Doctor Walt's™

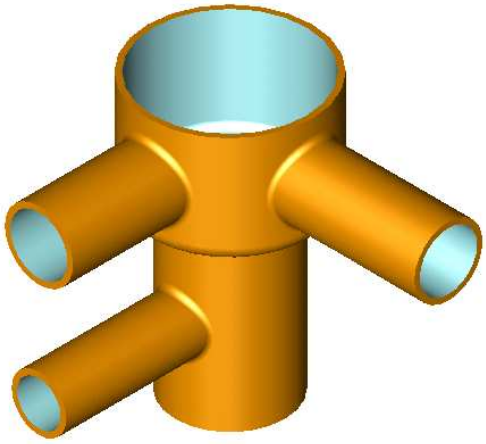
KEYCREATOR®

TIPS AND TRICKS

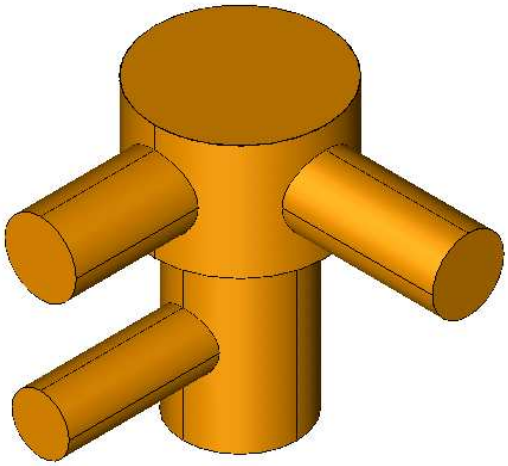
2008-VOL.3

Using Wireframe Grids to Construct Manifolds

New users often overlook a powerful capability in Keycreator that has roots back in the wireframe modeling era in the predecessor CADKEY product. When constructing complex manifolds like the one illustrated to the right, using a wireframe grid can greatly reduce the steps required to position the various parts of the manifold.



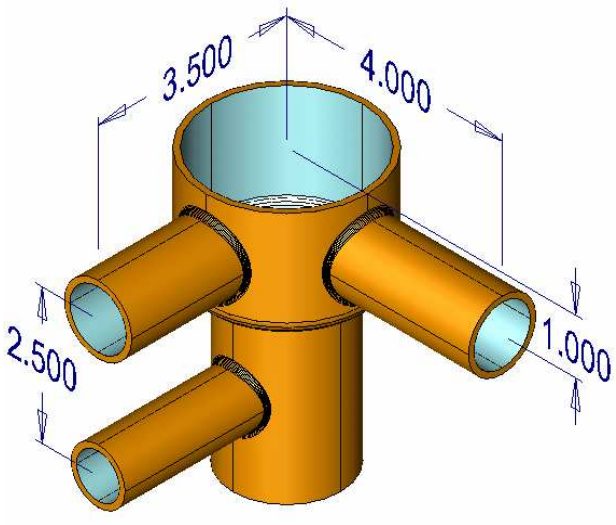
In typical feature-based, parametric systems, a circular sketch for each cylindrical portion of this part is created on a reference plane and then extruded into a cylinder.



If you look at this relatively simple part, you'll count five sketches with five corresponding extrusion steps just to generate the basic primitive of the part that is shown to the left.

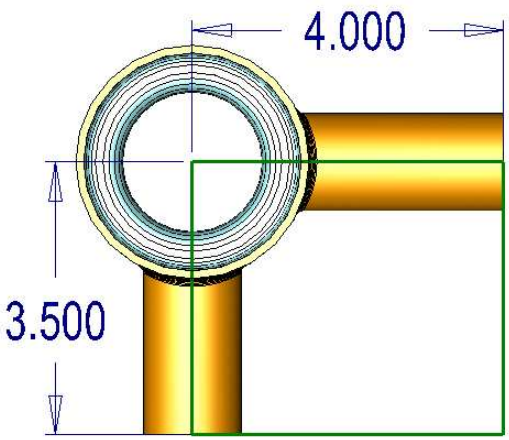
I find many Keycreator users taking the same approach to create this type of part. Now you can certainly travel on that road, but let's take a moment to look at a much easier way to develop a model of this type of part.

