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Introduction

CATIA Version 5 Electrical Design

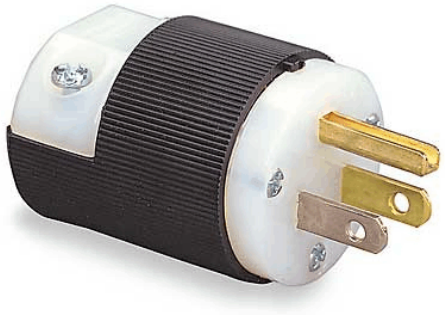
Upon completion of this course the student should have a full understanding of the following topics:

- Defining electrical parts and assemblies
- Defining electrical connection points
- Defining support parts
- Storing electrical parts into catalogs
- Assembling electrical parts

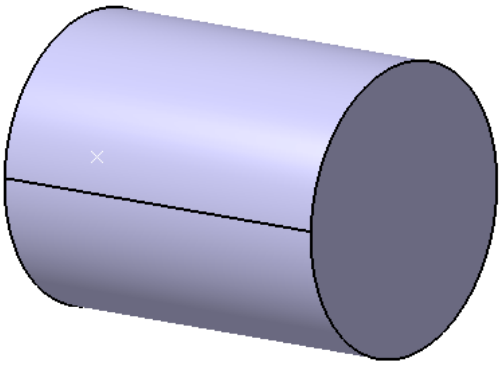
Electrical Design

Electrical Design is the first phase of defining an electrical harness. Before you can begin defining the wire segments and bundles, you need to first build the electrical parts. The actual building of the parts is done utilizing part design, generative shape design, and other part related workbenches. Once the model is developed, you are ready to begin defining the electrical properties for that model. Any part that is to be used with the electrical harness should have all necessary electrical properties defined prior to trying to build a harness.

There are three stages to defining an electrical part. You must first always build the part. This can generally be the most difficult aspect since you will need to determine the level of complexity for the part. The more complex you make the part, the more detailed it will become and the more information you can put into the part and take out of the part. Take, for example, a simple electrical cord plug.

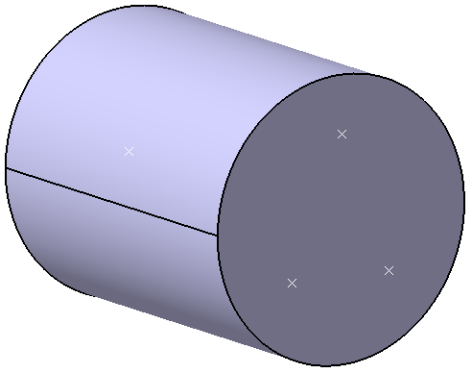


This type of plug can be modeled and electrified in a number of different degrees of complexity. You could model the plug as a single cylinder where only the wire connection point is identified.



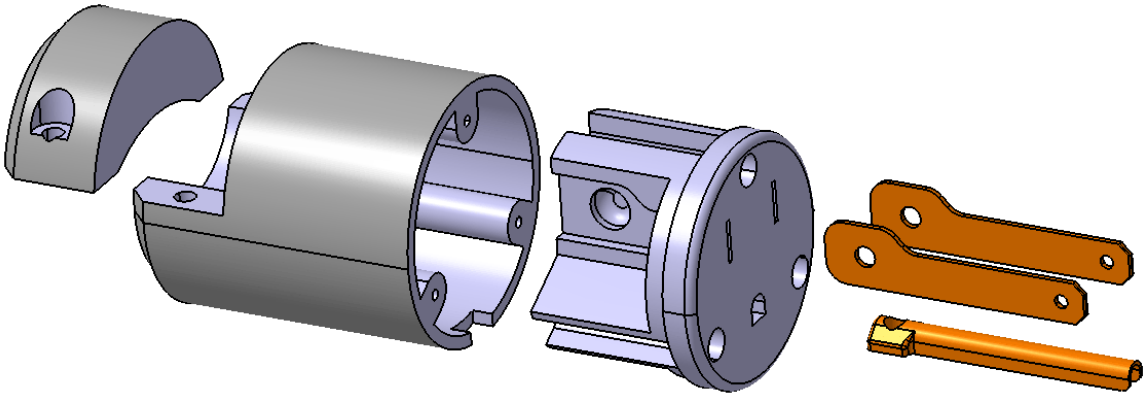
This type of model is easily created and can rapidly be used when defining electrical properties, however it lacks a lot of information. In this case, you would indicate that the wire bundle would connect to the connector via one termination point. You would then have to have adequate documentation to indicate which wire was to connect to which terminal, as well as the number of terminals, terminal arrangement, etc. This type of plug is often used more for space reservation and rapid proof of concept rather than a final design.

The next level of complexity would be to indicate that the plug has three connection points.



Although there is little change in the model, you will be able to define more information with the electrical terminations on this model. In this case, you will be able to define each specific termination and the route of the wire from pin to pin. Although there is not a high amount of part detail, you will have a higher amount of electrical detail just by adding a few extra points in the model.

The highest level of detail would be to define the entire product.



At this point, you would have a very high level of detail for both the digital design of the model and the electrical properties for this assembly. In this case, you would not only be able to define the contacts for the electrical part, but you would also be able to define the shells, back shells, supports, and all other components for the plug. Keep in mind, although this type of assembly does show and have the most detail, it also takes the longest to build.

When determining what you will need to build, be sure to take into account how long you want to spend building the part, and what information you need to pull from the part. If you find you need a high level of information from the part, you will need to be highly detailed for the product.

In this course, you will utilize two electrical workbenches along with all your part and assembly workbenches. It will be assumed that you have a good understanding of Part Design and Assembly Design, as well as some understanding of Wireframe and Surfaces. In this course you will primarily be using the Electrical Part Design and Electrical Assembly Design workbenches to electrify your parts and products.

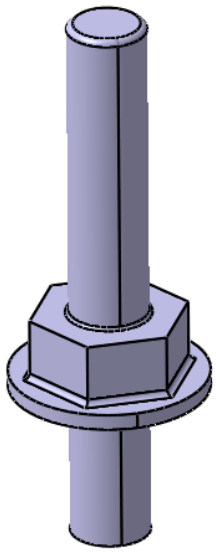
Stud, Terminal Strip, Terminal Block

A stud is generally a device used to terminate a wire, or group of wires at a common location. Terminal strips and terminal blocks also allow for wire termination at a common model location, but not necessarily in the same physical place. Grounding or power distribution points are often one of these devices where a series of wires all come together at a common point. These devices can have one cavity connection point and multiple bundle connection points or cavities defined. You can also have termination points directly defined on them as well.

