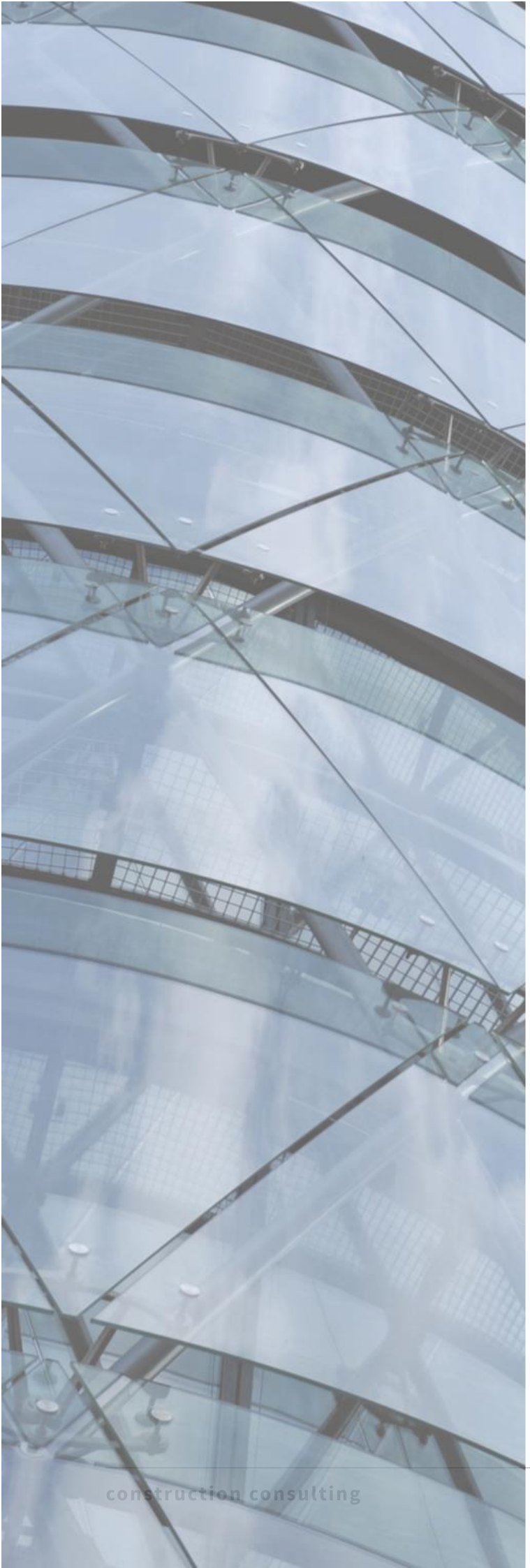

spányi partners

USER MANUAL

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construction consulting

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1. Introduction

The “SP MEP Library” was created for the ArchiCAD 23 version. The library contains intelligent mechanical elements, which extend and work together with the set of elements of the already existing “MEP Library”.

To use these elements, it is necessary to have the MEP extension and the pertaining “MEP Library” GDL set of elements with the subtypes defined in it. In current User Manual, the existence and the know-how to handle these tools are presumed.

The “SP MEP Library” currently contains 4 elements, two for Ductwork and two for Pipework. The structure of the library is the following:

- Duct
  Versatile Duct Tee (“Duct Tee Tool” Junction element type),
  Versatile Duct Bend (“Duct Bend Tool”, Bend element type),
- Pipe
  Versatile Pipe Wye (“Pipe Wye Tool”, Junction element type),
  Versatile Bypass Pipe (“Pipe Fittings Tool”, Inline element type).

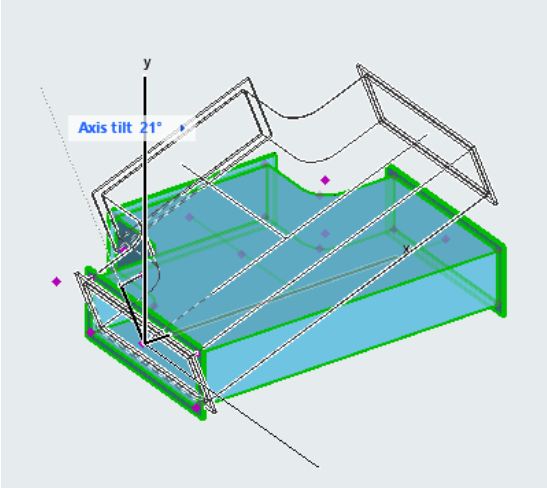
We are planning to extend the library soon with new elements, not only extending the MEP library.