I've indicated some of the key position dimensions for this model in the illustration to the right. (The completed model is available for download as Manifold2.)



The diameter of the cylinders is not important right now. What is important is to note that the top vertical cylinder is 2 inches long with the side outlets centered on the length. The lower vertical cylinder is 3 inches long with the side outlet centered on the length. Also the right side outlet projects out 4 inches from the vertical centerline and the front outlets project out 3.5 inches.

These positioning dimensions are key to creating any manifold design. I've illustrated a top view of the part with the projections of the side and front outlets dimensioned to the right.



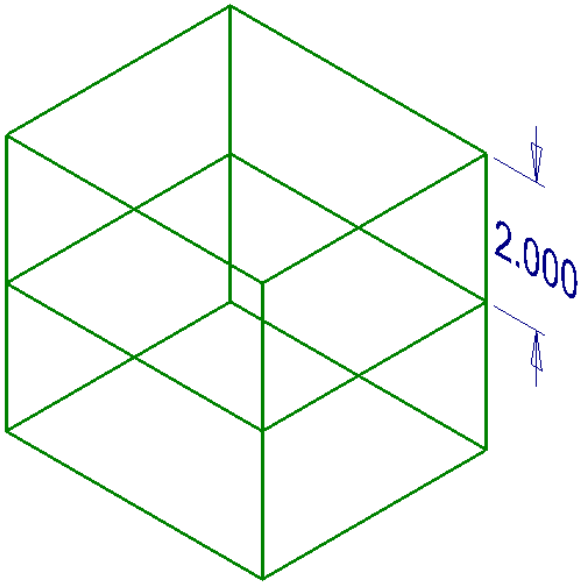
Notice the dark green reference rectangle used in the drawing.

The secret to quickly creating this part using a wireframe grid is to start in View 1 with a simple rectangle that is 4 inches wide by 3.5 inches high.

Then, use the XFORM DELTA JOIN Function.

Type 2 for the number of copies and 0 for dXC, 0 for dYC, and 2 for dZC.

In the top view (view 1.) it doesn't look like anything happened.

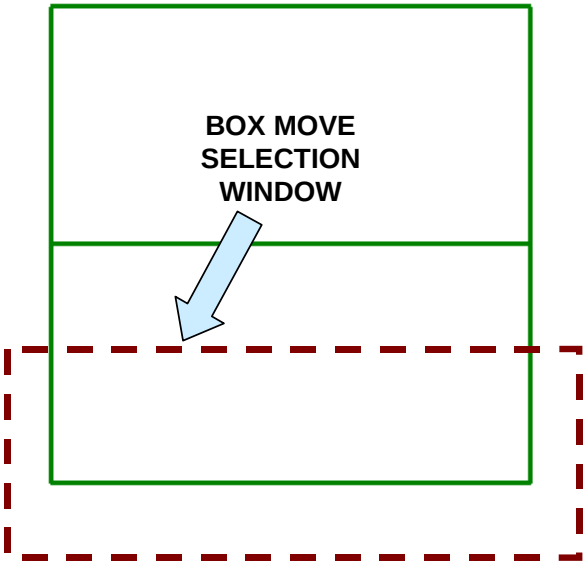


If you switch to the isometric view (view 7.), however, you'll see that you now have a rectangular, three-dimensional grid that looks like the illustration to the right.

