

TurboCAD® Mechanical

Version 15

Getting Started Guide

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Getting Started Guide

This guide is designed to get you acquainted with the basics of the tools available to you in the TurboCAD Mechanical Edition. It is not designed to teach you CAD or the basics of TurboCAD itself. Before using this guide, you should read the Getting Started Guide that came with your application (if one was provided) and you should familiarize yourself with the manual and TurboCAD itself.

Best Practices

If you are just learning the application it is OK to just dive right in and begin modeling. However, before you begin creating production models, there are some things you should keep in mind. These are called Best Practices.

Best Practices for Setup

Setting up the application and your drawing setting is a key step in making your modeling experience more productive and efficient. The following is a checklist of things you should do before you begin:

- Select the units and unit system you will be using in your drawing.
- Set up the grid and grid settings that will make using the grid easiest for you.
- Set up the layers that you will be using in your drawing. If your company or clients have standards for layers, use those.
- If you use standardized line styles or print styles, create them before you start.
- Save your setup drawing as a template. This will ensure that you do not have to walk through the setup process every time you start a model.
- If you start with a template to start, remember to save the file under a new drawing file name before you proceed. This will prevent you from accidentally overwriting your template.
- Set up and understand the Snaps and Geometric Alignment Aids you will be using.

Best Practices While Modeling

Once you have set up your drawing, there are some steps that will maximize your efficiency while you are modeling. The following is a checklist of these practices.

- Use blocks, which increase the efficiency of your model. Blocks reduce file size and make your operations more effective. A good rule of thumb: If you use an object or part more than once in your model, make it a block first.
- Use Layers, Categories and Graphics available from the Design Director, to keep your drawing organized. This might take some time at the front end of a project, but in the long run this will save you time and make your modeling smoother.
- Save frequently - there is no better way to prevent the loss of hours of work. Make sure that both the Auto Save and Backup functions are turned on.
- Name your saved files using a sequential naming scheme: e.g. “model_ version1,” model_version2,” etc. This will allow you to jump in and make changes from a particular point in the modeling process. If you use a source control application to protect your files, use it daily to protect your work.
- When possible, perform your edits in the Selection Info palette, rather than using Undo/Redo. This will keep your models more robust, and will give you greater control over model changes.
- Use SEKEs, Snaps, and Geometric Alignment Aides to ensure accuracy.
- Keep your drawing clean. Remove drawing and modeling elements you no longer need. If you think you may need them again, move them to a hidden “Trash” layer.

A Word on Constraints

Constraints are a very powerful tool for design and re-design of models. They are too complex to discuss in detail here. However, there is a lot of information about constraints available in the manual, and there are training materials available that focus on Constraint tools. There are some points about constraints that you should keep in mind:

- Constraints are best used for models derived from a 2D view. For complex multi-axis 3D geometries you should rely more on the parametric nature of 3D objects and the Selection Info palette.
- Constraints should not be used for hyper-complex 2D profiles, such as a spur gear. The complexity of the constraint system necessary for such a profile will actually slow you and TurboCAD down, with little benefit.
- Constraints provide their maximum benefit for 2D designs that may need multiple iterations of design. They are especially beneficial for parts that have a common design but required moderate adjustments for different versions of the part.

The Mechanical Pack Tools

The Mechanical tools that will be covered here are as follows:

- Bend
- Flange
- Tube Bend
- Tube Flange
- Facet offset
- Pattern Constraints
- Hole (with boss option)

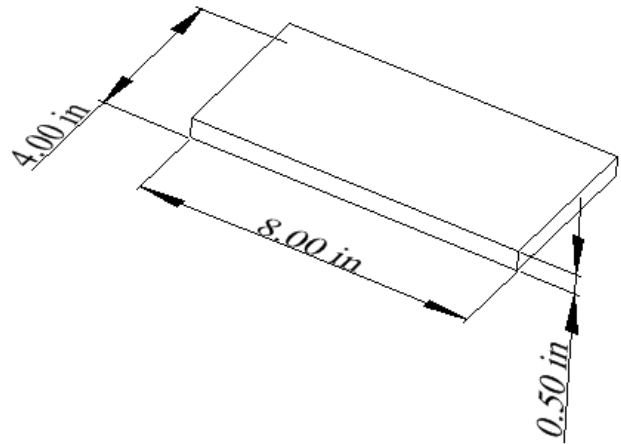
The Project

To review these tools, we will create a simple 3D model that will use each of these tools to achieve the final result.

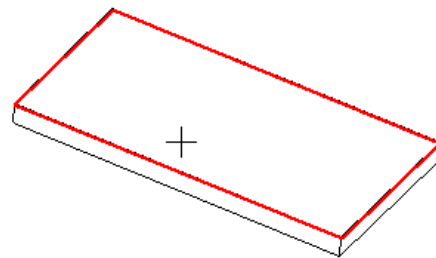
Bend a Plate

We will start the model with a box. Start a new drawing using the default settings. This means that the units will be in inches.

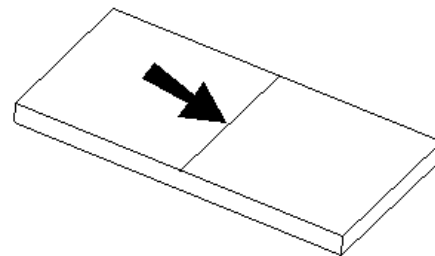
1. Use **Box** to draw a plate with these dimensions (8" long, 4" wide, 1/2" thick).



2. Activate **Single Line**, and move your cursor over the top face of the plate.



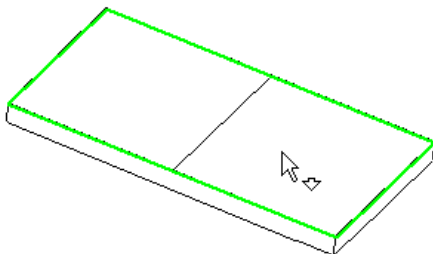
3. Use **Midpoint** snaps to draw this line. This line will be the bend axis.



4. Activate **Bend**. This tool can be found on the **3D Modify** toolbar, or from the **Modify** menu.



5. Select the top face of the box. This is the face that will be bent.



6. Press Tab to enter the Inspector Bar. Set the **Radius** to 1", **Angle** to 90 degrees, and **Neutral depth** to 0.25".

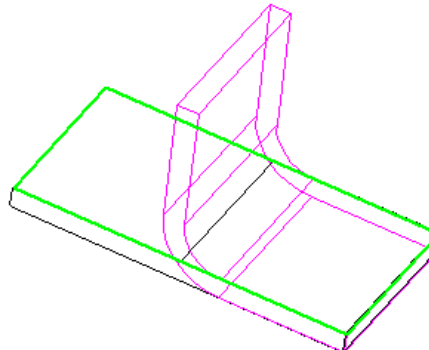
Radius	Angle	Neutral depth	Distance from e
1	90	0.25 in	0 in

NOTE: Neutral Depth sets the depth of the object for which the bending of the object does not affect its length. If the depth is set to zero, then the top of the bent object remain the same length. If the depth is set to the same value as the thickness of the object, the bottom of the object will remain the same length. If the depth is set to 1/2 the thickness of the object the center (vertical) will remain the same length. Setting the **Neutral Depth** to 1/2 the thickness of the object will ensure that the object will retain the same volume before and after the bend.

