

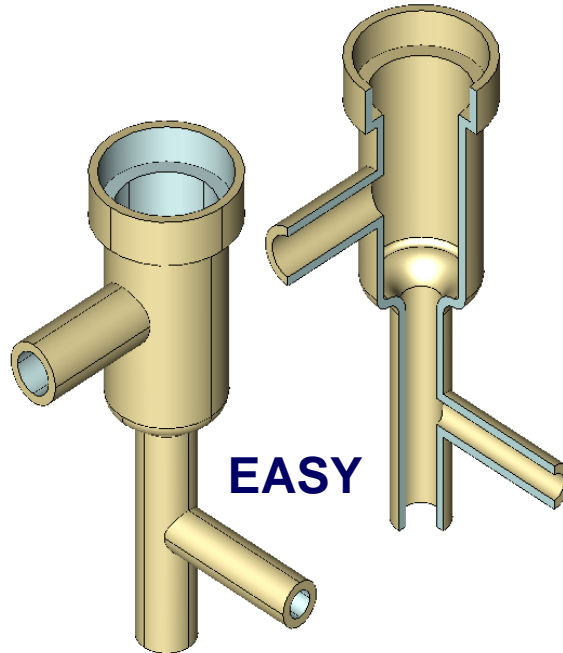
Chapter Two

Manifold Parts

The word manifold has multiple connotations. We use the terms manifold and non-manifold in a mathematical sense when talking about solid models.

For instance, if you create a solid part by creating a union between two separate solid bodies that only share a single tangent edge, you create a non-manifold part.

This can happen when adding a simple flange on a drafted plastic part if you forget about the draft on the outside wall of the main part.



Engineers also use the term manifold to talk about something that directs the flow of a gas or liquid. The exhaust manifold on an internal combustion engine is a good example. A simple pipe tee or any other pipe-fitting is also a typical manifold.

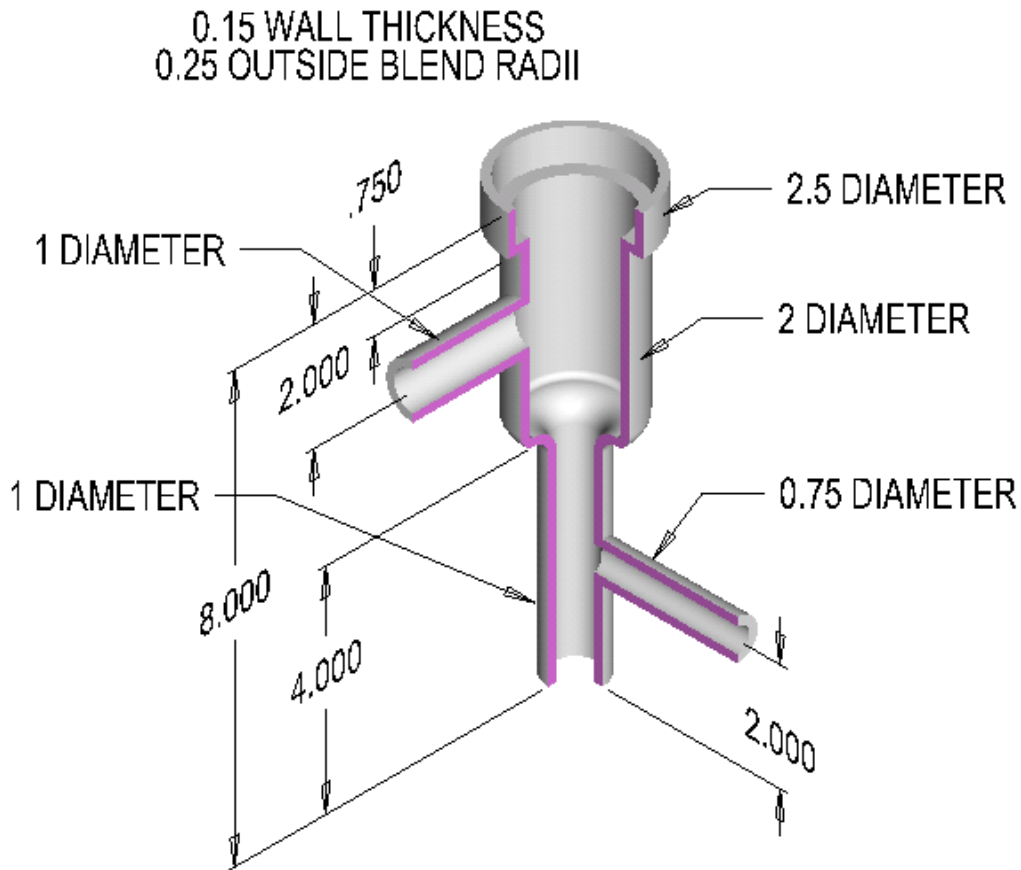
I've illustrated a simple manifold part above right. (The additional three-quarter section view is added to convey more information.)