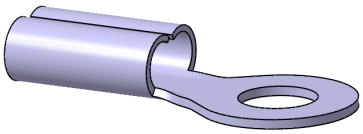
Stud, Terminal Strip, Terminal Block Connection Type	Can Connect to this Connection Type	On this type of Device
Cavity	Cavity Connection Point	Contact
Cavity Connection Point	Cavity	Mounting Equipment Equipment Shell
Bundle Connection Point	Bundle Segment Extremity	Bundle Segment

Notice, to connect things such as a contact to your stud you will need to define a cavity on the device. Many times you may not model your device with cavities (holes / pockets). In this exercise, you will not only define the stud equipment, but you will also look at "fooling" the system into allowing for the types of connections you wish to make. Even though you will only be looking at a stud device, keep in mind, the exact same options and methods are available for the terminal strips and terminal blocks.

Open the Stud document. This is a simple grounding post model that you will define as a stud connector, then define the various connection types on it.



Note that there are no cavities on this stud, however, you will still want to be able to define contact connection points to allow for terminals to be attached to the stud (for example, the terminal shown below).



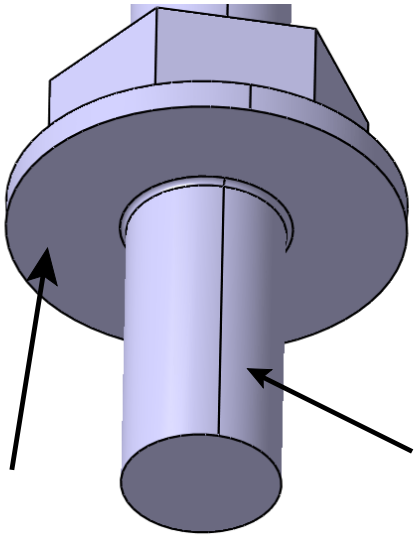
Select the Define Connector icon and select the part.  This will display the connector definition window.

Change the connector *Type* to *Stud* and change the *Part Number* to <u>Ground Stud</u>. At this moment, you will not define terminations on the grounding stud. Terminations can always be added at a later time.

Select *OK* when done. At this point, you are ready to define the necessary connection points on the grounding stud.

Start a cavity connection point on the stud. Change the *Name* to <u>Stud Mount</u>. The stud mount point is going to be at the bottom of the stud, against the flat portion of the built-in washer.

Select the cylinder of the stud as the *Representation*, the flat portion of the washer as the *Contact* and the centerline of the cylinder as the *Coincidence*.



Select *OK* when done. This will define the necessary placement constraints for the stud mount. At this point, you are ready to start defining the other connection points.

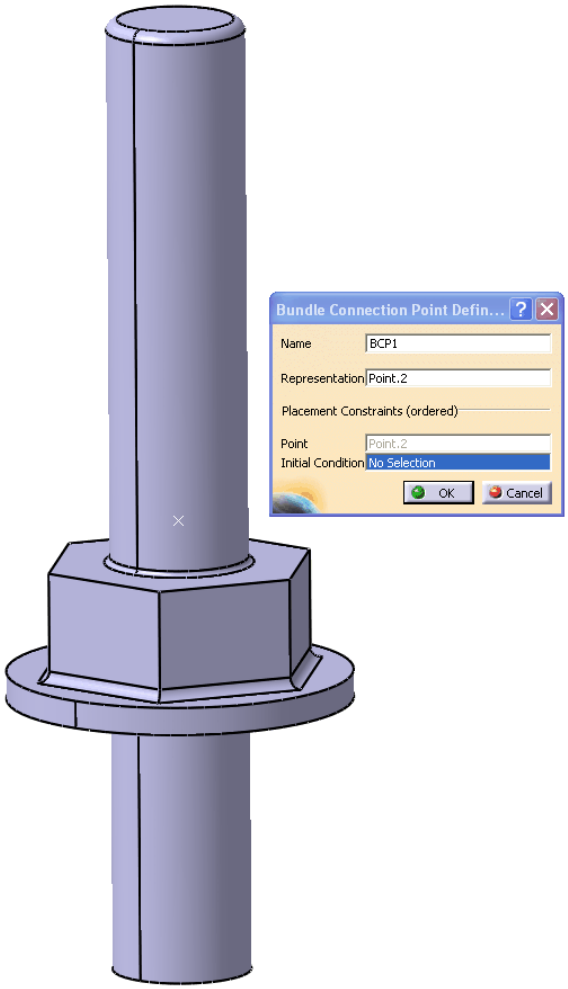
If you remember right, stud connectors can have bundle connection points or cavities defined on it. A bundle connection point would simulate a wire being wrapped directly around the stud, whereas a cavity will allow a contact or terminal to be mounted on the stud. In this example, you will define both a bundle connection point and a cavity at each virtual connection location along the stud to allow for several wires to ground at the same point.

Start a bundle connection point on the *Ground Stud*. Change the name to <u>BCP1</u>. This will identify this as the first bundle connection point.

In this case you will be representing the bundle connection points as a point along the stud.

Press the third mouse button while on the *Representation* field and select *Create Point.* This will allow you to create the necessary point to represent the bundle connection point on the fly. This will display the point definition window.

With the point type set to *Coordinates*, set the point at (0,0,0.075). Select *OK* when done. This will put the point at 0.075in along the Z-axis. This will display the bundle connection point window when you select *OK*.



Notice that the representation and the point definition were defined just by creating the one point. When you select a point as the representation, the point placement constraint is automatically defined.

Since you will not know or want to control the initial condition of the bundle, you will not be defining an initial condition.

Select *OK* to the *Bundle Connection Point Definition* window. This will establish the bundle connection point.

Now you are going to define a cavity at the exact same location, thus allowing the user to terminate a bundle or a contact at the stud.

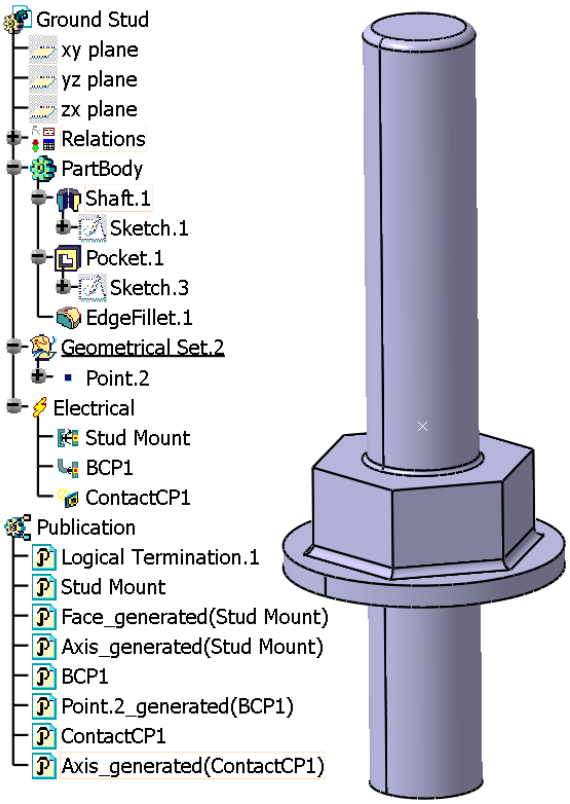
Select the Define Cavity icon and select the stud.  **Change the *Id Number* to ContactCP1.** This will indicate the first contact connection point. Even though you do not have a physical cavity in the stud, you will be able to define the cavity via the point created with the bundle connection point.