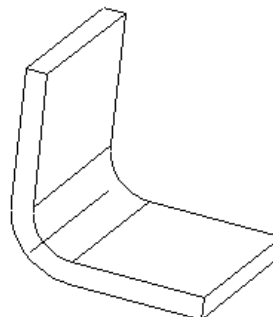
7. Make sure **Left** and **Center** are active. **Center** means that the bend will be centered on the axis line.



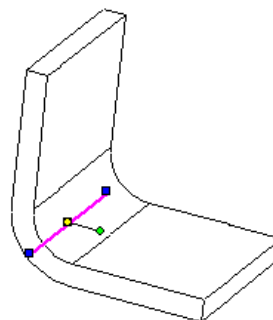
8. Click the line on top of the face, and the preview shows how the plate will bend.



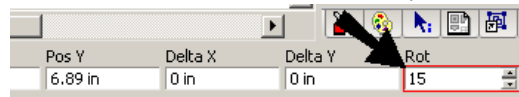
9. To complete the bend, select **Finish** from the local menu or Inspector Bar.



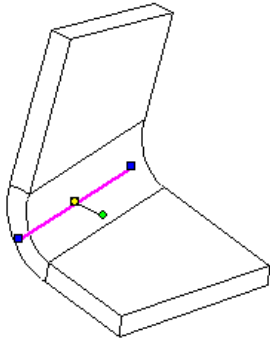
10. Changing the bend axis affects the bend results. To show this, select the line used as the axis.



11. In the Inspector Bar, enter 15 in the **Rot** field and press Enter. (Use the **Rot Z** field if you're in 3D.)

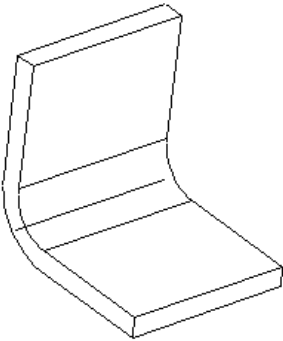


The bend updates to reflect the new angle.

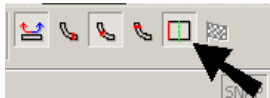


NOTE: If you delete the line that was used as the bend axis the bend will disappear.

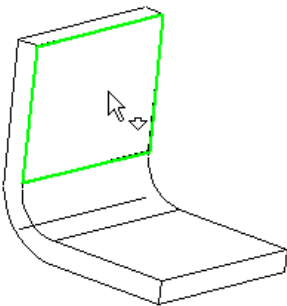
12. Enter 0 in the **Rot** field to change the bend back.



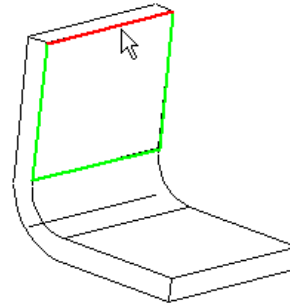
13. The next bend will be made without an axis line. Activate **Bend** again, and activate the **By Distance from Edge** option.



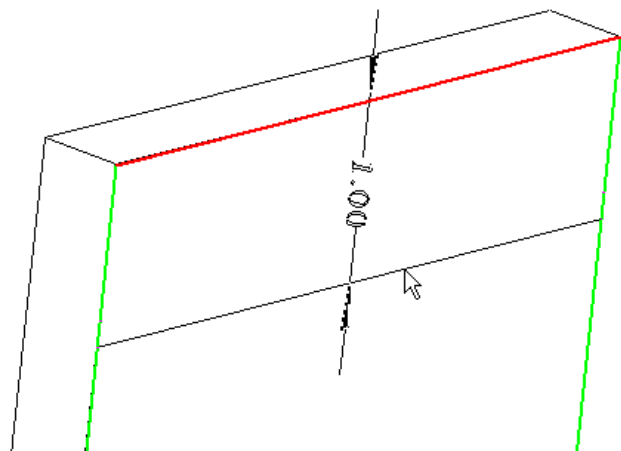
14. Click the inside vertical face of the bent object.



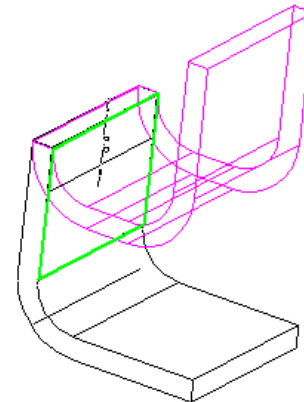
15. Click on the top edge of the face to set it as the edge of the face from which the bend will be measured.



16. Move the mouse down about 1-inch, then click.



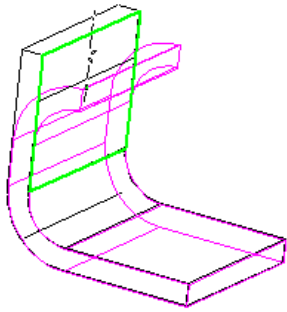
If the preview look like this:



Then toggle the **Left** button.



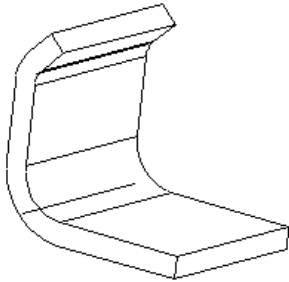
The preview should look like this:



Set the **Radius** to 0.5 in, **Angle** to 45, and **Distance from edge** to 0.75 in.

Radius	Angle	Neutral depth	Distance from e
0.5	45	0.25 in	0.75

17. Select **Finish** to complete the bend.

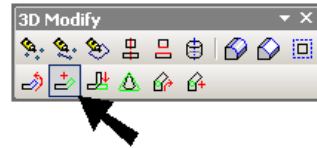


TIP: The **Unbend Sheet** tool can be used to straighten a bent plate.

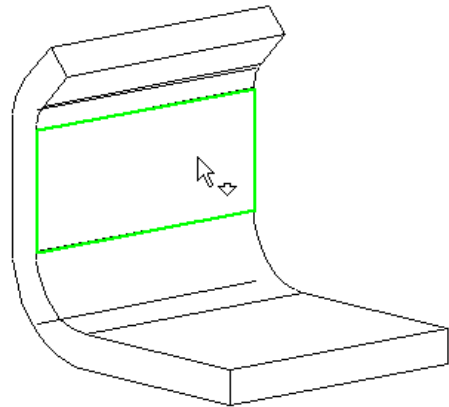
Add Flanges

The **Flange** tool enables you to create a extension of a plate, extending off to on side of the face.

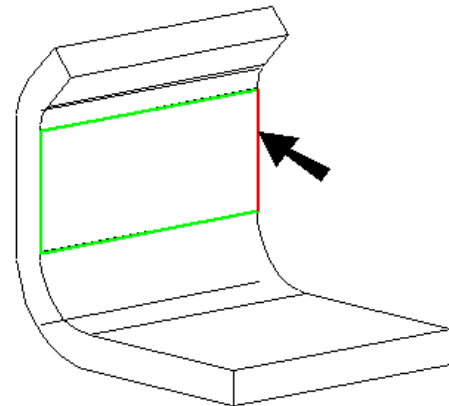
1. Activate **Flange**.