Like many parts of this type, there is an extremely easy way to construct the little sucker that takes advantage of KEYCREATOR's unique ability to handle three-dimensional wireframe construction, surfaces, and solids in the same display space.

We're going to begin our project with a new part file in View 1. We'll use the default GREEN Construction color.

Our first task will be to construct a three-dimensional wireframe grid that will be used to position the various pieces that make up the finished part.

For reference purposes, I've illustrated the part below with key vertical dimensions. The two horizontal taps extend out 3 inches from the vertical centerline of the part.



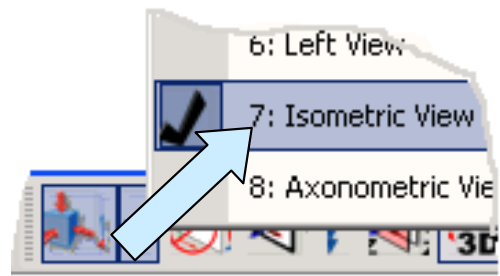
Click on the CREATE RECTANGLE WIDTH HEIGHT Icon.

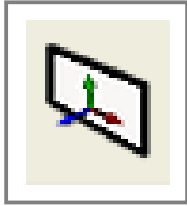
Use any Anchor Option. Type 3 for dXC and 3 for dYC.

Now, using the Cursor Option, click anywhere on the screen to place the rectangle.



Next, switch to the Isometric View.





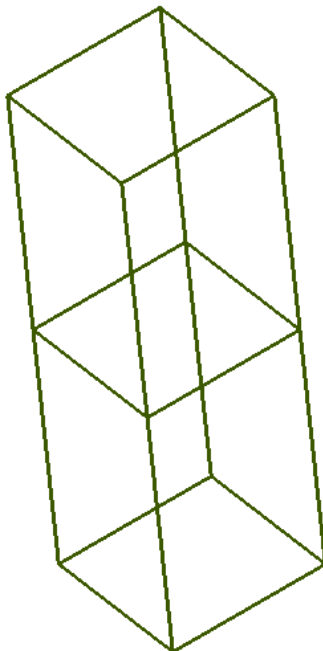
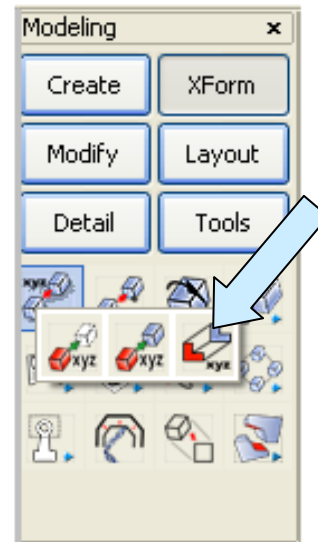
Click on the CONSTRUCTION PLANE Icon.

Click on the front edge of the rectangle and then on the left edge of the rectangle. This establishes a construction plane on the plane of the rectangle.

Now, click on the XFORM DELTA JOIN Icon.

Click on the ALL DSP Option and then on the ALL Option. Click on the ACCEPT Button.

Type 2 for the Number of Copies.



Hit the ENTER Key twice to indicate zero values for dXC and dYC.

Then, type 4 for the dZC value and hit the ENTER Key.

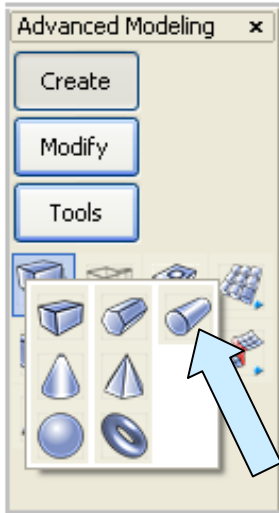
You will now have a three-dimensional wireframe grid on your screen like the one illustrated to the left. (I've rotated the grid slightly out of true isometric view so that you can clearly see all of the entities.)

Click on the SET ATTRIBUTE Icon.
A Dialog Box appears.

Select a new Construction Color. I'm going to use BROWN.

