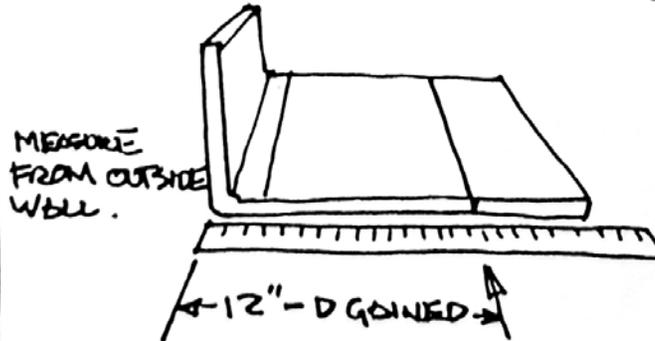


MEASURE DISTANCE FROM OUTSIDE SURFACE AND SUBTRACT REF DISTANCE

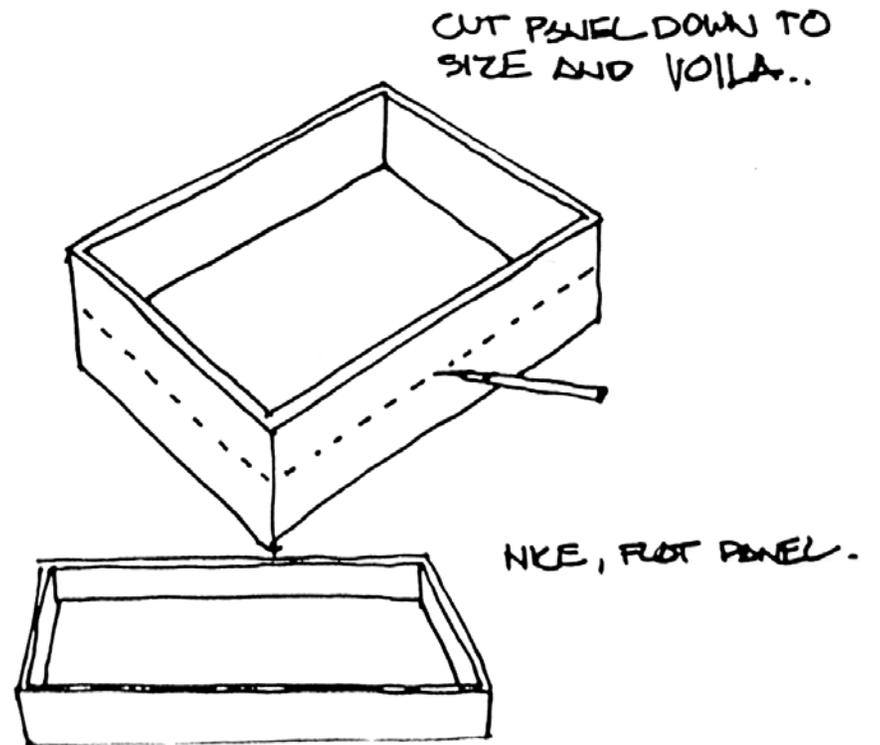