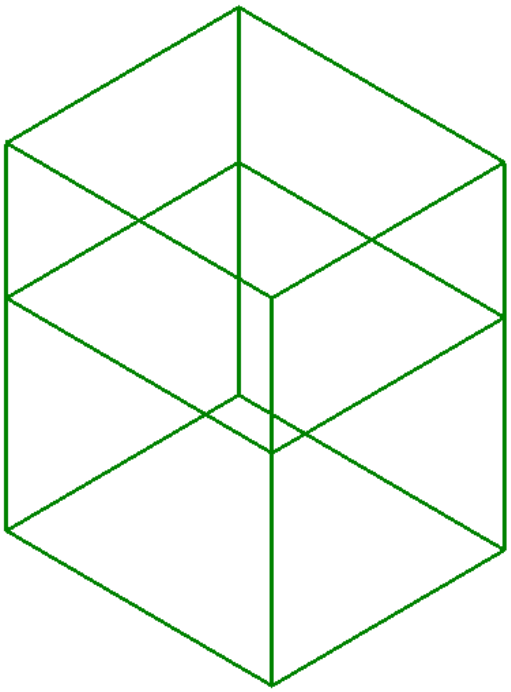
The 2 inch vertical dimension corresponds to the top vertical cylinder being 2 inches long.

Now at the moment, the lower part of the grid also has a spacing of 2 inches. Our lower vertical cylinder in the part, however, is 3 inches long. We need this spacing to be 3 inches long before we proceed.

We can quickly switch to the front view (view2.) and use the XFORM BOX MOVE Function to drag the lower part of the grid downward 1 inch.



the three-dimensional grid, you simply stretch the structure downward by 1 additional inch.

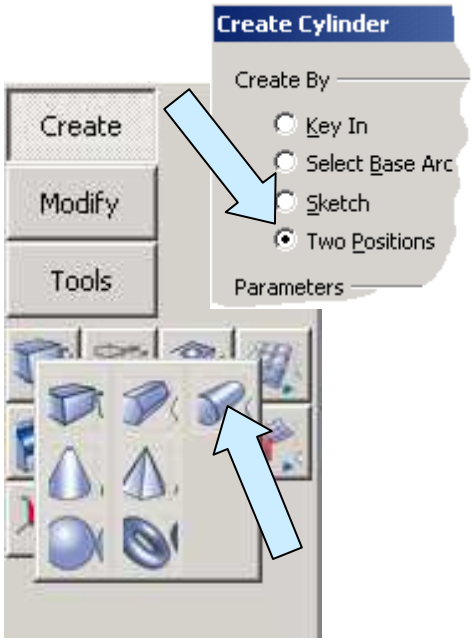


In the isometric view (view7.) your three-dimensional grid will now look like this:

Now we can quickly create all of the component cylinders in our manifold by using the PRIMITIVE CYLINDER Function.

We'll use the grid to instantly position each cylinder.

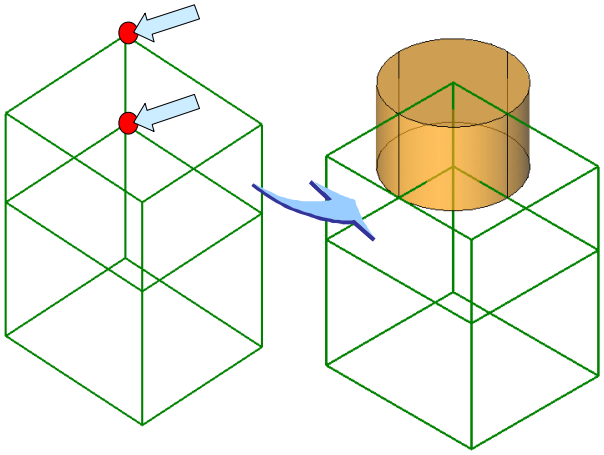
This is much simpler than creating a series of circles that then have to be extruded.