Then, click on the OK Button.

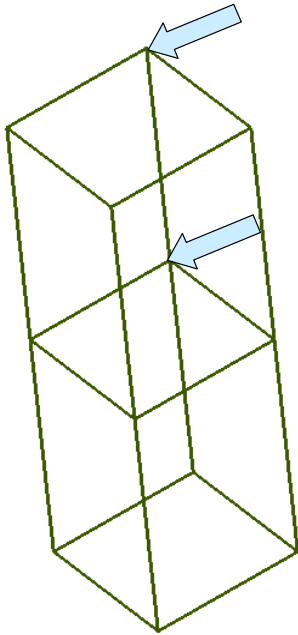
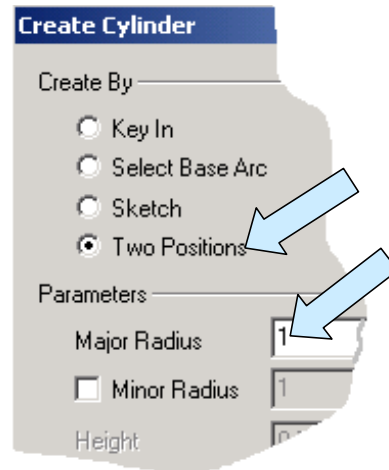




Click on the CREATE CYLINDER Icon.

A Dialog Box appears.
Click on the Two Positions Option.

Type 1 for the Radius and click on the OK Button.

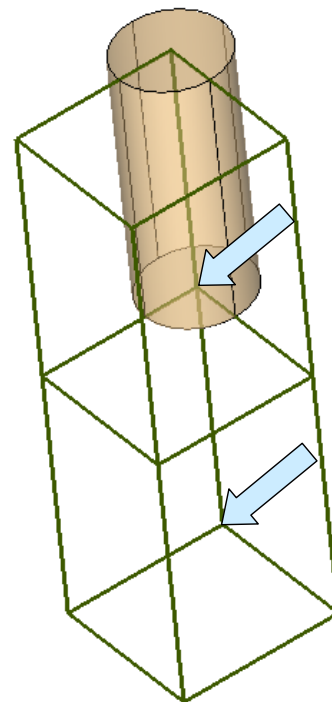


Now, using the EndEnt Option, click on the two grid locations indicated by arrows in the illustration to the left.

A cylinder appears on the grid.

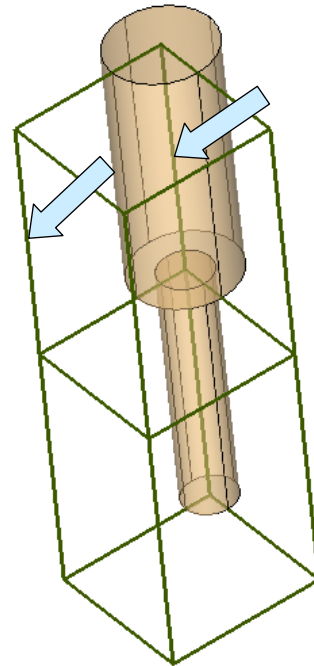
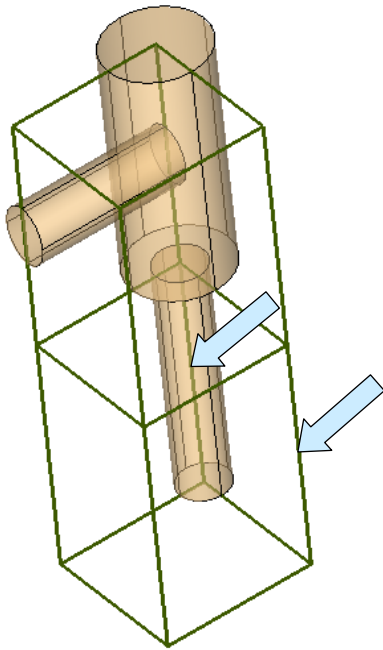
Click on the BACKUP Button.
The Dialog Box reappears.
Type 0.5 for the Radius and click on the OK Button.

Now, using the EndEnt Option, click on the two locations indicated by arrows in the illustration to the right.



A second cylinder now appears on the screen.

Now, click on the CtrMid Option and click on the two locations indicated by arrows in the illustration to the right.



Click on the BACKUP Button. Type 0.375 for the Radius and click on the OK Button.

Using the CtrMid Option, click on the two locations indicated by arrows in the illustration to the left.

Click on the BACKUP Button once more.
This time, click on the KEYIN Option.