Note: If you did not want the bundle connection point, you could always create the point first, then define it with the cavity connection point. You cannot, however, create the point on the fly with the representation of the cavity connection point.

Select the point created earlier as the *Representation*. Now you can define the necessary placement constraints for the cavity.

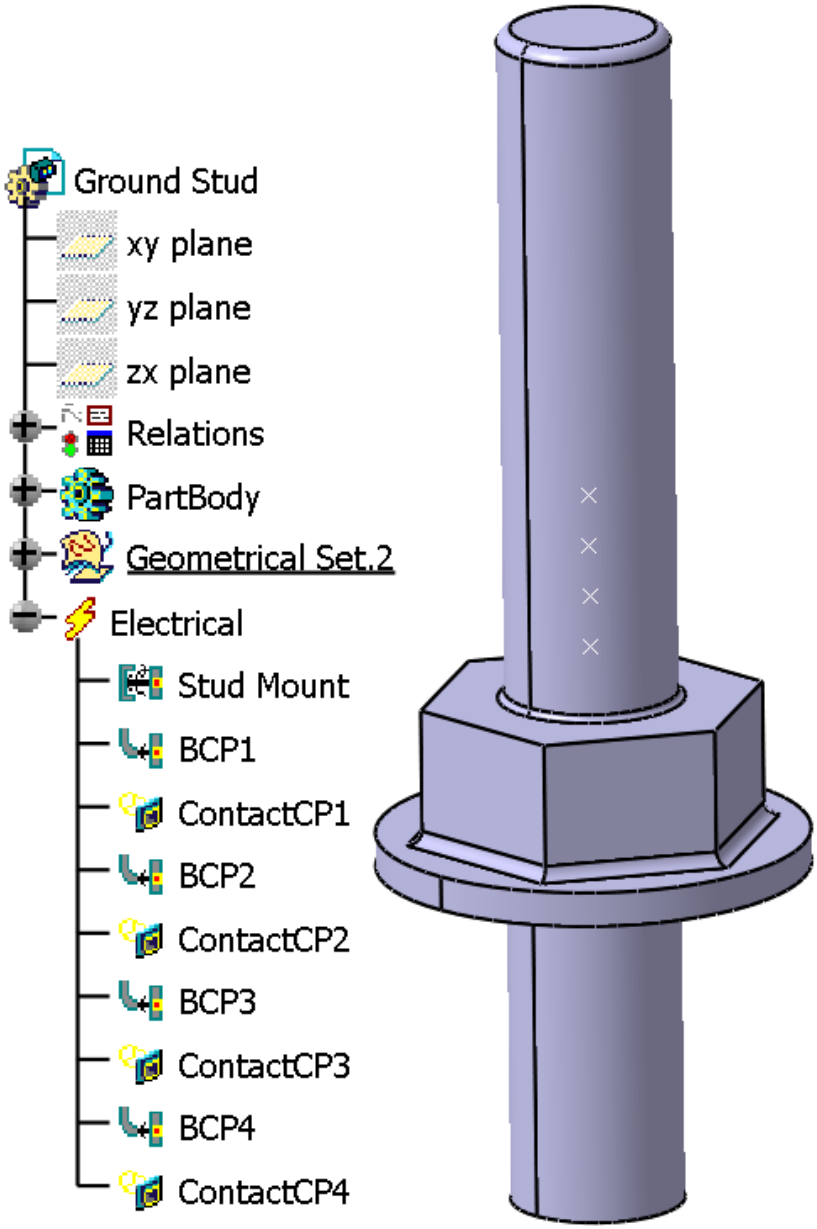
Select the same point as the *Contact* placement constraint. Select the centerline of the stud as the *Coincidence* placement constraint. Again, since you do not want to force the contact in any particular direction, you do not need to define an orientation constraint. Keep in mind, if you did want to define an orientation constraint, you would need to generate a line that goes through the coincidence and contact locations.

Select *OK* when done. This will establish a cavity on the model to allow for a cavity connection point in a contact to attach.



At this point, you can now attach a contact or a bundle at the same location.

Feel free to create a few more connection points along the length of the stud. Creating the additional connection points is not required, however, it makes for good practice to define the necessary connection points. Be sure to space the connection points out along the length of the stud.



Note: Publications not shown for clarity.

Save and close your document.

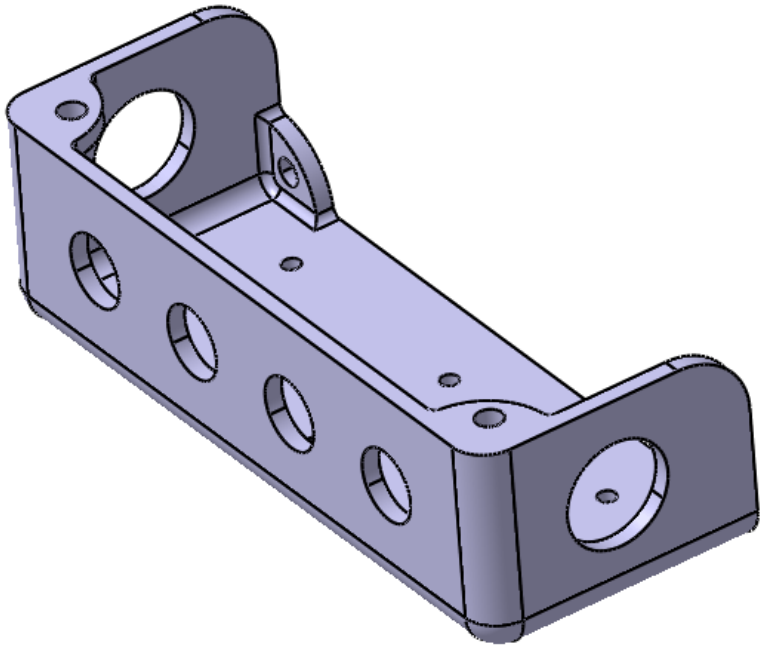
External Splice

An external splice is similar to a junction box. The external splice only allows for bundle connection points and is not designed to be a wire by wire splice. Wire to wire splices within a geometric bundle is an internal splice and is only available when in the Electrical Assembly Design workbench.