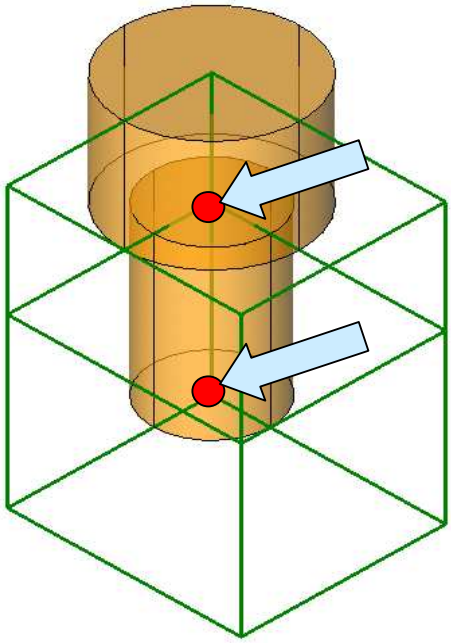
Click on the PRIMITIVE CYLINDER Icon.

When the Dialog Box appears, select the Two Positions Option.

Now, you can quickly create each cylinder by keying in a radius and clicking on two positions on the three dimensional grid that define the endpoints of the cylinder!



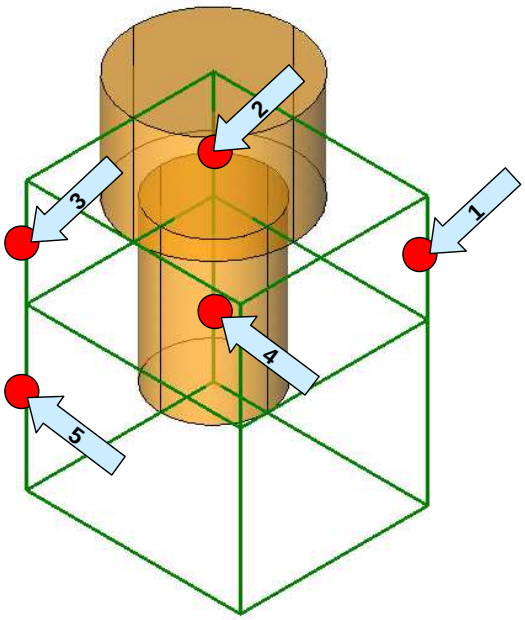
To create the top vertical cylinder, type 1.5 for the radius and using EndEnt, click on the top, rear left corner of the grid and then on the next intersection directly below it.



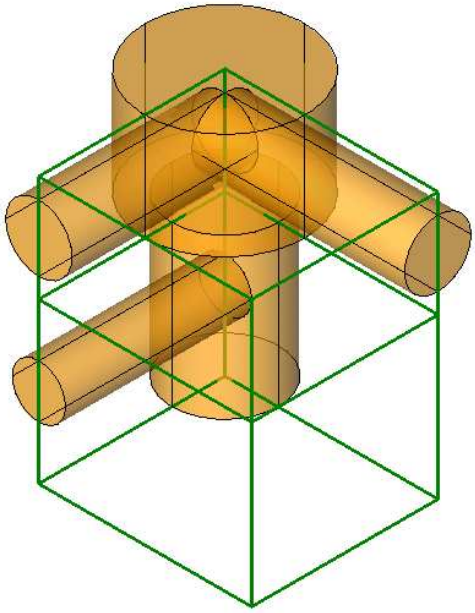
You can backup and type 1 for the radius and use the same approach to create the lower vertical cylinder selecting the appropriate positions at the rear left corners of the grid.

Your construction will now look like the illustration to the left.

Since the side outlet cylinders are positioned at the midpoints of the vertical cylinders and extend out 4 inches and 3.5 inches respectively, we can use the same approach, keying in the appropriate radius value and then using the CtrMid Option to pick on the corresponding vertical lines of the grid

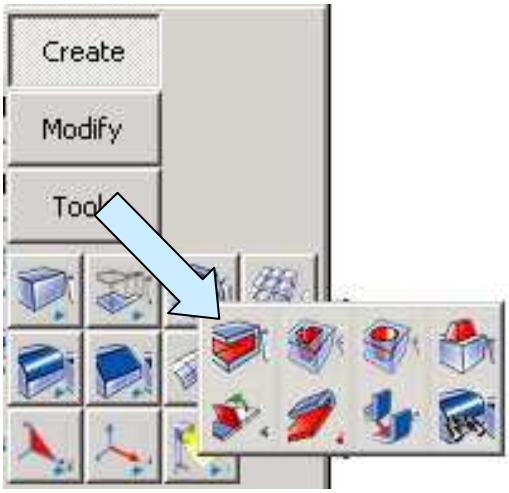


I've indicated the pick points in the illustration to the left.