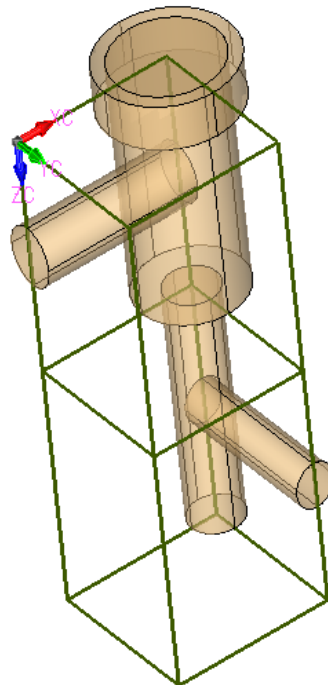
Type 1.25 for the Radius.

Look at the Construction Axis in the top, right corner of the screen.

If the Z Vector is pointing up, type -0.75 for the Height.
If the Z Vector is pointing down, type 0.75 for the Height. Then, click on the OK Button.

Using the CtrMid Option, click on the circular edge at the top of the uppermost cylinder on the screen.

Your construction should now look like this:





Click on the BOOLEAN UNION Icon.

Click on one of the cylinders.
Next, click on the ALL DSP Option and then on the ALL Option. Click on the ACCEPT Button.

At this point, let's do some level management.



Click on the MOVE ENTITIES Icon. (If you don't have this Icon on a toolbar, you can find it in the VIEW Pulldown Menu in the LEVELS Option.)

Click on the SELECT Option on the Conversation Bar.

Click on the ALL DSP Option and then on the BY TYPE Option.



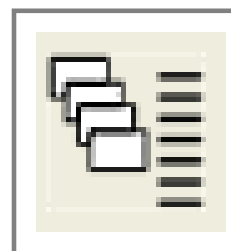
The MASKING BY TYPE Dialog Box appears. Click on the GREEN Option and then on the OK Button. Then, click on the ACCEPT Button.

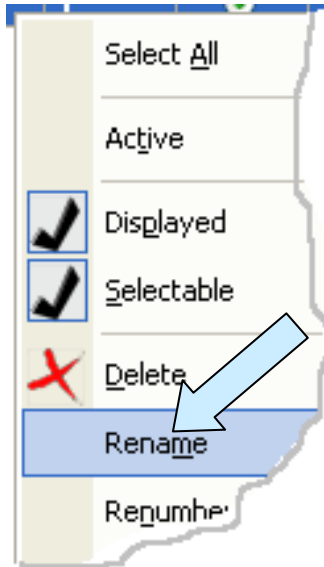
You are prompted to type a level. Type 2. This places all of the entities that make up the grid on level 2.

Repeat this process, moving the solid body to level 3.

Click on the TOGGLE SPLITTER Icon.

The Level List appears.

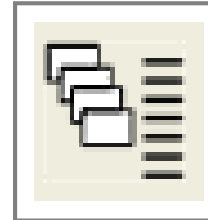




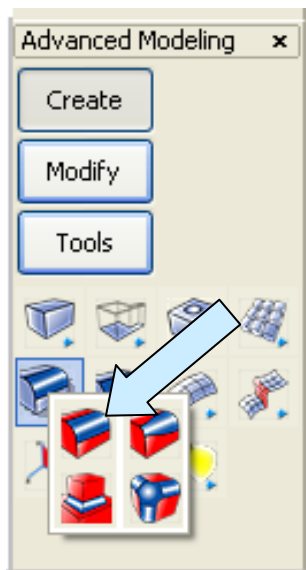
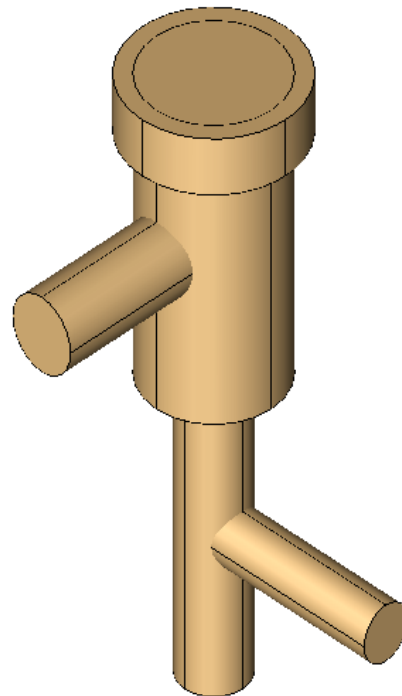
RIGHT MOUSE CLICK on the level 2 row and then on the Rename Option in the Menu that appears.