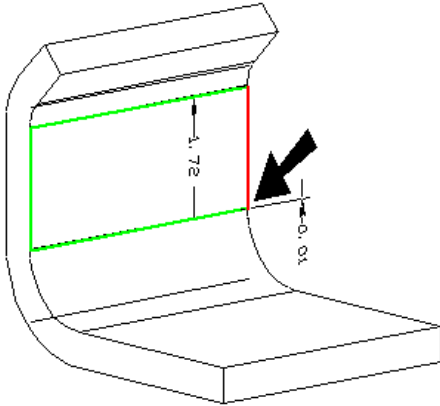
2. Click the inside vertical face.



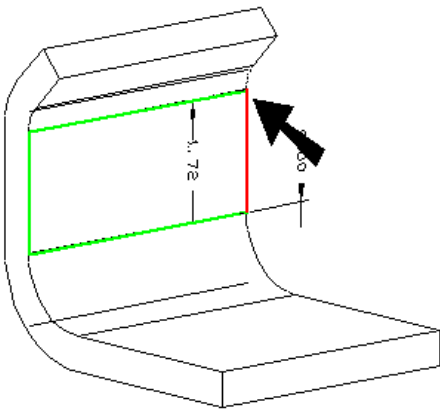
3. Next, click this edge - the flange will be extended along it.



4. The next two clicks determine where along the edge the flange will be extended. Move the mouse to one end and use the V SEKE to click the endpoint.



5. Then use the V SEKE to click the other endpoint.



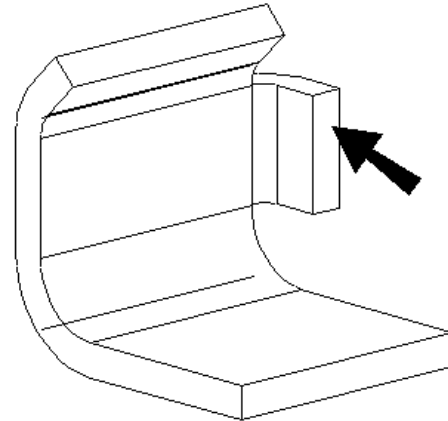
6. In the Inspector Bar, set these values:

- **Radius** = 0.25
- **Angle** = 90
- **Neutral Depth** = 0.25
- **Flange Height** = 1.5 (the length of the extension)

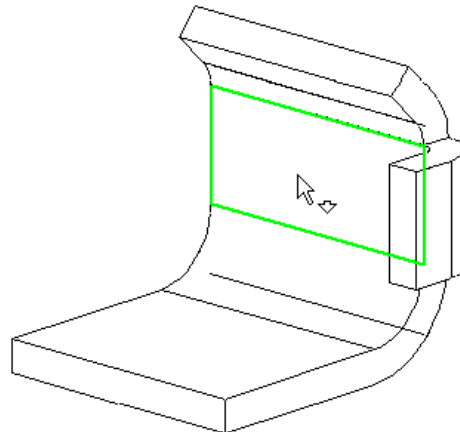
Radius	Angle	Neutral depth	Flange height	Start flange pos	End flange pos
0.25 in	90	0.25 in	1.5 in	0.02 in	1.72 in

(Start and end flange positions are already set by the endpoints of the edge you clicked.)

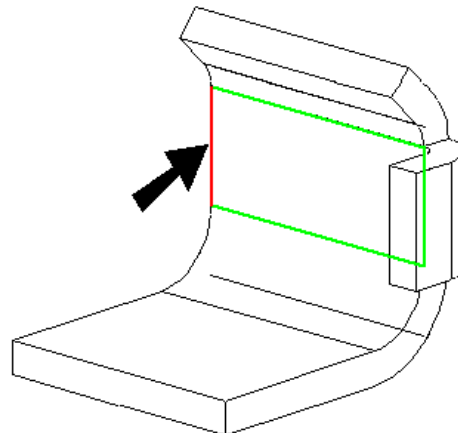
7. Press Enter to accept the values, then select **Finish** to create the flange.



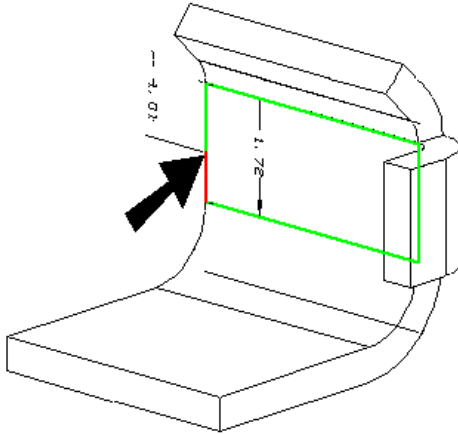
8. For the next flange, click the same vertical face.



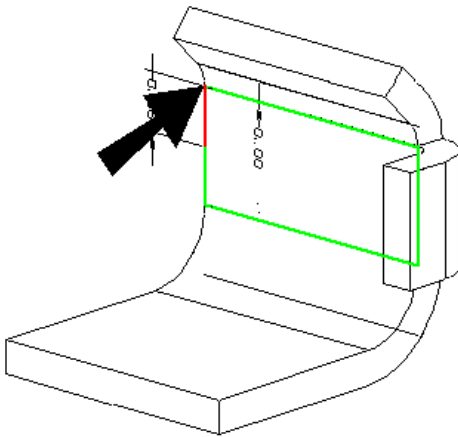
9. Click this edge.



10. This flange will extend over half of this edge. Press the M SEKE to snap to the midpoint.



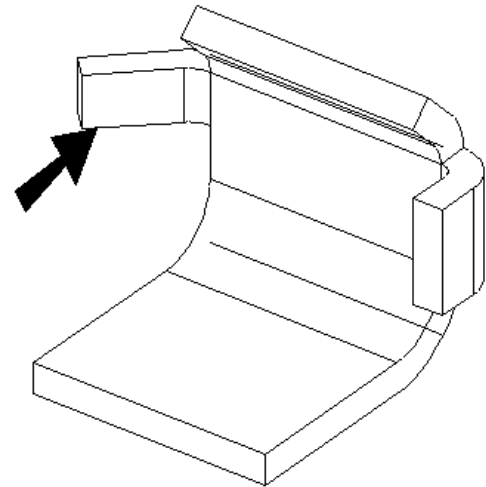
11. Then press the V SEKE to snap to the top endpoint of the edge.



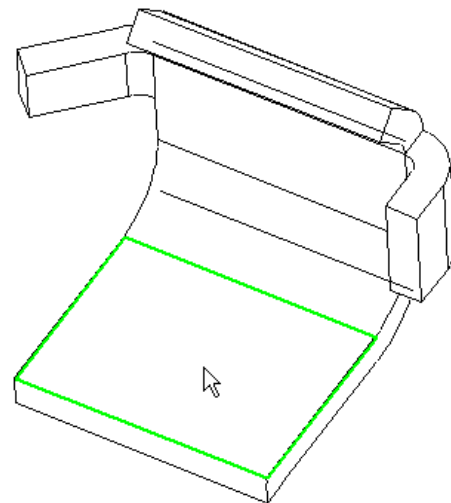
12. Enter these values for **Radius**, **Angle**, and **Flange Height**.