After placing the cylinders, your construction should look like this:

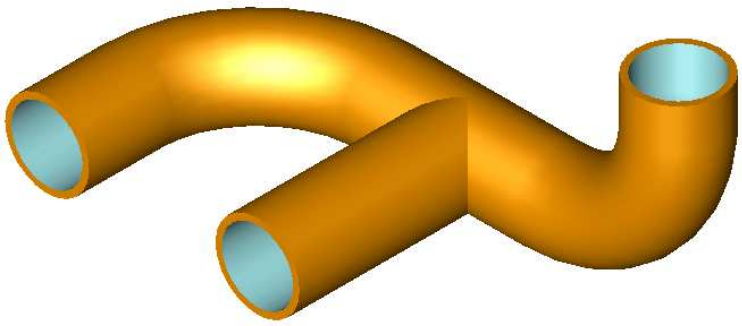
You now use the BOOLEAN UNION Function to create one body from the individual cylinders.



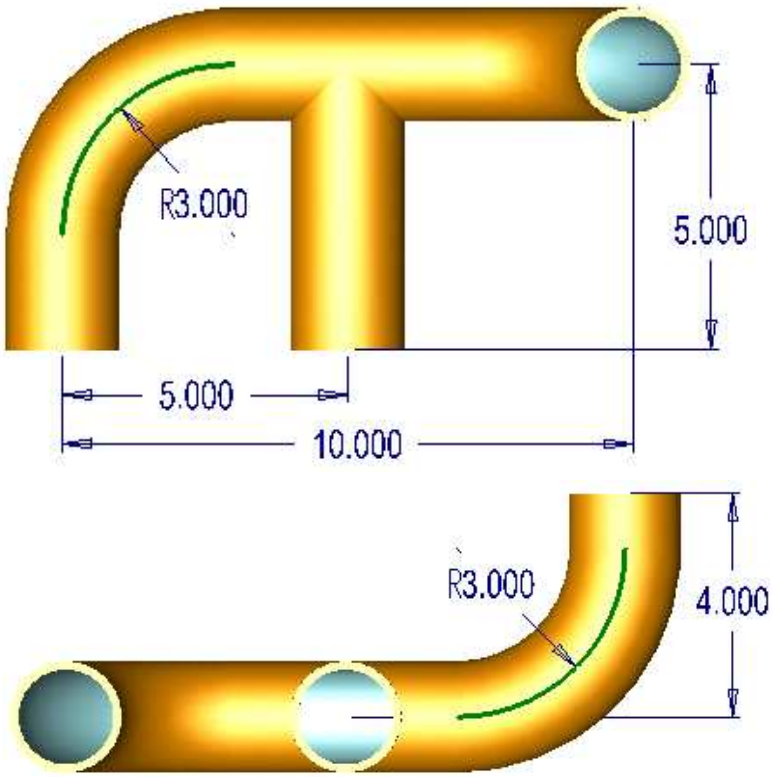
Finally, you can use the SHELL Function to hollow out the part.

Combining Wireframe Grids with the PIPE Function

Three-dimensional wireframe grids are extremely useful when you need to create a manifold like the one illustrated to the right.



This model is available for download as “manifold3.”