Type "Grid" and hit the ENTER Key. Next, rename Level 3 as "Full Part." Now, click on the display cell for level 2 to remove the check. This removes the construction grid from the display.

Click on the TOGGLE SPLITTER Icon to remove the Level List from the display.



Your screen should now look like this:

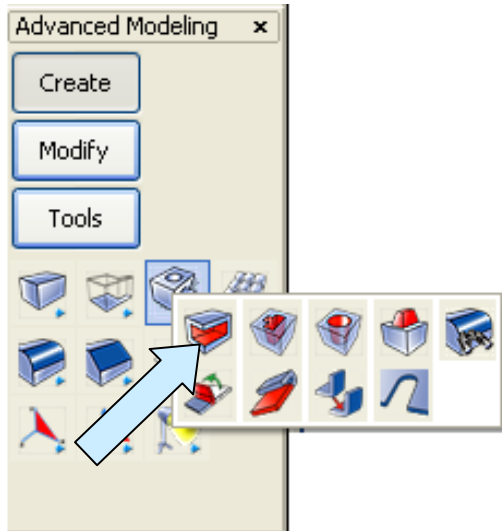


Click on the BLEND CONSTANT RADIUS Icon.

A Dialog Box appears.

Type 0.25 for the Radius and click on the OK Button.

Click on the bottom edge of the 2 inch diameter cylinder and on the circular edge at the top of the vertical 1 inch diameter cylinder. Then, click on the ACCEPT Button.



Next, click on the SHELL Icon.

Type 0.15 for the Shell Thickness and click on the OK Button.

Now, click on the circular face at the top of the part, the circular face at the end of the right side extension, the circular face at the end of the front extension, and the circular face at the bottom of the part. (This one is hidden, so use the TAB Key to index the Face Selector to the Hidden Face.)

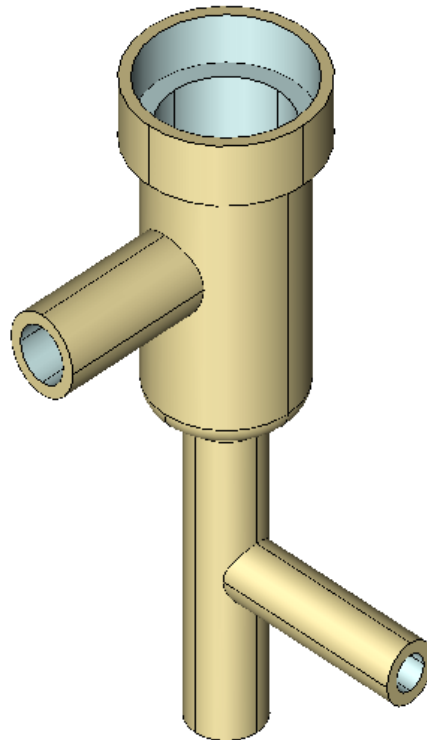
Then, click on the ACCEPT Button.

Your finished part should look like this:

You can see how the construction of the three-dimensional grid simplified the placement of the cylinders that make up this part.

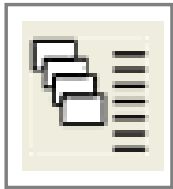
We could certainly have created the part without resorting to the grid, but it would have required more work.

The grid will be handy for future work on the part, so we placed the grid entities on a unique level. This allows us to remove the grid from the display when it is not needed.



Creating A Three-Quarter Section of the Part

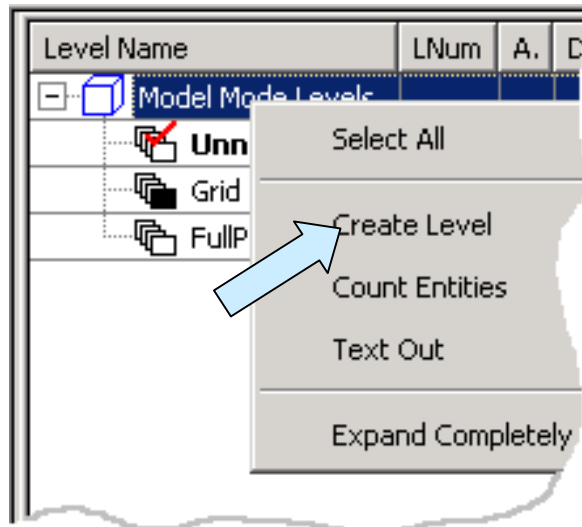
At the beginning of this exercise, I illustrated a three-quarter sectional view of the part. Let's take a moment to show you how this can be easily created using our handy construction grid!