External Splice Connection Type	Can Connect to this Connection Type	On this type of Device
Bundle Connection Point	Bundle Segment Extremity	Bundle Segment

The only type of connection point that can be defined on the external splice is a bundle segment.

Open the External Splice document. This is a simple junction box with the cover removed.

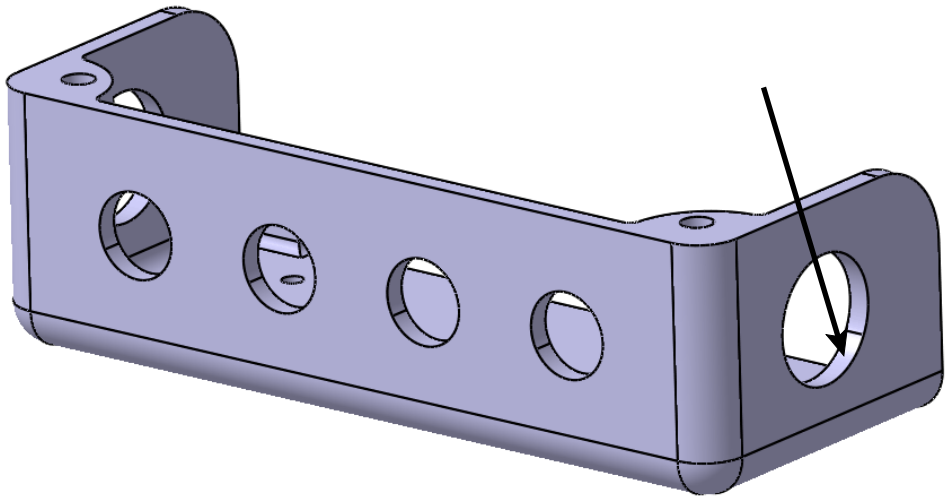


This external splice will have six different bundle connection points.

Select the Define Connector icon and select the External Splice part. **Change the connector *Type* to *External Splice* and change the *Part Number* to Junction Box. Select *OK* when done.** This will have the box defined as a connector device. This part will have no terminations at this point.

Select the Define Bundle Connection Point icon and select the junction box. The first bundle connection point you are going to define will be on the right side.

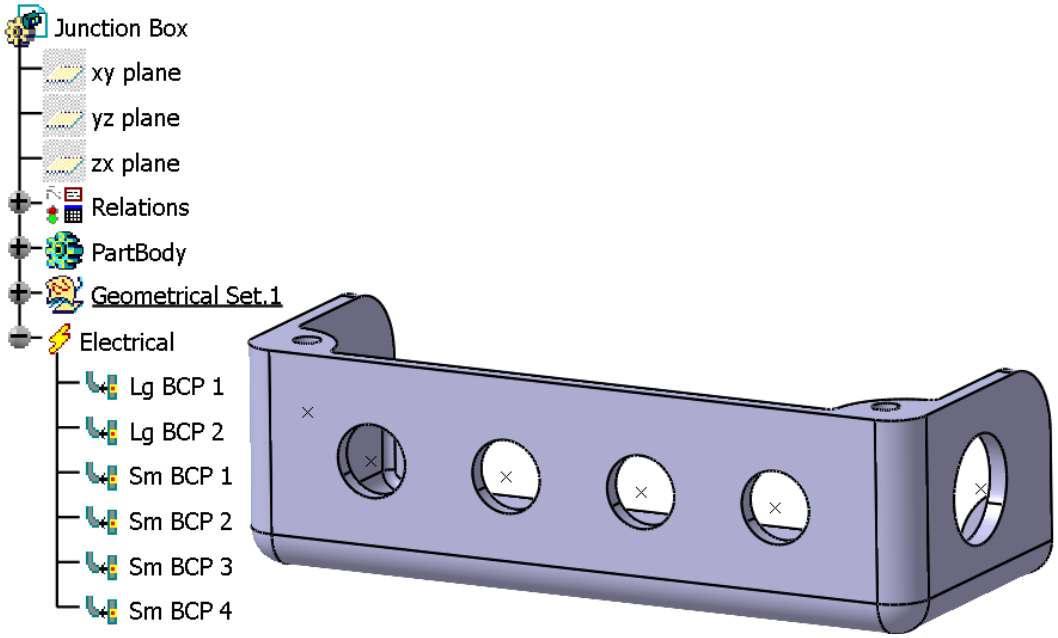
Change the *Name* of the bundle connection point to Lg BCP 1 and select the right hole as the *Representation*. This hole is shown below.



Create a point at the center of the hole as the *Point* placement constraint and select the planar face as the *Initial Condition* placement constraint. This will have the first bundle connection point defined for the external splice.

Select *OK* when done. Creating the bundle connection point for the external splice is no different than creating the bundle connection point for any of the other type of device.

Create the other necessary bundle connection points around the front and left side of the external splice. You should end up with the following electrical connection points.



Note: Publications not shown for clarity.

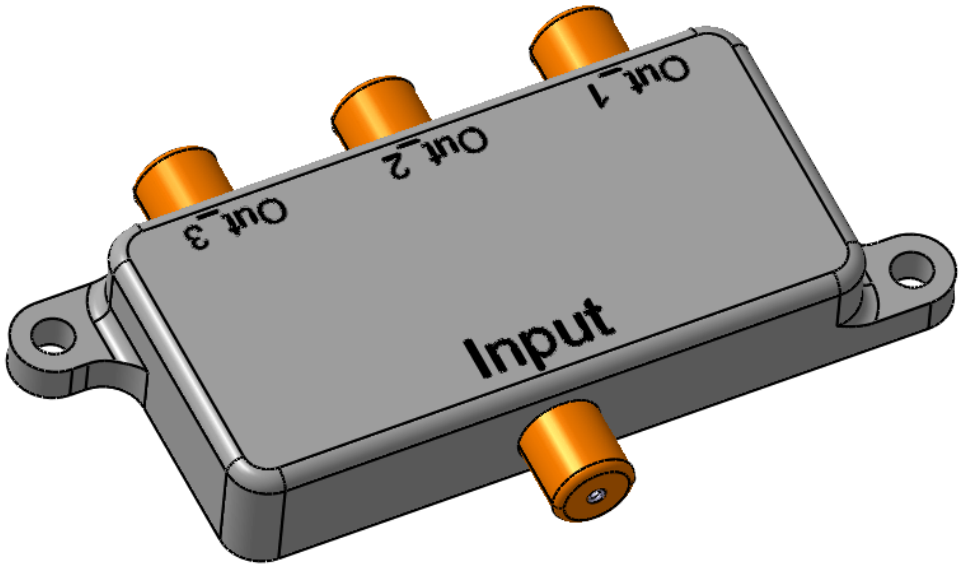
Save and close your document.