Radius	Angle	Neutral depth	Flange height	Start flange pos	End flange
0.5	45	0.25 in	2	0.87 in	0 in

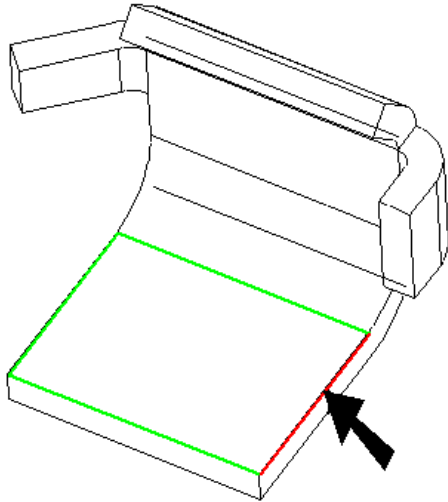
13. Press Enter and select **Finish** to complete this flange.



14. The last flange will be a flat extension of the horizontal face. Click this face.



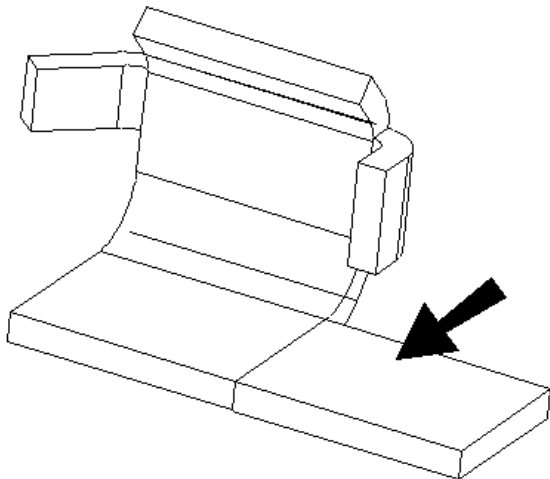
15. Click this edge, and use the V SEKE's to snap to both endpoints.



16. Leave the **Radius** as is (the value cannot be zero), but change the **Angle** to 0 and the **Flange height** to 4.

Radius	Angle	Neutral depth	Flange height	Start flange pos	End flange pos
0.5 in	0	0.25 in	4 in	-0.05 in	3.06 in

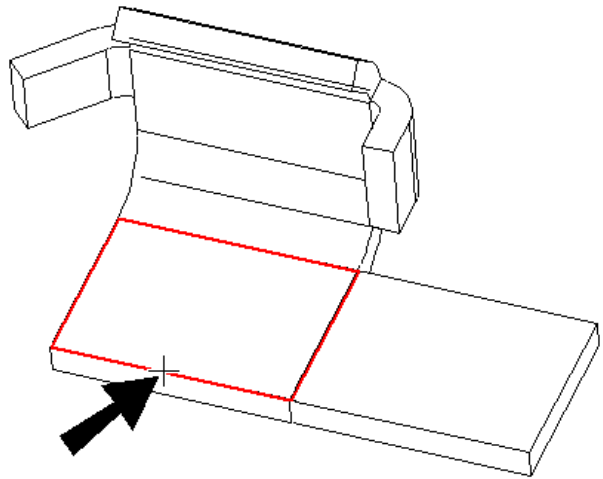
17. Here is the resulting flange.



Tube Bend and Flange

The **Tube Bend** and **Tube Flange** tools are similar to the ones you've just used, but they apply to tubes (long cylinders) instead of plates.

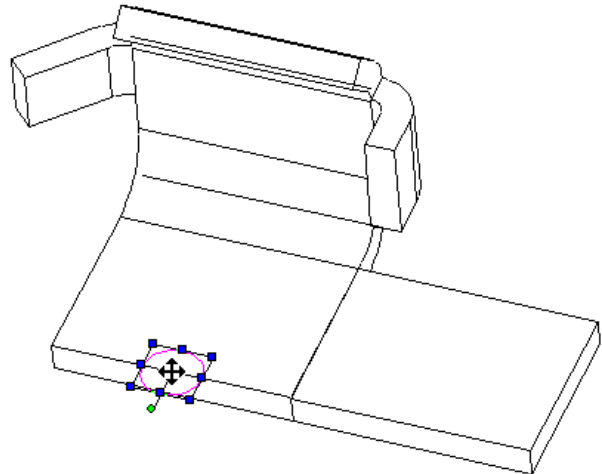
1. The cylinder will be based on a circle, located in the middle of the horizontal plate. Place the center of the circle using the M SEKE, to place it on the midpoint of this edge:



2. Set the **Radius** to 0.5.

Radius	Diameter	Circumf.
0.5 in	1 in	3.14 in

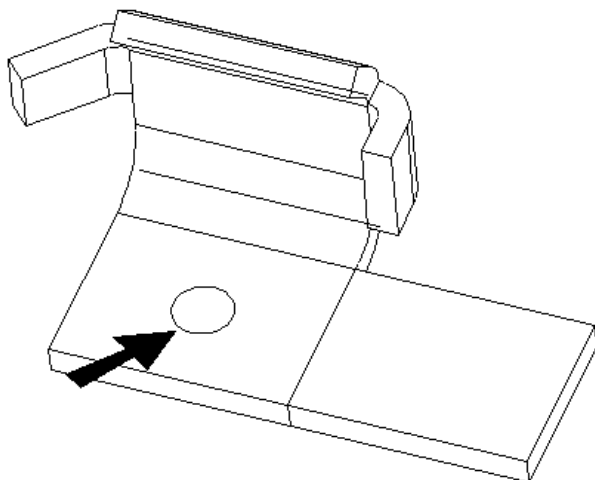
3. Next, we'll move the circle to the center of the plate. First, select it, and click the yellow reference point.



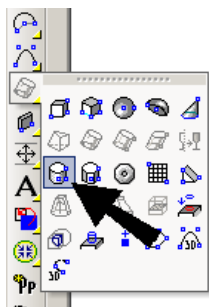
4. Enter these **Delta X** and **Delta Y** values, and press Enter.

Pos X	Pos Y	Delta X	Delta Y	Rot
10.22 in	6.89 in	-1.5	0	0

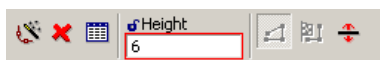
The circle should be located here:



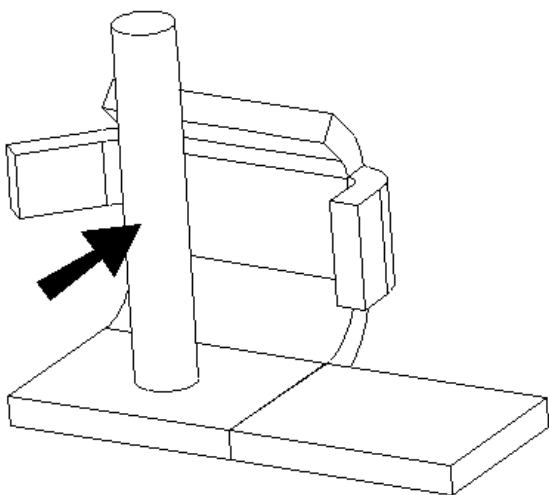
5. From the 3D Tools, activate **Simple Extrude**.



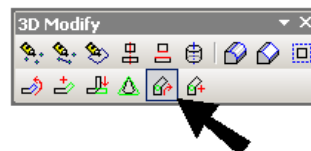
6. Click the circle to extrude it, and make it 6-inches high.