1.1 Initial cross-section

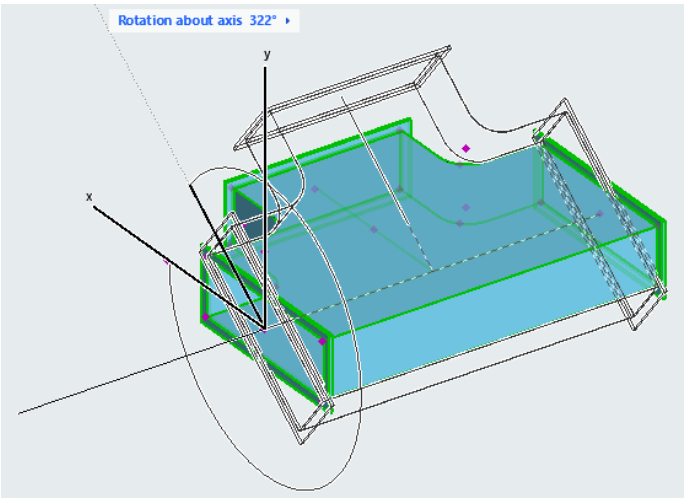
Here and further on, the modifiable Hotspots are indicated with purple, and the Selection Dots are marked with black.

The starting point – zero point, (X, Y, Z) = (0, 0, 0) of every element – is the centerline point of the “1st cross-section” as well, we call this initial cross-section. In this cross-section, you can rotate the elements in 3D into any position with two angles (ϕ: Axis tilt, Ω: Rotation about axis) and Hotspots. These two angles can be set at the User Interface “General Settings” page as well. These Hotspots to set these two angles, operate the same way at all three cross-section shapes (rectangle, circle, oval), and following illustrations show how to use these:

ϕ: Axis tilt:



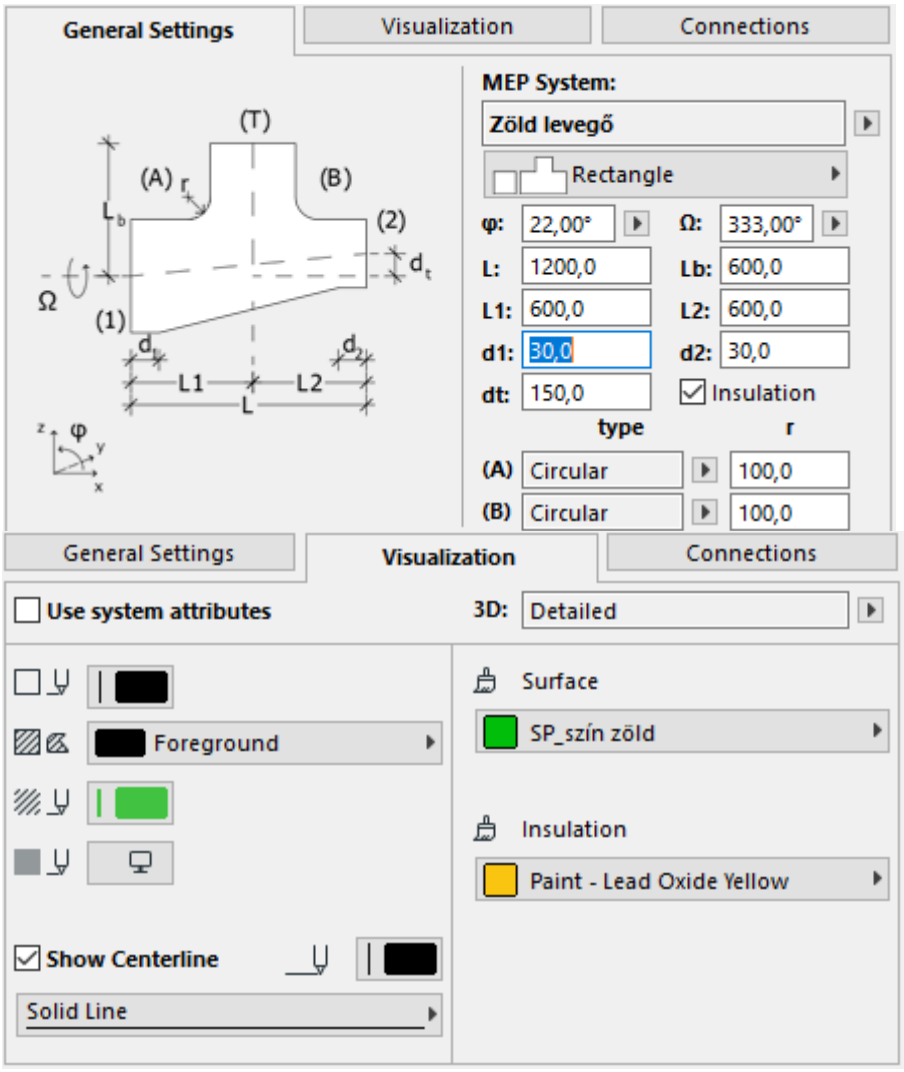
Ω: Rotation about axis:



1.2 User Interface

The User Interface of every element contains three tab pages, which are the following:

- General Settings,
- Visualization,
- Connections.