Multi Insert Connectors

Multi insert connectors only allow for connections to single insert connectors and mounting equipment. Generally multi insert connectors work good for "Y" adapters or splitters where you will have multiple single insert connectors connecting. Multi insert connectors can also be used in the place of an external splice when several connectors are connecting together, rather than the bundle segments themselves.

Multi Insert Connector Connection Type	Can Connect to this Connection Type	On this type of Device
Connector Connection Point	Connector Connection Point	Single Insert Connector
Cavity Connection Point	Cavity	Mounting Equipment

Open the Multi Insert Connector document. This is a mockup of a coax cable splitter.

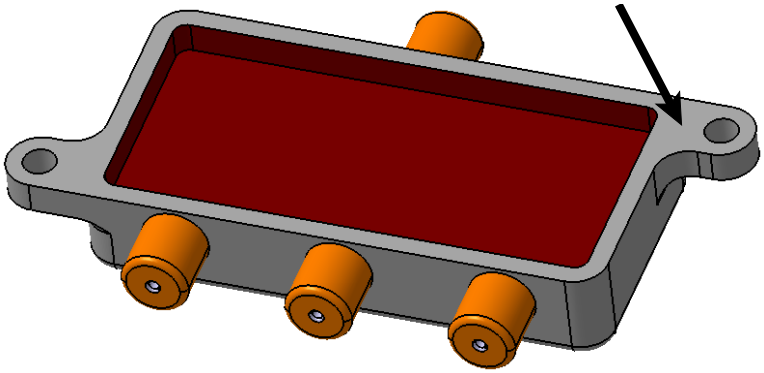


Using the Define Connector icon, define this part as a *Multi Insert Connector*. Change the *Part Number* to Cable TV Splitter and leave the *Number of Terminations* at zero and select *OK*. Even though you are going to end up defining eight terminations for this model (two per connector) you will be learning to define this after the fact for this connector.

Now that the device is defined as a multi insert connector, you are now ready to define the cavity connection point for mounting to other mounting equipment devices.

Select the Define Cavity Connection Point icon and select the connector. You will be defining the cavity connection point with just a contact constraint. Since this type of connector does not specifically go into a cavity, just the contact placement constraint will suffice.

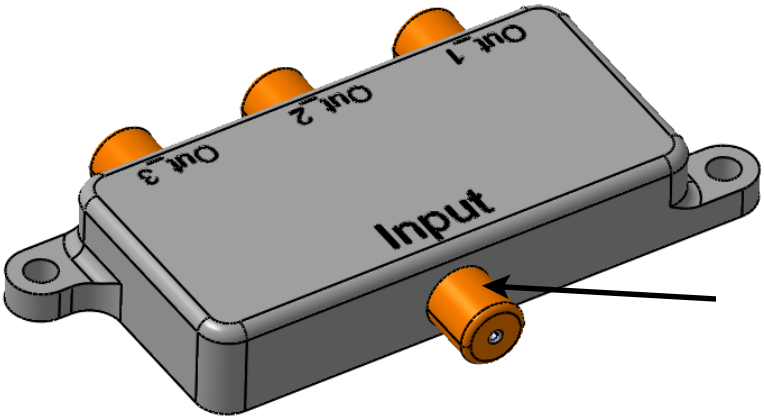
Change the *Name* to Connection Face and select the bottom face of the connector as shown below for the *Representation* and the *Contact* placement constraint. This will have the cavity connection point defined.



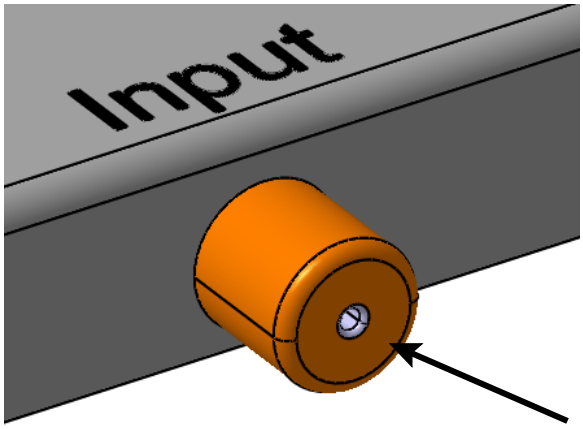
Select *OK* when done. Now that the cavity connection point is defined, you are ready to start defining the connector connection points.

Select the Define Connector Connection Point icon and select the connector.  This will start the connector connection point. The first connection point you will define will be the input connection point.

Change the *Name* to Input and select the cylinder for the *Representation*. This surface is shown below.



Select the front face of the connector as the *Contact* placement constraint. Again, this surface is shown.



Select the centerline of the connector as the *Coincidence* placement constraint. This will have the connector connection point defined.

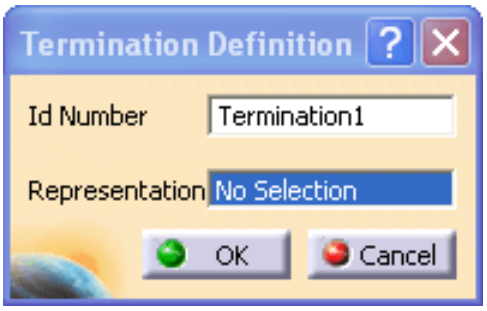
Select *OK* when done. Now all you need to do is define the terminations for the input connector connection point.

Defining Terminations

Terminations can be defined on any type of connector. Keep in mind, the terminations are just simply the termination of a wire at the connector. Terminations can only be defined in the following type of equipment:

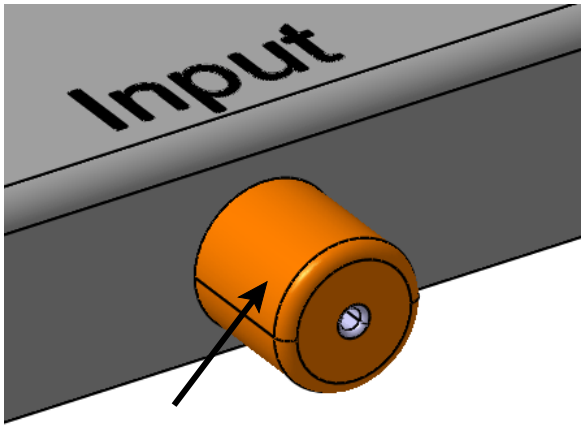
Equipment	Shell
Single Insert Connector	Multi Insert Connector
Stud (only one)	External Splice
Internal Splice	Terminal Strip
Contact (Only One)	

Select the Define Termination icon and select the connector.  This will display the *Termination Definition* window.