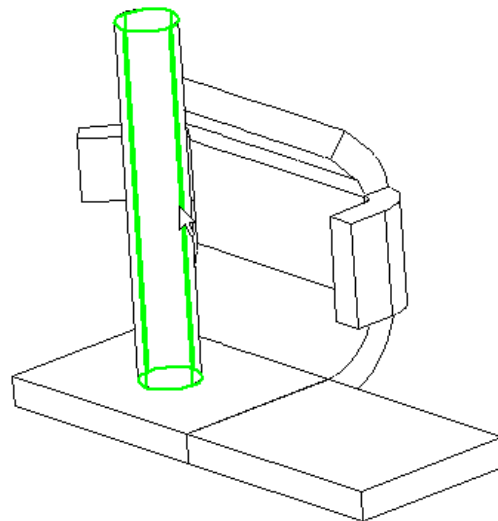
Here is the tube:



7. To bend the tube, activate **Tube Bend**.



8. Click the cylinder.

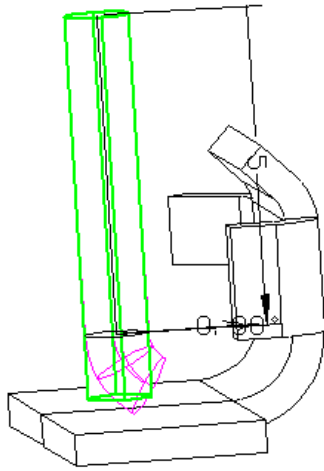


9. Here are the values to use for this bend:

- **Radius** = 0.5
- **Angle** = 90
- **Neutral depth** = 0.5 (it is the same as the tube radius)
- **Axial distance** = 5 (the length of the bent part)
- **Azimuth angle** = 0 (controls the direction of the bend)

Radius	Angle	Neutral depth	Axial distance	Azimuth angle
0.5 in	90	0.5 in	5	0

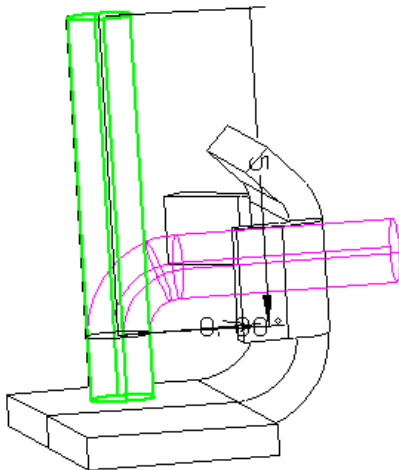
If your preview looks like this, the bend is on the wrong side.



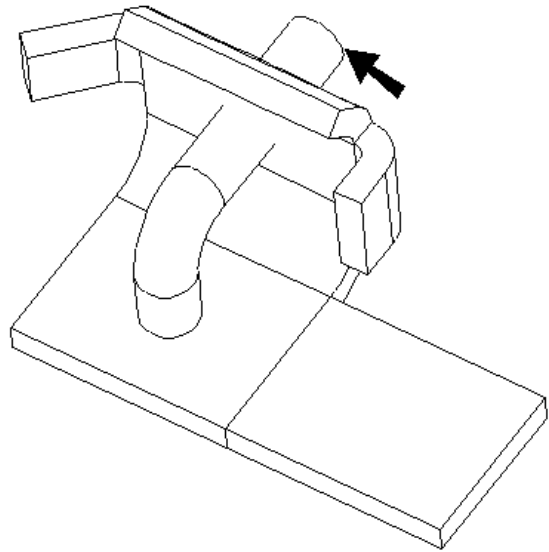
If needed, toggle **Left Side** to change the bend side.



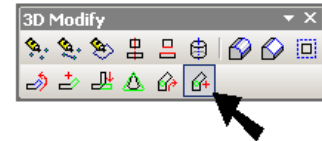
This is how the preview should look. If the bend points the wrong way, adjust the **Azimuth angle**.



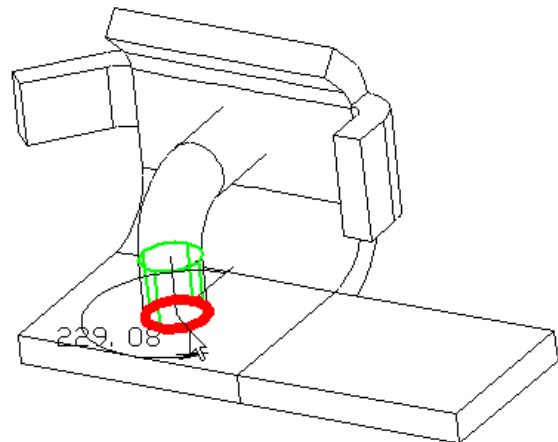
10. Press Enter and select **Finish** to complete the bend.



11. To extend the tube downward at the other end, click **Tube Flange**.



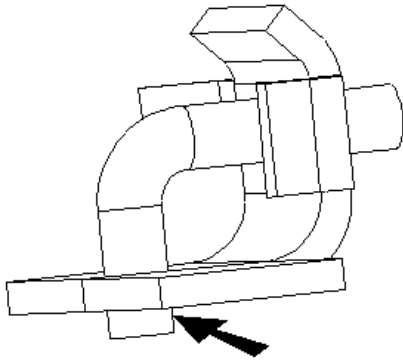
12. Click the lower part of the tube, near where it meets the plate.



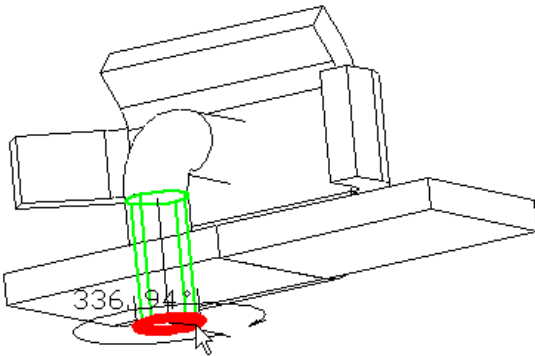
13. Set **Radius** and **Angle** to zero, since we're making a straight extension. Set **Flange height** = 1.

Radius	Angle	Neutral depth	Flange height	Azimuth angle
0	0	0.5	1	229.08

14. This is the result of the extension:



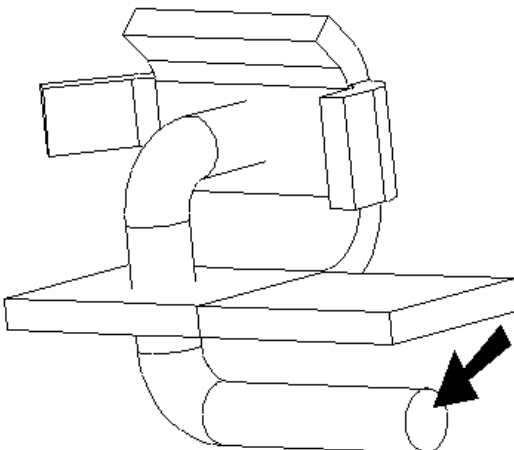
15. We'll create a bent flange at this end. Click the bottom of the tube.