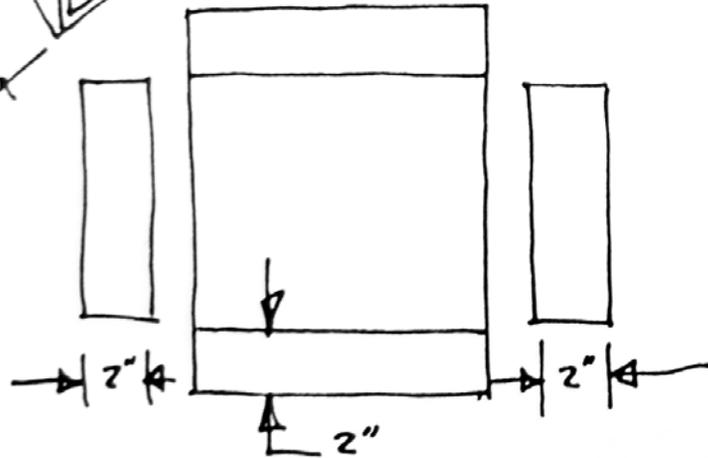
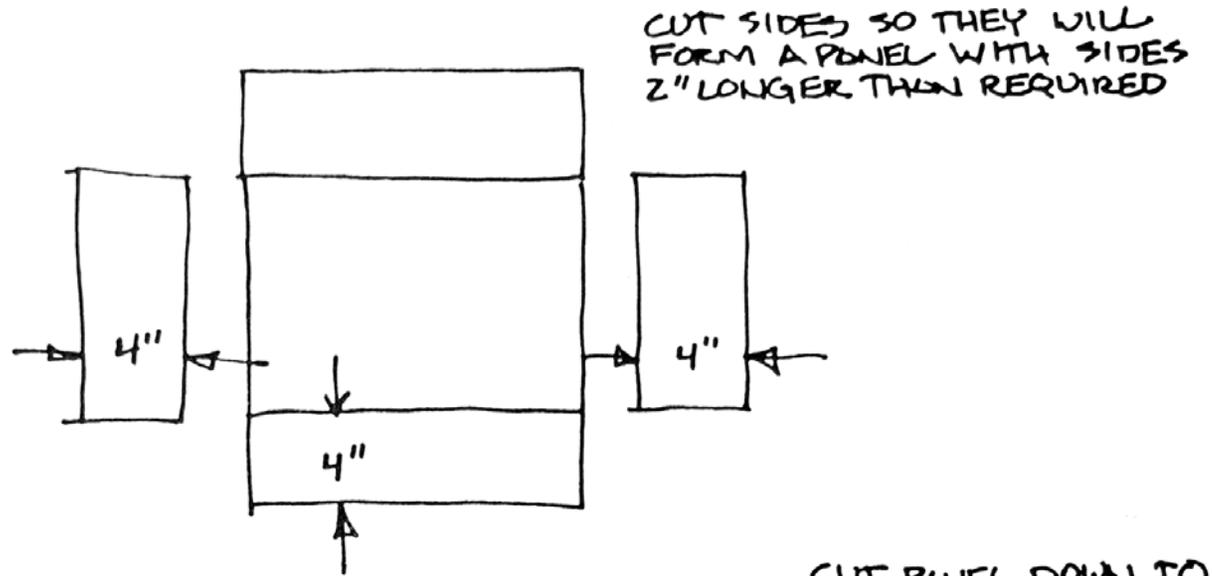
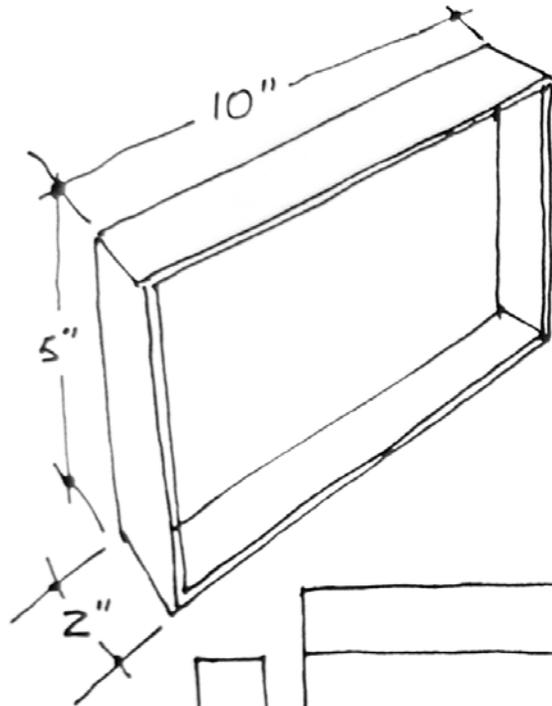
$$X - 1" = \text{DISTANCE GAINED}$$