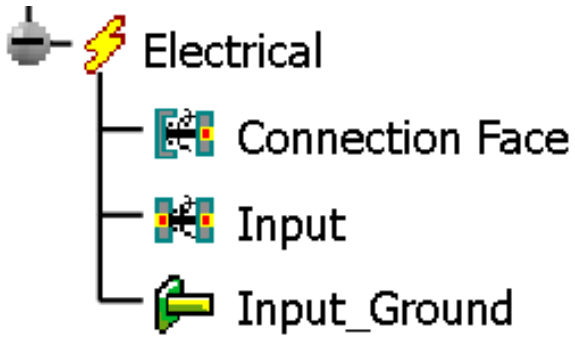


Look familiar? This is the same window that is displayed when you double select on a termination from the tree. If you remember, the *Id Number* simply defines the termination identifier and the *Representation* defines the geometry that will highlight when the terminal is selected.

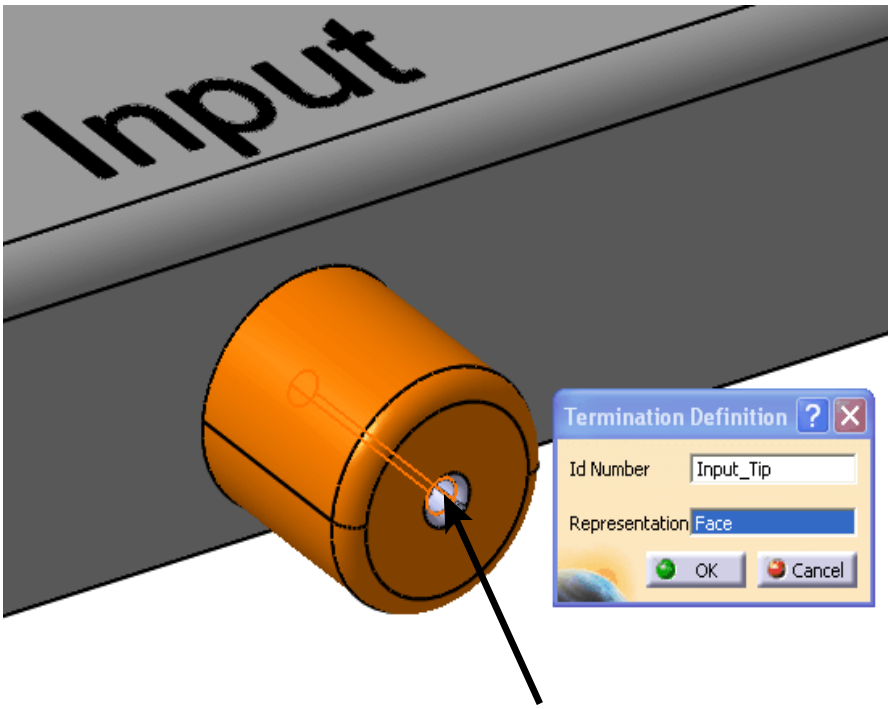
Change the *Id Number* to Input_Ground and select the outer surface of the input connector as the *Representation*. This surface is shown below.



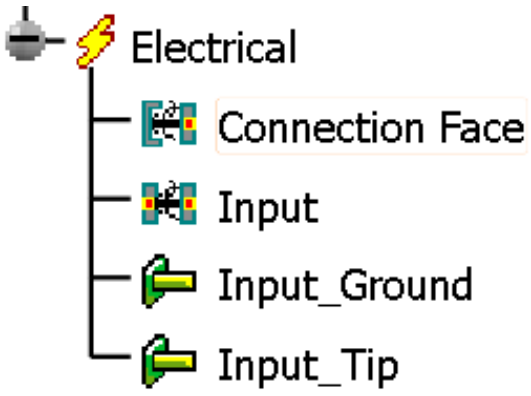
Select *OK* when done. This will have your first termination defined.



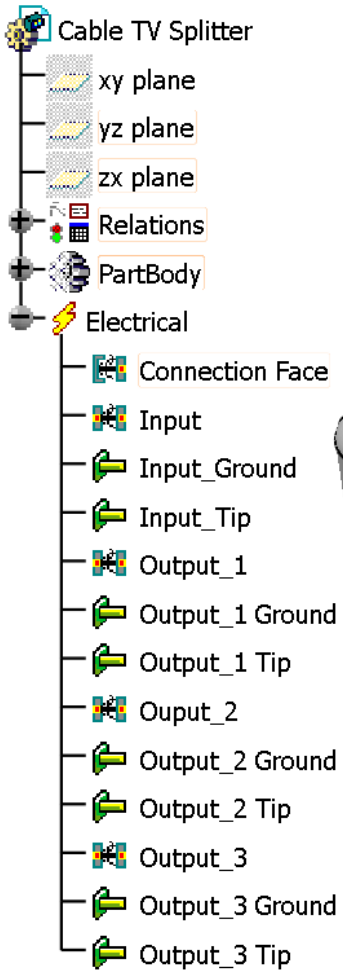
Using the Define Termination icon, define another termination for the tip.  **Set the *Id Number* to <u>Input_Tip</u> and select the inner cylindrical surface as the *Representation*.** This is shown below.

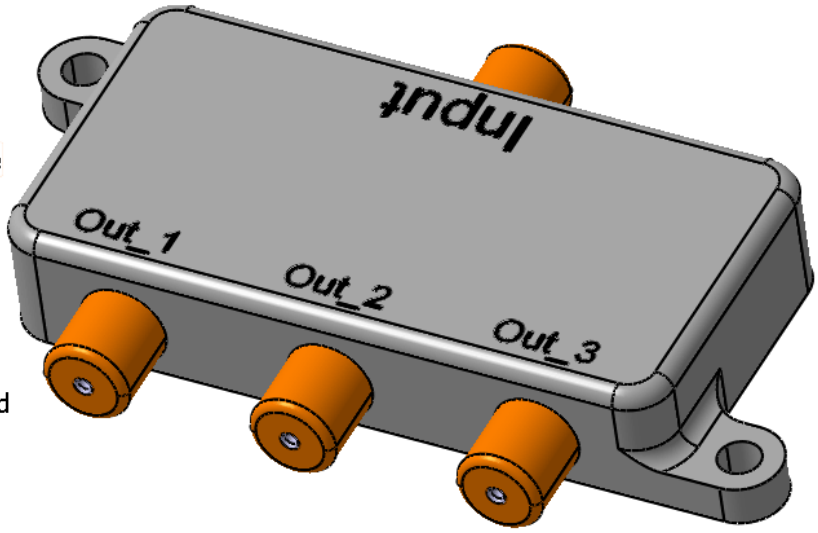


Select *OK* when done. This will have the two terminations defined for the input.



Create the necessary connector connection points and terminations for the three output connectors. This will have all the necessary connections and terminations defined.





Note: Publications not shown for clarity.

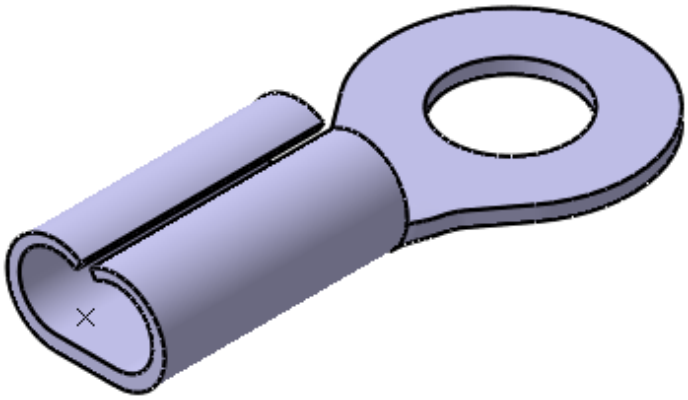
Save and close your document.

Contacts

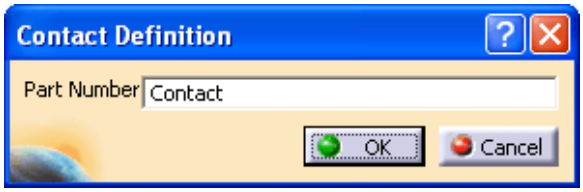
Contacts can be any type of device used to make the physical electrical power transmission from one connector to another.

Contact Connection Type	Can Connect to this Connection Type	On this type of Device
Cavity Connection Point	Cavity	Mounting Equipment Equipment Shell Single Insert Connector Back Shell
Bundle Connection Point	Bundle Segment Extremity	Bundle Segment

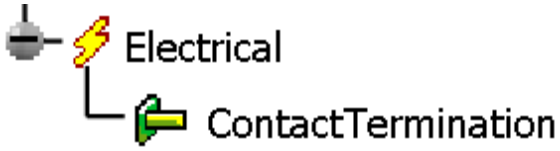
Open the Contact document. This is a simple round terminal that you will define as a contact.



Select the Define Contact icon and select the terminal.  This will display the *Contact Definition* window.



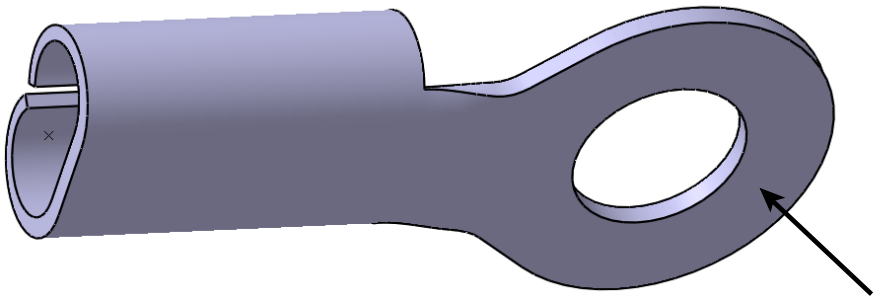
Change the *Part Number* to 0.25 Round Terminal and select *OK*. This will define the part as an electrical contact, and define a contact termination in the specification tree.



Now all you need to do is define the bundle connection point and a cavity connection point.

Select the Define Cavity Connection Point icon and select the terminal.  **Change the cavity connection point *Name* to Terminal Hole. Select the surface of the hole as the *Representation*.** This will have the cavity connection point definition started.

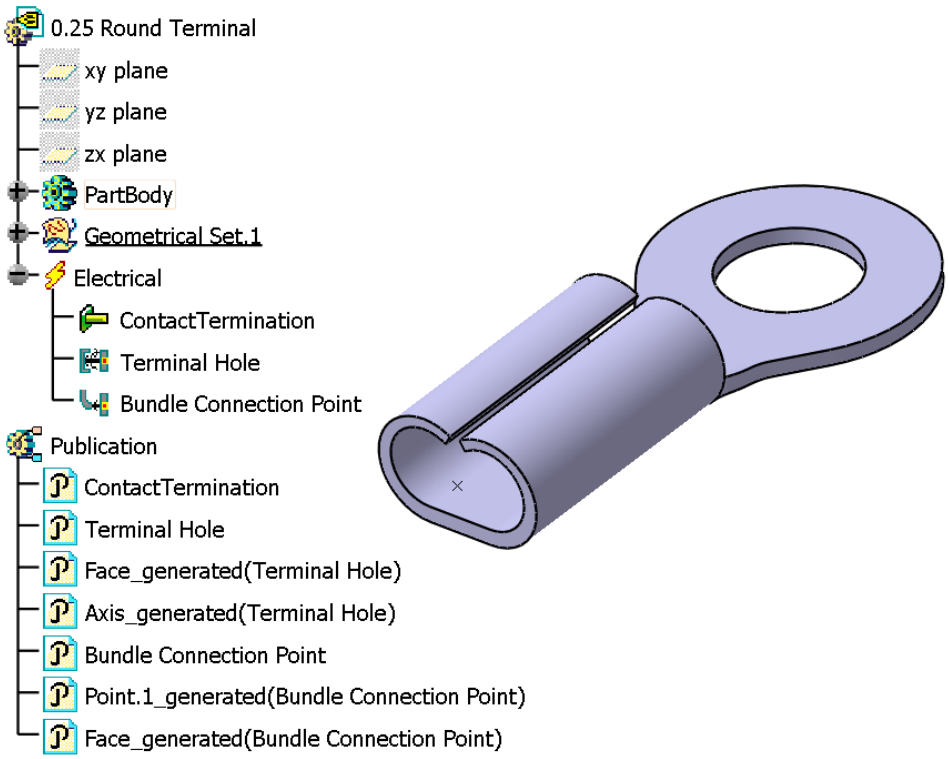
Select the bottom of the terminal as the *Contact* placement constraint. This surface is shown below.



Select the centerline of the hole as the *Coincidence* placement constraint. Select *OK* when done. This will have the cavity connection point defined.

All you have left is to define the bundle connection point at the back of the terminal. This will be left for you to complete. You can use the point at the back center as the bundle connection point placement constraint.

This will have the terminal defined.



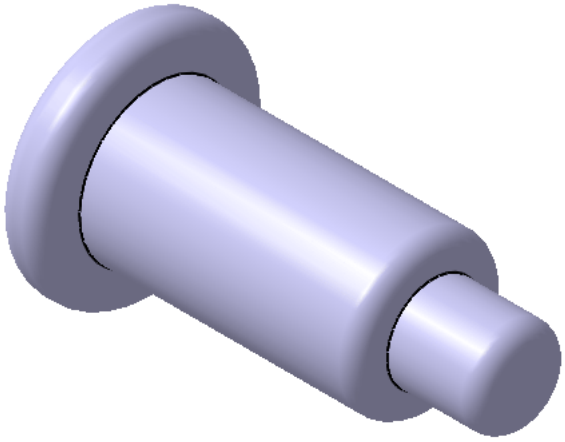
Save and close your document.

Filler Plug

Filler plugs are devices designed to fill unused cavities in various types of equipment. Filler plug equipment is a very simple definition, only allowing cavity connection points.

Filler Plug Connection Type	Can Connect to this Connection Type	On this type of Device
Cavity Connection Point	Cavity	Mounting Equipment Equipment Shell Single Insert Connector

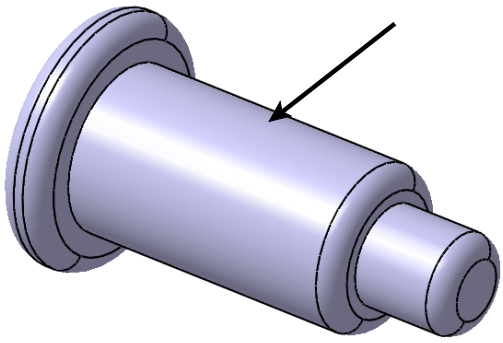
Open the Filler Plug document. This is a simple round filler plug.



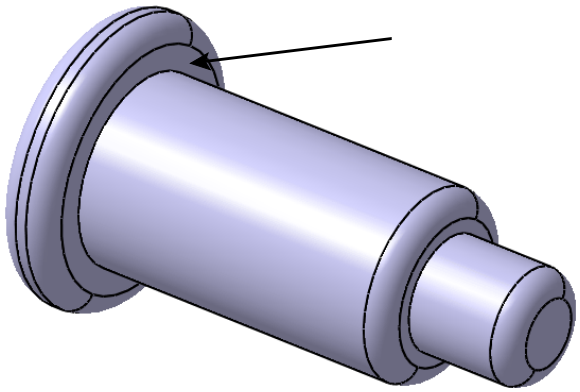
Select the Define Filler Plug icon and select the filler plug.  This will display the *Filler Plug Definition* window. Just like a contact, only a part number change is available with the definition of a filler plug.

Change the *Part Number* to 0.16 Filler Plug and select *OK*. This will establish the part as a filler plug device.

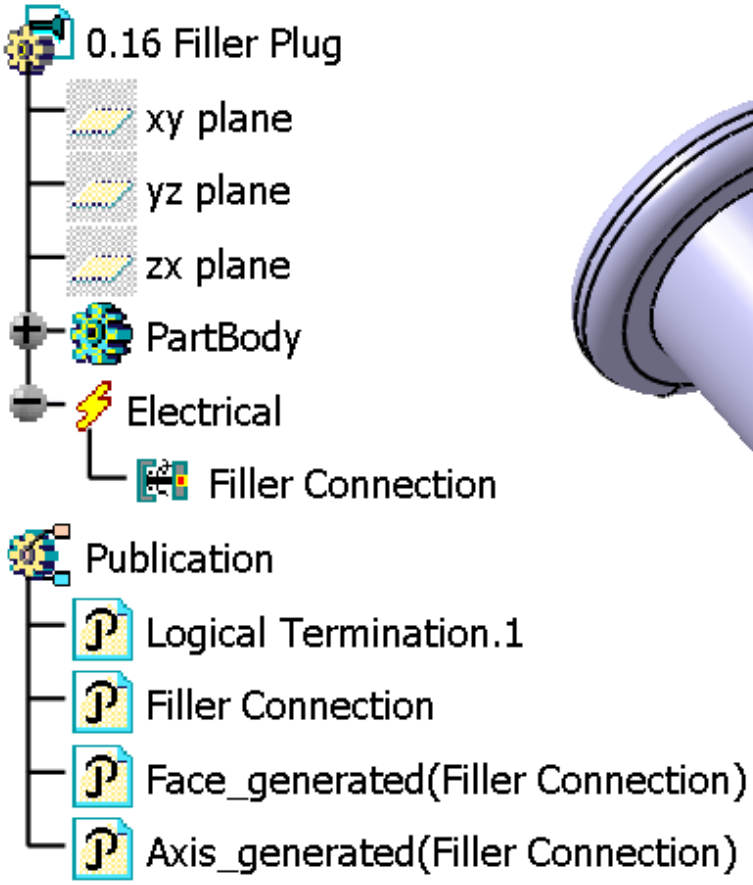
Start a cavity connection point definition on the filler plug. Change the *Name* to Filler Connection then set the *Representation* to the middle cylindrical surface. This surface is shown below.

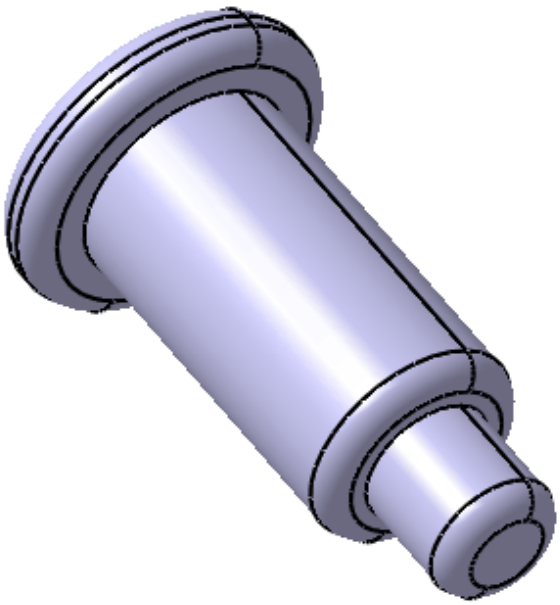


Select the ledge of the larger surface as the *Contact* placement constraint and the centerline of the filler plug as the *Coincidence* placement constraint. The contact placement constraint surface is shown below.



Select *OK* when done. This will have the filler plug defined.





Save and close the document.