16. Set these values:

Radius	Angle	Neutral depth	Flange height	Azimuth angle
0.5	90	0.5 in	5	270

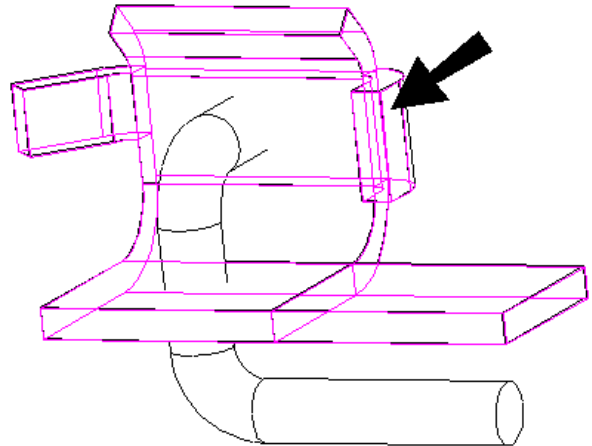
17. This should be the result. Again, if your tube points the wrong way, adjust the **Azimuth angle**.



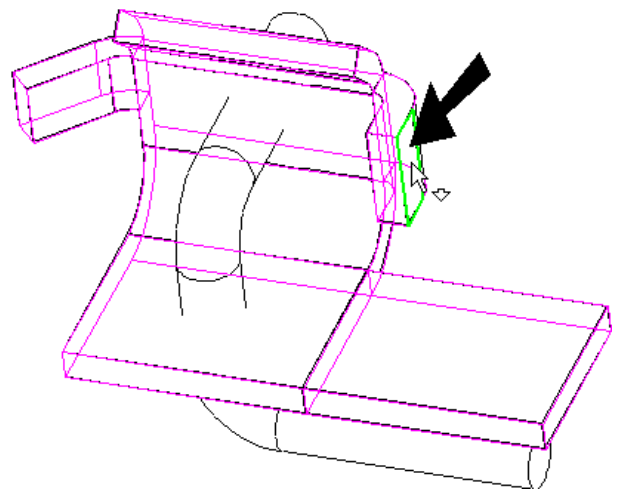
Face Offset

The **Face Offset** tool is used to move a flat face of a object parallel to the plane of the face.

1. Select **Edit / Face Offset**. Click any part of the bent plate - it is all one solid.



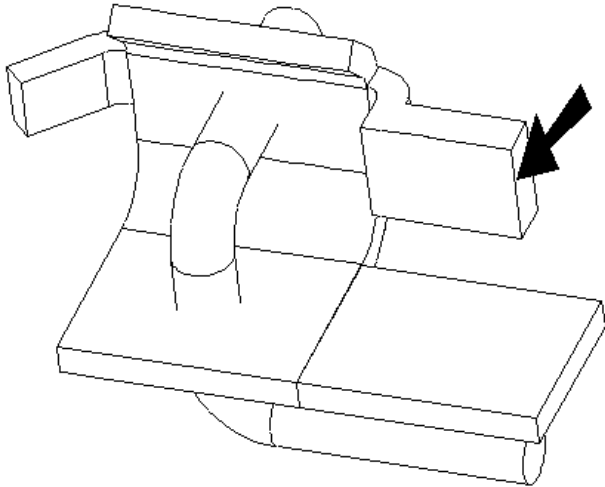
2. Click the exterior face of this flange:



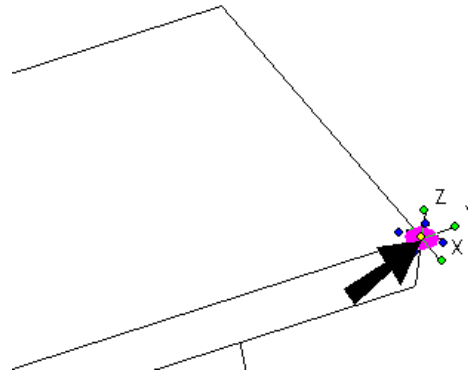
3. Set the **Offset** value to 2.



4. Press Enter, and this is the result: the face moves 2-inches outward.



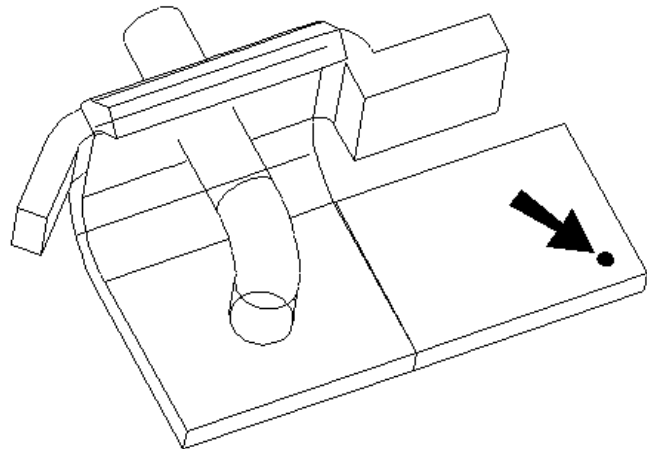
3. This point has to be moved into the right location. First select it, then click its yellow reference point.



4. Enter these **Delta X** and **Delta Y** values.

Pos X	Pos Y	Delta X	Delta Y	Rot
11.22 in	12.39 in	-0.5	-0.5	0

The point should now be here:



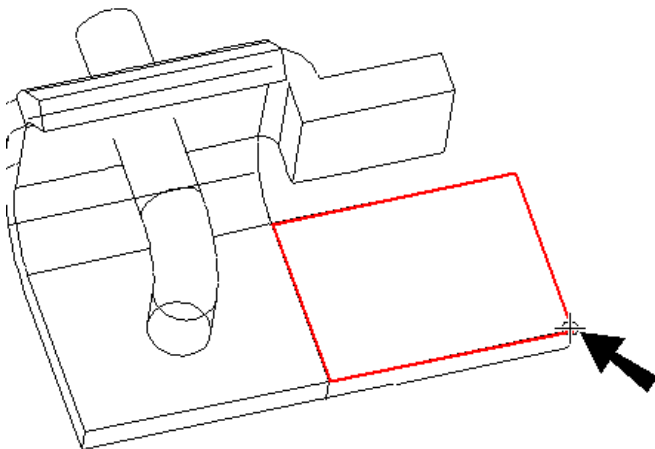
Hole Pattern

The next task is to add an array of holes, in a constrained pattern.

1. Before you can create holes, you must first mark the hole locations with points. Activate the **Circle** point tool (you can use another type of point, but these are easy to see).



2. Place the point at the corner of this plate, using V to snap to the corner.



5. With the point still selected, activate **Array Copy**. (If you use the menu, this tool is on the **Edit / Copy Entities** menu.)



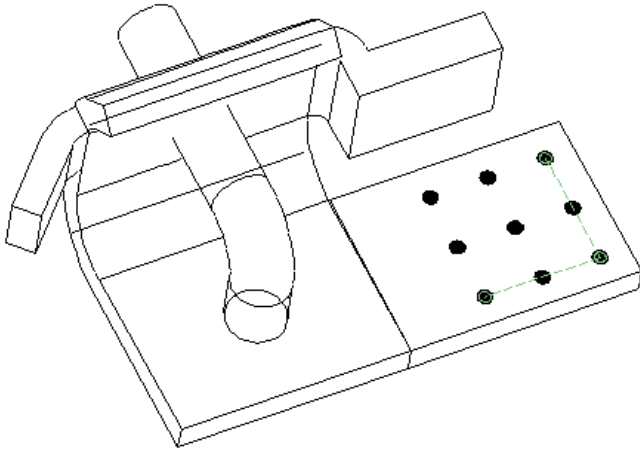
6. For the pattern to be constrained, make sure **Auto Add Constraints** is active.



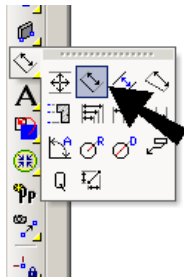
7. Set the **XStep** and **YStep** values so that each point will be 1-inch apart. There should be 3 **Rows** and **Columns**.

XStep	YStep	Rows	Cols
-1	-1	3	3

This should be the result: nine points, with two green constraint lines.



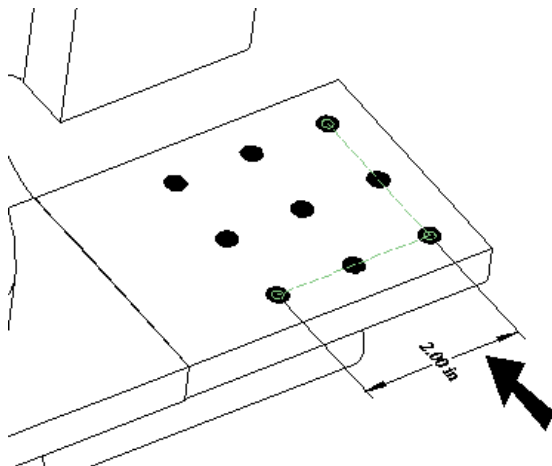
8. Activate **Parallel** dimension.



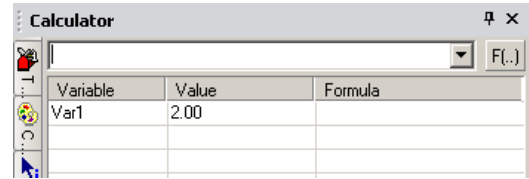
9. Activate **Segment dimensioning**, so that you can create the dimension by selecting one line.



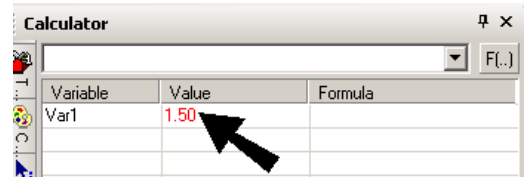
10. Click this constraint line and place the dimension - it should be 2-inches.



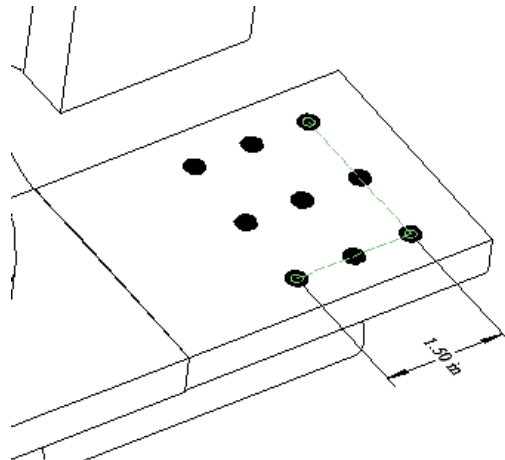
11. Because we applied constraints, the dimension is a variable that can be changed, thereby updating the pattern. To do this, open the Calculator palette.



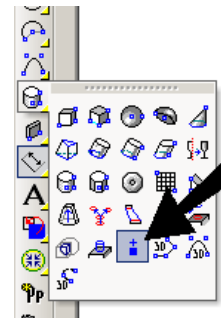
12. Click the 2.00 value and change it to 1.5.



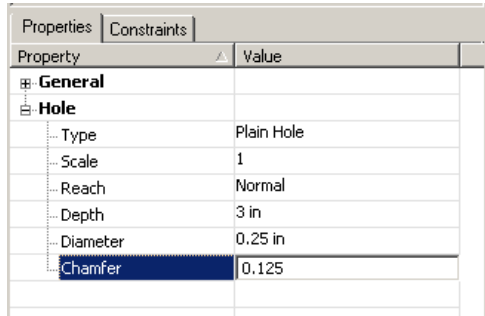
The pattern updates to accommodate the changed dimension.



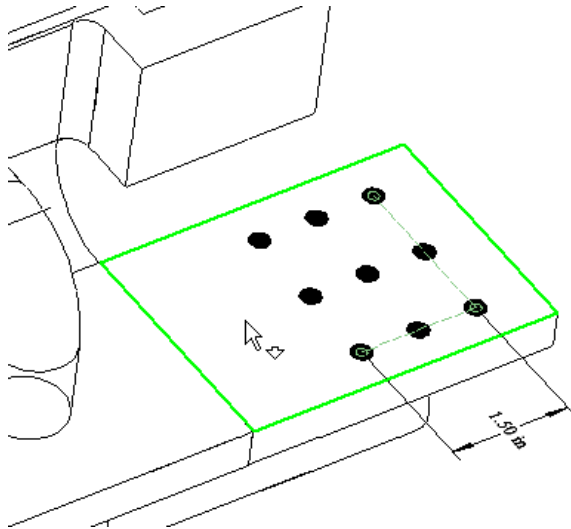
13. Now we're ready to make holes where the points are. Activate the **Hole** tool, which is found with the other 3D tools. (**Hole** is also on the **Insert / 3D Objects** menu.)



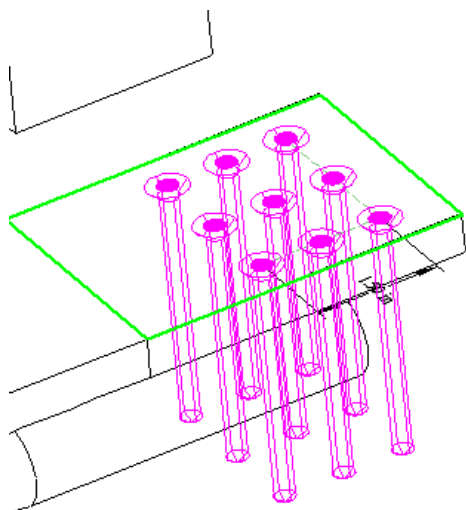
14. One way to set the properties for the **Hole** tool is via the Selection Info palette. Open this palette, and set these values:



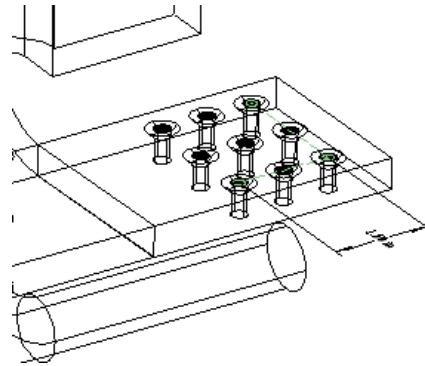
15. Click the top face of the plate with the holes.



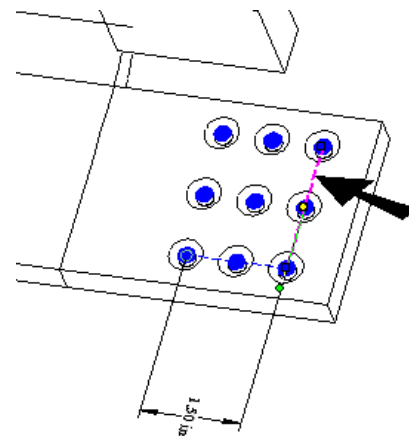
16. Then click any of the points. A preview of the nine holes appears - they are much deeper than needed, which does not affect the results.