THE LARGER THE RADIUS THE LARGER DISTANCE GAINED

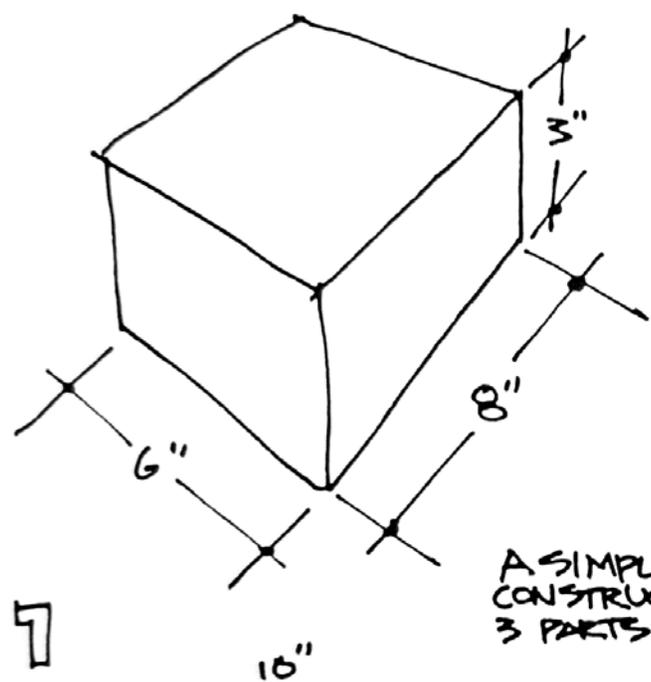
SUBTRACT DISTANCE GAINED FROM THE DISTANCE YOU WANT THE OUTSIDE SURFACES APART.



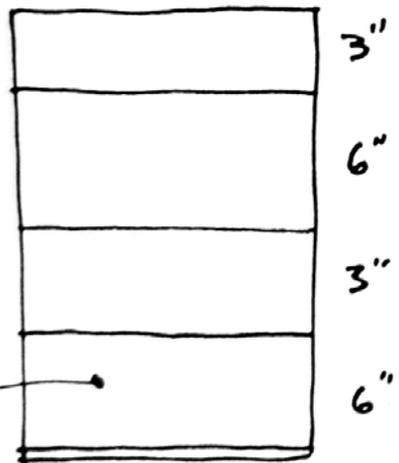
▶ A SIMPLE PANEL



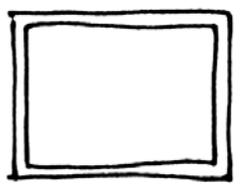
▷ A SIMPLE BOX



A SIMPLE BOX IS CONSTRUCTED USING 3 PARTS



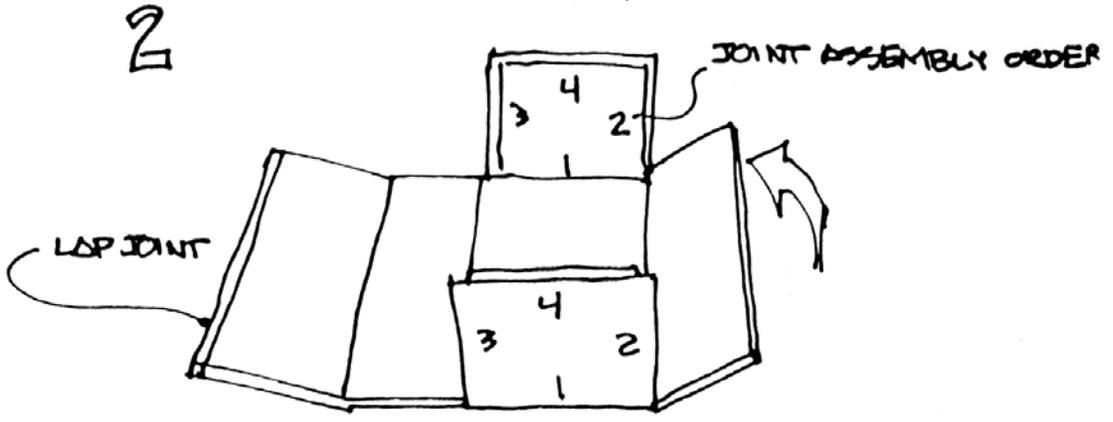
NEED 2 END CAPS.



REMOVE 3/16 ALL AROUND FOR LAP JOINTS.

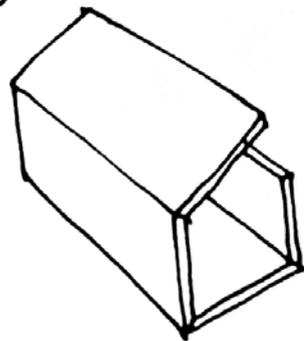
4 SIDED CENTER SECTION PICK LONGEST JOINT TO BE 6 FOAM-COR BEND JOINT.

2 HOT GLUE ASSEMBLY:



GLUE ONE SIDE AT A TIME ON BOTH END CAPS

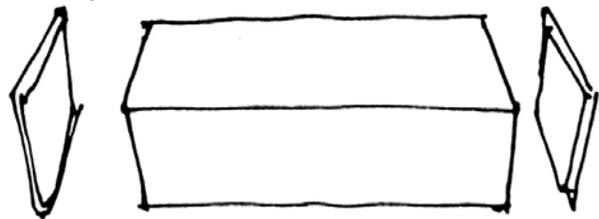
3 RUBBER CEMENT ASSEMBLY



JOIN LAP JOINT TO FORM A TUBE.

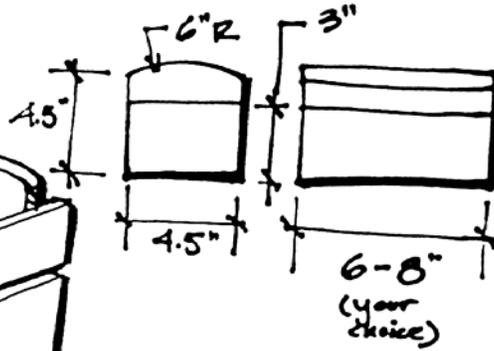
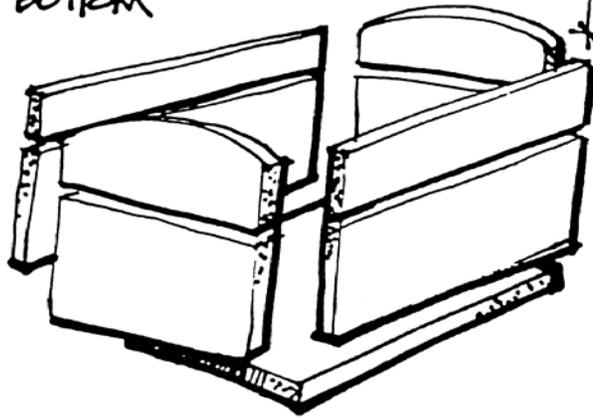
ADD LAP JOINT ENDS (WITH RUBBER CEMENT TAPE ON JOINTS)

CHECK BOX FOR SQUARENESS

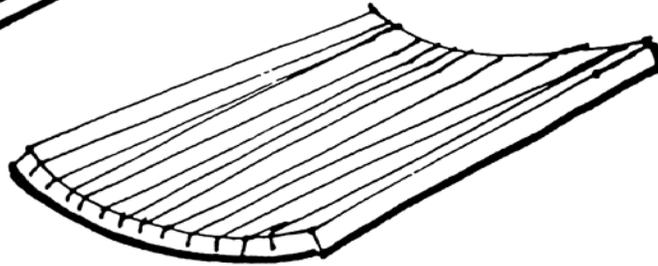


DISK BOX

① CUT SIDE PARTS & BOTTOM



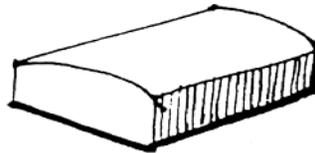
② CUT CURVED TOP



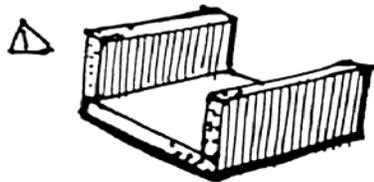
③ ASSEMBLE TOP



②



④ ASSEMBLE BOTTOM



②



⑤

FIT IN TOP GUIDES



⑥

TEST FINIS!



KJAN 92 - P. MACDONALD
REV 23 OCT 92