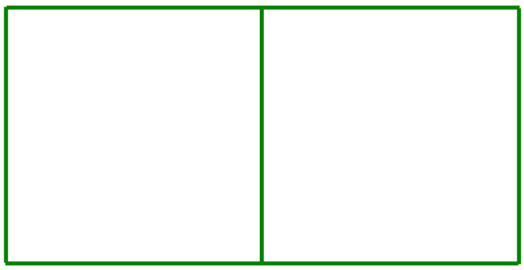
The part has a uniform diameter of 2 inches with a common wall thickness of 0.15 inches.

The basic centerline dimensions are shown in the drawing to the left.

For this type of part, we begin by creating a rectangle that defines the major plan view dimensions of the centerline curve for the main section of the manifold.

In the top view (view1.) this would be a rectangle that is 10 inched wide by 5 inches high.

We would then create a line by endpoints that connects the center of the top edge of the rectangle to the center of the bottom edge of the rectangle.

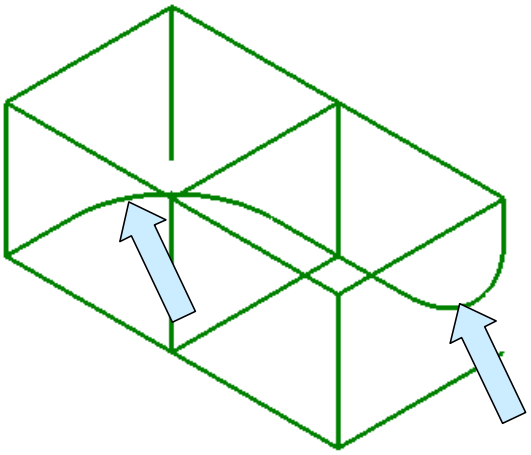


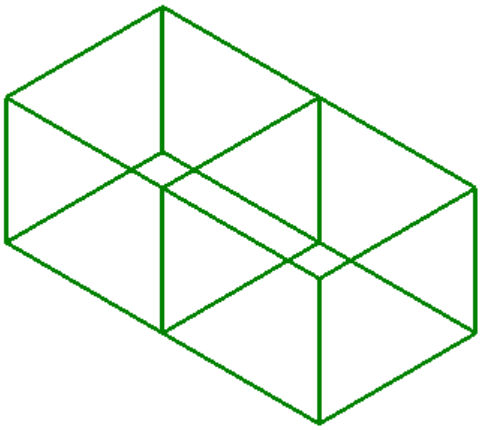
Your screen would now look like this:

We're going to use the XFORM DELTA JOIN Function again.

This time, type 1 for the number of copies and type 0 for dXC, 0 for dYC, and 4 for dZC.

When you switch to the isometric view (view7.), your construction should look like this:

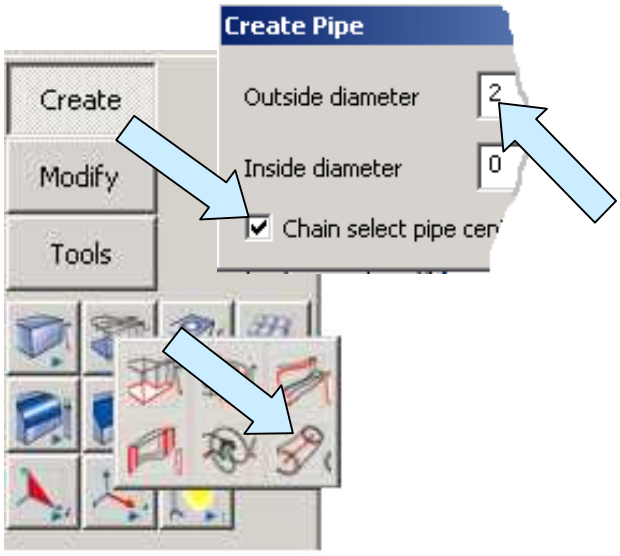




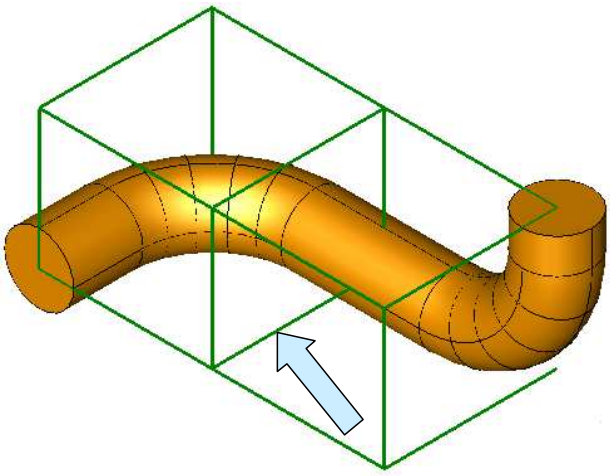
Next, create simple 3 inch radius fillets at the lower, rear, left corner and at the lower, right, rear corner as shown in the illustration to the left.

Next, use the PIPE Function to create the main sweep of the manifold.

Use 2 for the outside diameter, 0 for the inside diameter, and check the Chain select pipe centerline option.

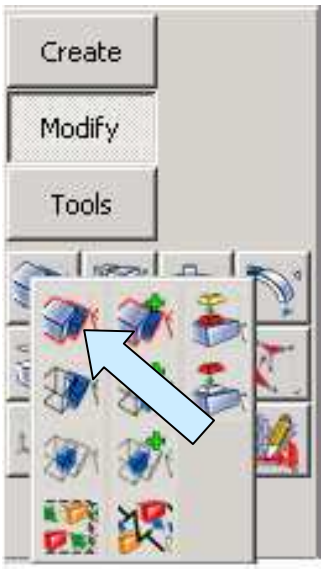


Select the three line segments and 2 fillets that define the main sweep and hit the ENTER Key.

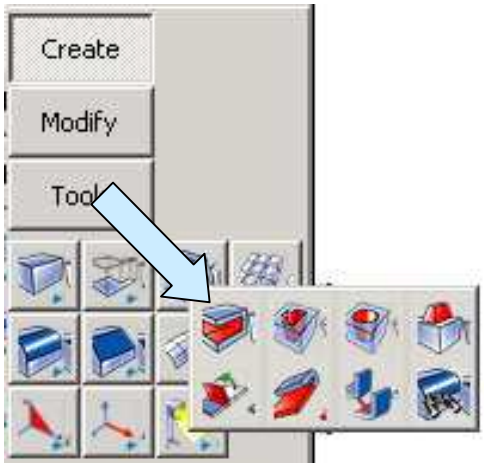


Your construction will now look like this:

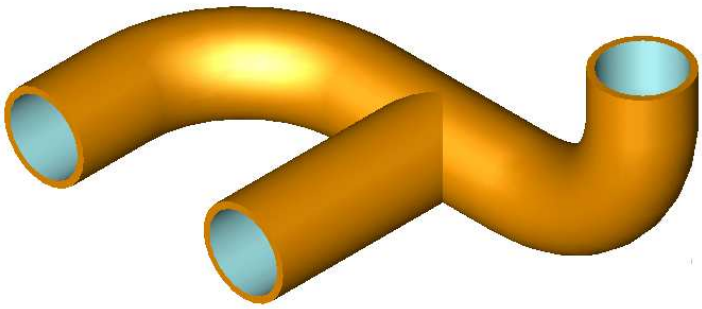
Next, click on the line indicated by the arrow in the illustration to the right and hit the ENTER Key again. This creates the side leg.



Now, use the BOOLEAN UNION to unite the two pieces into one body.



Then, use the SHELL Function to hollow out the part.



Your completed part should now look like this:

Notice how simple this construction was. After creating the original rectangle, the Xform Delta Join function gave us an orthogonal vertical leg for the right end of the part.

Two simple fillets completed the paths that we needed for the pipe function. We then simply created the pieces, unioned them together, and shelled the part. Presto, our job was done!