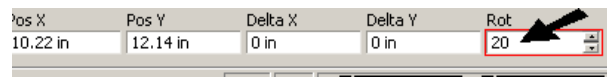
17. Select **Finish** to make the holes. (They are easier to see in **Wireframe** mode.)



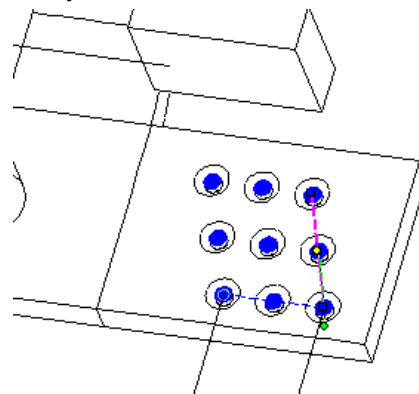
18. Any change to the array of points affects the holes they are based on. To see this, select this constraint line.



19. Enter 20 in the **Rot** field.



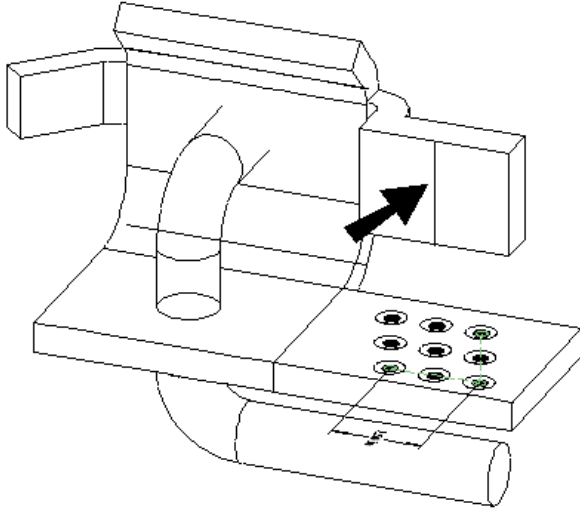
The array is now skewed.



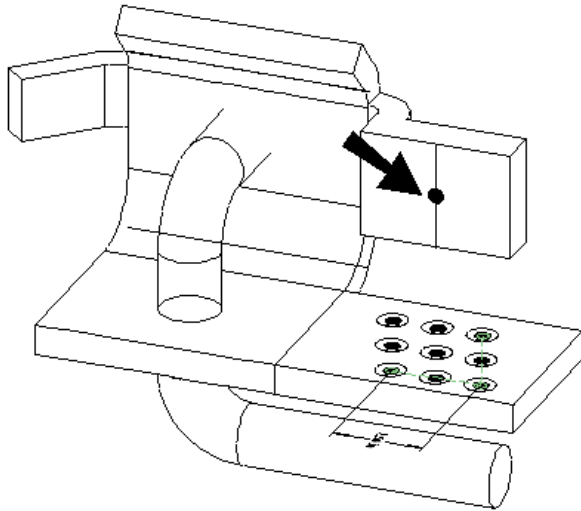
Add a Boss

The last step is to add a boss, which is also done using the **Hole** tool.

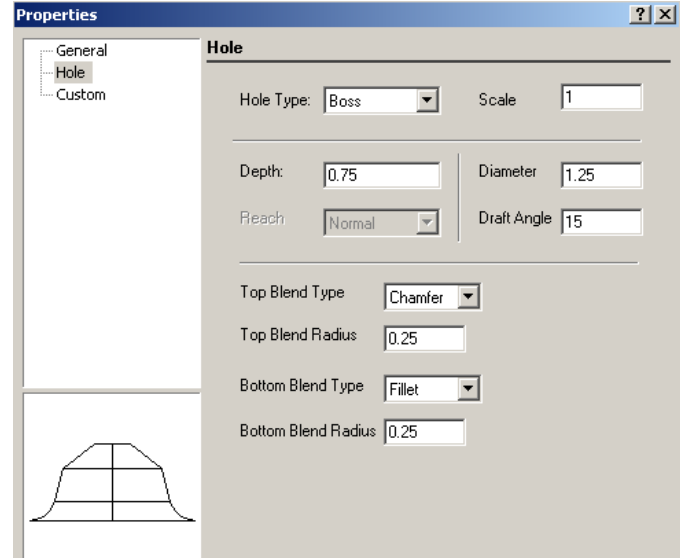
1. First, we need to add some geometry to help locate the boss. Start with a vertical **Line**, placed using **Midpoint** snaps.



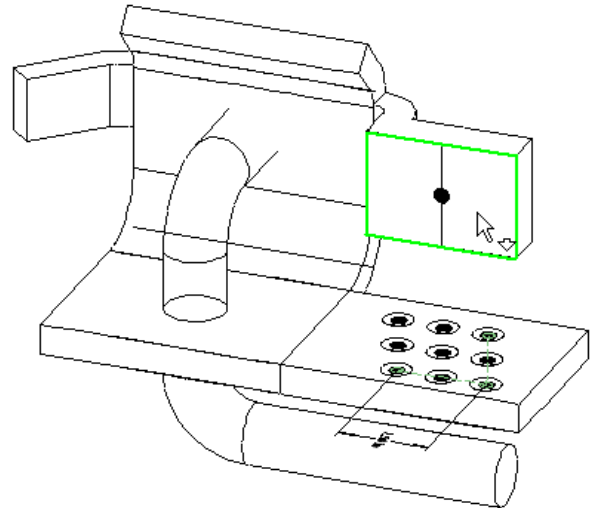
2. Then add a **Point** at the midpoint of the line.



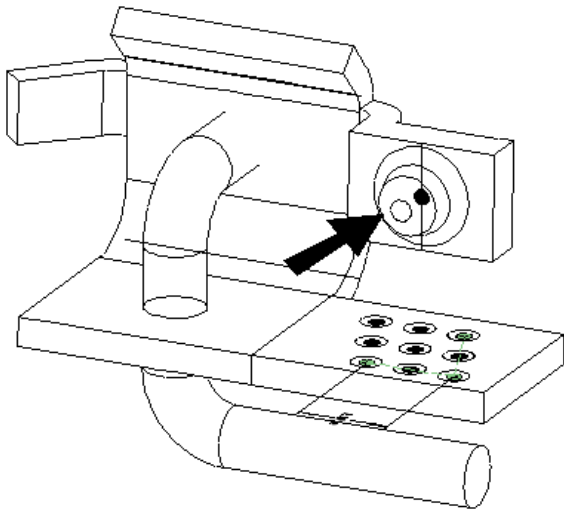
3. This time, open the **Properties** window for the **Hole** tool. (You can do this by right-clicking on the **Hole** icon, or by activating **Hole** and selecting **Properties** from the local menu.) The **Hole Type** should be **Boss**, and the remaining properties are shown below:



4. To create the boss, first click this face:



5. Then click the hole, and complete the boss.



6. To better see the two solids, apply colors and switch to **Draft** or **Quality** rendering.



This concludes the Mechanical Getting Started Guide. But you can continue working on the model, adding fillets, shells, booleans etc. You will find more details on the Professional and Mechanical features in the TurboCAD User Guide.