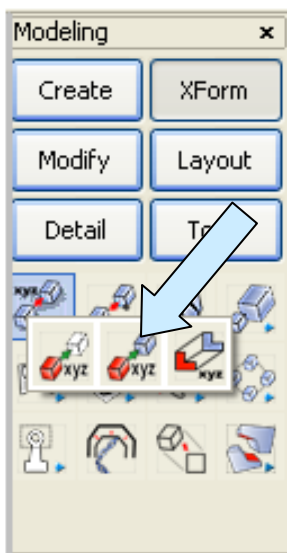
Start by clicking on the TOGGLE SPLITTER Icon.

RIGHT MOUSE CLICK on the Model Mode Levels row in the Level List.

Then, click on the Create Level Option in the Menu that appears. A Dialog Box appears. Type "SectionView" for the level name and click on the OK Button.



Notice that a new level (4) is created and it is now the Active Level.



Click on the XFORM DELTA COPY Icon.

Position the cursor over the solid body and click on it when it highlights.

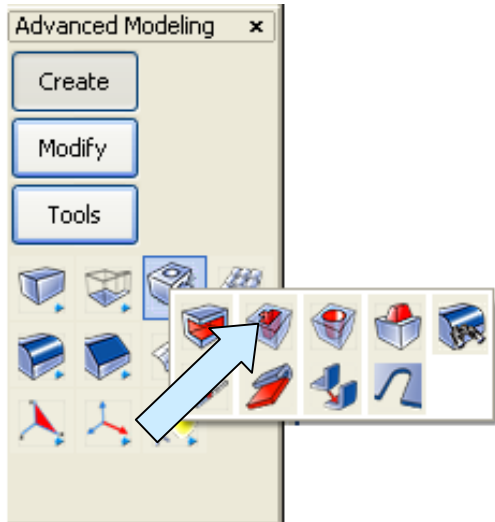
Then, click on the ACCEPT Button.
Type 1 for the Number of Copies.

Hit the ENTER Key three times to place the copy directly on top of the original part.

Now, click on the check in the display column for Level 3 to remove the original part from the display.

You'll notice that nothing seems to happen on the display because the copy occupies the same space!

You'll also notice that there is now an entry of "1" in the Entity Count for Level 4. This represents the new copy of the part.



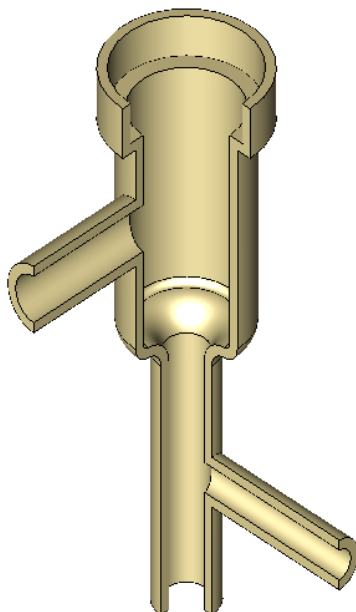
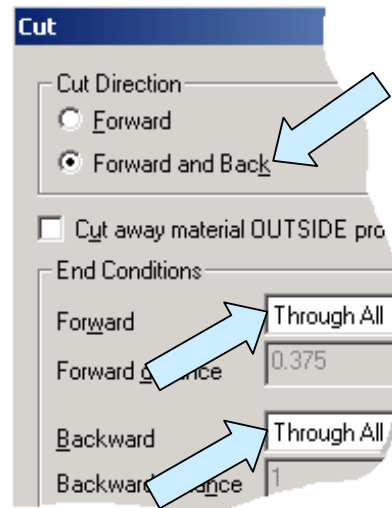
Take a moment to RIGHT MOUSE CLICK on the Level 4 row and then on the Rename Option in the Menu that appears. Type "Section View" for the name.

Next, click on the display cell for Level 2 to redisplay the construction grid.

Now, click on the CUT Icon.

A Dialog Box appears. We'll use the Forward and Back Option with Through All for each direction. Click on the OK Button.

Click on the solid body.



Then, click on the four lines that make up the topmost section of the grid. Click on the ACCEPT Button.

Click on the checkmark under display for Level 2 to remove the grid from the display.

Your sectioned part should look like this:

