Making accurate cuts on a 4'x8' plywood panel with a circular saw
"The Plywood Solution"

Over the years I have enjoyed doing woodwork. Some of these projects requires cutting a 4'x8' piece of plywood into smaller pieces. My only tools for cutting the plywood was a small table saw and a circular saw. The table saw is restricted to a max. 24" wide rip cut and a much smaller miter gage cut. So the dilemma here, which involves most woodworkers sooner or later, is how do you cut sections of plywood small enough to finish on the table saw and maintain a strait cut with a 90degree angle? How do you accurately cut panels larger than the table saw will accommodate? The only tool available in my small garage-driveway shop is the circular saw, so the thought occurred to me, the circular saw has the capability to cut an accurate strait line if I could discover a method to very accurately locate the fence.

1 Provide an offset gage that would accurately measure the distance between the face of the fence and the cut line. The offset gage is initially adjusted on the offset jig, and may require a final adjustment from the feed back information from the first cut.

2 Provide a flat rule with a dimension stop devise that can be adjusted to the required cut dimension.

3 Utilize contact dimensions between the face of the fence, the offset gage and the stop device on the flat rule. For example the machine shop micrometer is capable of very accurate measurements only if it actually contacts the part that is being measured.

What is the plywood solution?

The plywood solution is the incorporation of familiar tools, ideals, methods and one new part, the offset gage, in such a way that produces very accurate cuts. The table saw is an exceptional tool that can produce very accurate cuts and produce very small parts very quickly. But most table saws have a limit on the maximum panel size that it can practically accommodate. On the other hand the plywood solution can accommodate large heavy panels with 8' long cuts but cannot cut a panel smaller than about 6". The plywood solution can do what it does best with cutting large panels into smaller parts that can be transferred to the table saw so it can do what it does best. The plywood solution will produce very accurate cuts and transfers near perfect 90degree angles. Because the plywood solution and the table saw have the ability to enhance the performance of each other when they work together, the total performance of the combination is greater than the simple total of the two,

The offset gage

The offset dimension is the distance from the jig fence to the right side of the trail cut. It is also the distance from the end of the screws to the contact face of the calibrated offset gage. When the offset gage is calibrated the contact face will line up with the right side of the jig trail cut.

(see detail A) If we were to physically measure the offset dimension, or the distance from the jig fence to the right side of the trial cut, we would arrive at about 1-27/64"+/-. So what could we possibly do with this approximate dimension? We are woodworkers, not machinist. However, the problem can be solved by using contact dimensions. The offset gage can be calibrated very accurately without knowing the absolute mathematical value of the offset dimension. If the offset gage is calibrated and is in contact between the rule and the fence it will tell the saw blade exactly where to cut. (the measured dimension above is for the saw-blade combination that I am using).

Making the offset gage

The offset dimension will very from approximately 1-1/8" to 2" depending on the type of circular saw and saw blade cut width combination. Drill two 3/16" holes for the #10x32x1" screws. Do not use a tap for the threads because the screws will be loose and may not maintain the adjustment. The screws can tat there own threads. The length of the thread engagement into the plywood will determine the proper fit. For baltic plywood the screw will be loose if the engagement is much less than 3/4" and the screw will be too tight if the engagement is much more. For denser hard woods it is advisable to drill some trail holes to determine the proper engagement. The 3/16" holes are on the centerline of the 18mm plywood so if the contact face of your fence is less than 3/8" you need to move the screw down to make good contact with the fence.

Calibrating the offset gage

(see photo) With the screws installed, place the gage on the jig and turn the screws clockwise until the outside face of the gage lines up with the outside edge of the saw cut. Place an adjustable square in the jig saw cut. Use a combination of feeler gages to press the strait edge in contact with the outside edge of the saw cut. Place the offset gage against the jig fence. Adjust the top screw so that the contact face of the offset gage is lined up with the outside edge of the saw cut and the strait edge. Flip the offset gage end over end and adjust the bottom screw.

It has been my experience that it is possible to feel a misalignment of two edges that are in contact that may be very difficult to see. I think it is possible to feel a misalignment of .007" or 1/128". By rubbing your finger back and forth over the misalignment, between the edges of the offset gage and the strait edge you can determine which edge projects up or if they are both aligned. So now if you adjust the top screw, flip the gage end over end and adjust the bottom screw and you cannot feel any difference between the edges of the gage and the strait edge, you are calibrated.

For a correction of 1/32" - (0.03125") turn the screw 1 turn
For a correction of 1/64" - (0.01563") turn the screw ½ turn
For a correction of 1/128"- (0.00782") turn the screw 1/4 turn

The offset jig

I made the offset jig from some scraps of solid oak for the fence and oak plywood for the base. The fence face that contacts the offset gage should be strait and vertical and the fence can be screwed to the base. Make a trail cut with the circular saw and saw blade combination that you will be using. A plywood saw blade is recommenced.

Contact dimensions

We can also use contact dimensions on the rule. With the stop devise in contact with the lower edge of the plywood panel and the top of the rule in contact with the offset gage and the offset gage in contact with the fence, we are able to locate the fence parallel to the lower edge of the panel with high accuracy. Even if we could measure it, the difference in parallelism on a cut panel will probable be a few thousands of an inch. This is possible because we used the same preadjusted rule on both ends of the panel to locate the fence. This allows the cut dimension to be very accurate but what may be more important it provides a method to accurately transfer the original factory 90 degree angle to all cut panels. If you need to cut a 4'x8' panel into eight 11"x 4'-0" panels, set the rule (one) time and make 8 cuts and you will have 8 identical panels.

So do we really need such accuracy in woodworking? Probably not, but if we take out the contact feature the whole thing falls apart: however, as a woodworker I will pursue the accuracy, not because I need it for any of my projects, but because it is here, because it is available, and because it is irresistible.

A quick check for accuracy of the first cut

Place the flat rule on the cut panel with the stop at the bottom of the panel .The top of the panel should line up with end of the rule. If you can see or feel any difference you can make a feed back adjustment on the offset gage. The #10 screw has 10 threads per inch.

If the panel is shorter, the offset gage dim. Is too short. To correct turn the screw clockwise
If the panel is longer, the offset gage dim. Is too long. To correct turn the screw counter clockwise
For a correction of 1/32" turn the screw 1 turn.
For a correction of 1/64" turn the screw ½ turn.
For a correction of 1/128" turn the screw 1/4 turn.

Set-up for cutting plywood panels

Provide a rigid fence that will not deflect. A 2"x1/8" rule is recommenced so it will not deflect if it hangs over the edge of the plywood. When setting the stop device on the rule, make sure the tightener screw is located on the bottom side of the rule, 0r on the 0pposite side from the dimensions. Locate the rule close to and parallel to the side of the panel.

Step 1 (see photo) Assemble the fence, gage and rule that is stopped at the lower edge of the plywood. Visually aline the fence parallel to the lower edge 0f the plywood. Now lightly clamp the fence to the plywood. The quick grip type clamps are recommended because you can hold down the fence in place with one hand and apply the clamp with the other. This is a temporary clamp-up to help aline the fence and will be realigned in step 3.

Step 2 move the offset gage and the rule to the other side. Move the end of the fence in contact with the offset gage. With all parts in contact, press down on the fence with one hand and tighten the clamp with the other.

Step 3 move the offset gage and the rule back to the other side and close any small gap between the fence and the offset gage. With all parts in contact press down on the fence with one hand and tighten the clamp with the other.

So now the question is why did we have to realign step 1? When we went to step 2 we had to move the free end of the fence in order to make contact with the offset gage. When we moved the free end of the fence the whole fence moves all the way back to the clamp; however, most movement occurs at the free end a very small amount , maybe a few thousands of an inch, can occur close to the clamp.

Set up for cutting angles

The set up for cutting angles is the same as cutting a 90 degree angle, except one end of the fence together with the off set gage is moved to the correct angle to be cut. The angle is determined with a miter gage with an auxiliary fence.

* Locate the rule so that the outside edge lines up with the edge of the plywood panel. Clamp the rule with a clamp that will also support the end of the miter gage bar. The dimension set on the rule will determine the point where the angle cut line starts on the panel edge.
* Set the required angle on the miter gage. Place the miter gage auxiliary fence in contact with the saw fence and the miter gage guide bar in contact with the plywood panel edge.
* Place the off set gage in contact with the saw fence and the outside corner at the top of the rule.
* Make sure there is contact between the miter gage fence, the saw fence, the off set gage and the clamped rule. Now go to the opposite side and clamp the saw fence to the plywood panel.
* Remove the miter gage and recheck that the saw fence, the off set gage and the outside corner of the rule are all in contact. Clamp the saw fence to the plywood panel and make the angle cut.

The reliability and the repeatability of the angle cut will depend on how accurate we can set the miter gage, and how strait the wood auxiliary fence is. If the wood fence is in question, it may be better to remove the fence and make direct contact between the miter gage and the saw fence. The auxiliary fence in the photo is a 1"x2"x1/8" alum. Fence that I have been using for 5 or 6 years, and I will never go back to wood.

A test for accuracy, repeatability and reliability 7/20/10

I cut 5 panels 6" wide and 4'-0"long and measured the width of each panel. The panels were measured at 3 locations. The first and third locations were 4" in from each end, and the second location was at the center of the panel.(see photo) I used two adjustable squares that were clamped lightly on each edge of the panel. I used a very accurate machinist 12"rule that has 1/64"graduations together with a magnify lens. The stop on the large rule that contacts the offset gage is set at 6".

The deviation from 6" is shown in the graft below.

Location	1	2	3
Panel 1	+ 1/128	0	+ 1/128
2	+ 1/128	+1/64	0
3	0	-1/128	+ 1/128
4	+1/128	+1/128	- 1/64
5	+1/64	+1/64	0

1/32" = .031 1/64" = .015 1/128" = .007

An accuracy of +/- 1/64 seems to be acceptable.
The repeatability and reliability are very good.

The 90 degree angles were accurately transferred at each of the 5 cut, including the new 90 degree angle transferred to the remaining part of the 4'x8' panel.

The odyssey of the plywood panel

The adventure 0f moving plywood panels from the plywood store to final assembly and lifting only half the total weight of a single panel.

I have a small pick up truck, so the plywood will not lay flat on the bed. I have two 2x4s that clamp to the top of the bed sides, and the plywood rest on the top of the 2x4s. When I purchase plywood there is always a store guy that helps me load. When we pick up a panel I will select the good side and we will turn the good side down. When I return home I will back into the drive way and roll out my working table which has a 32"x79" solid core top. The plywood panels on the truck are a few inches higher than the table top, so it is easy to slide the panels onto the table ,one at a time, without lifting the total weight of a panel. If you have 3 or 4 panels slide all of the panels on to the table top with the good side down. Now we are ready for the plywood solution. Place spacers under the top panel. You can make all plywood solution cuts down to table saw size if you know all the dimensions, or make one or two P. S. cuts and go directly to the table saw. For assembly you can place a 4'x4' piece of hard board on top of the top panel and on the opposite end from the plywood solution activity. Now you can make a P. S. cut , go directly to the table saw and do some assembly as required all on the same table at the same time. This store to assembly procedure is especially beneficial for a one man operation like myself , working in a drive-way shop, and it is also beneficial for a contractor that must do most of his work on the job site.

The advantages of the plywood solution

1 The most important advantage is that the large and some times heavy panels are located on a table or saw horses and all necessary P. C. cut are made that produces smaller parts that can be finished on the table saw. Rough cuts have been eliminated except for a few special conditions. Onfeed tables and outfeed tables are no longer required, although they may occasionally be used.

2 The P.S. cuts can be extremely accurate in length and in transferring the factory 90 degree angle to the remaining part of the panel. The set up for P. S. Cuts are faster and easer if you consider the extra time and material the rough cuts may require to reestablish a strait cut and the factory 90 degree angle.

3 To use the plywood solution the woodworker needs only information on how to do it. If he has a circular saw, a fence, a flat rule with a stop devise, two clamps and a few scraps of plywood, all he needs is two screws and information on how to do it.

4 With the plywood solution the 4'x8' plywood panel lays flat on the table and the saw blade moves across the panel. With the table saw the panel must move across the saw blade. The larger and heaver the panel the great the problem.

5 To make a cut with the plywood solution the circular saw moves from right to left or it is right handed. For a shop made cutting guide and for some track saws the circular saw moves from left to right which makes them left handed.