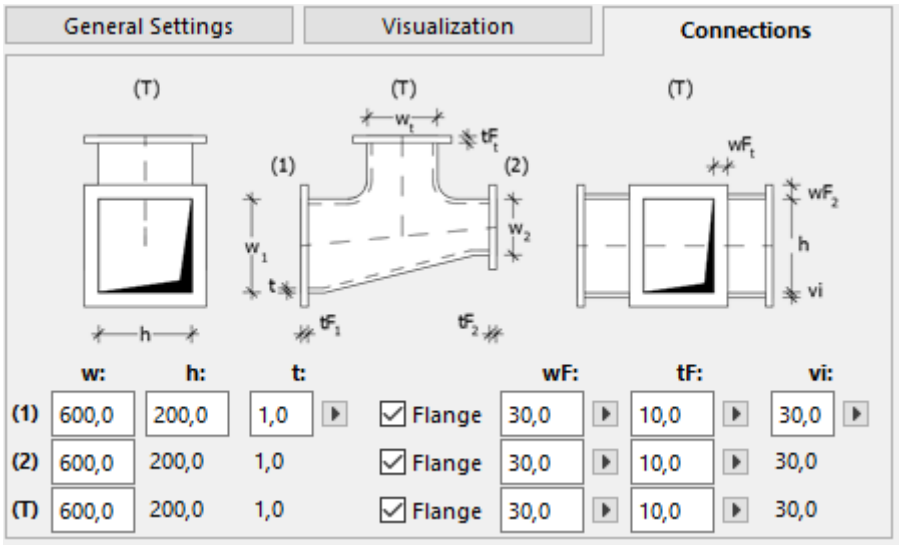
On the "General Settings" page

- you can choose the MEP System
- you can choose the shape of the element (if available)
- you can find the parameters of the two angles defining the 3D position,
- the main parameters of the element,
- and an illustration explaining the latter.

On the "Visualization" tab page you can find the parameters related to the appearance of the element. The "Use system attributes" checkbox is usually selected in most cases of the placed elements, which means the attribute parameters cannot be adjusted (except for the "Show Centerline").

You can adjust in any case, how detailed the 3D should be. Options and impacts of these are:

- "Detailed" – best resolution of the 3D body, appearing as the real element,
- "Simple" – worse resolution of the 3D body, appearing as a solid body,
- "Off" – no 3D body, and if the centerline is switched off, no centerline either.

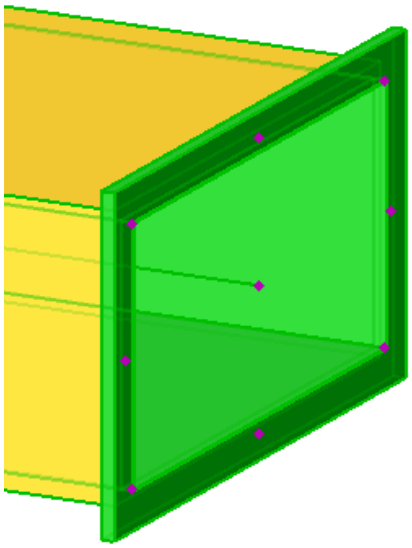


On the “Connections” tab page you can modify the parameters of the cross-section:
– the dimensions,
– the flange parameters,
– thicknesses (of the element and of the insulation),
– and in some cases, small dimensions of the cross-section.

The illustration explains the parameters.

1.3 Hotspots of rectangular cross-sections

a) 3D Hotspots

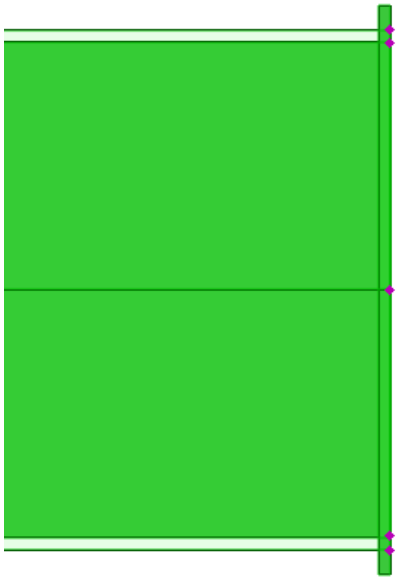


You can adjust an overall size of the element with the center point of the cross-section. This point turns black, if the cross-section is connected.

You can modify the internal dimensions of the cross-section with the four corner points. In the event of a modification, the centerline – the center point of the cross-section – remains in place. Half of the cross-section size is modified by dragging and snapping, and the whole size is modified by entering parameters while dragging, same as in the User Interface. You can adjust with all four points two dimensions at the same time: the width and the height.

The thickness of the insulation can be adjusted with the midpoints of the cross-section. Any of these Hotspots modify the only insulation thickness, of the whole element.

b) Hotspots on Floor Plan Display – rectangular cross-section in vertical position



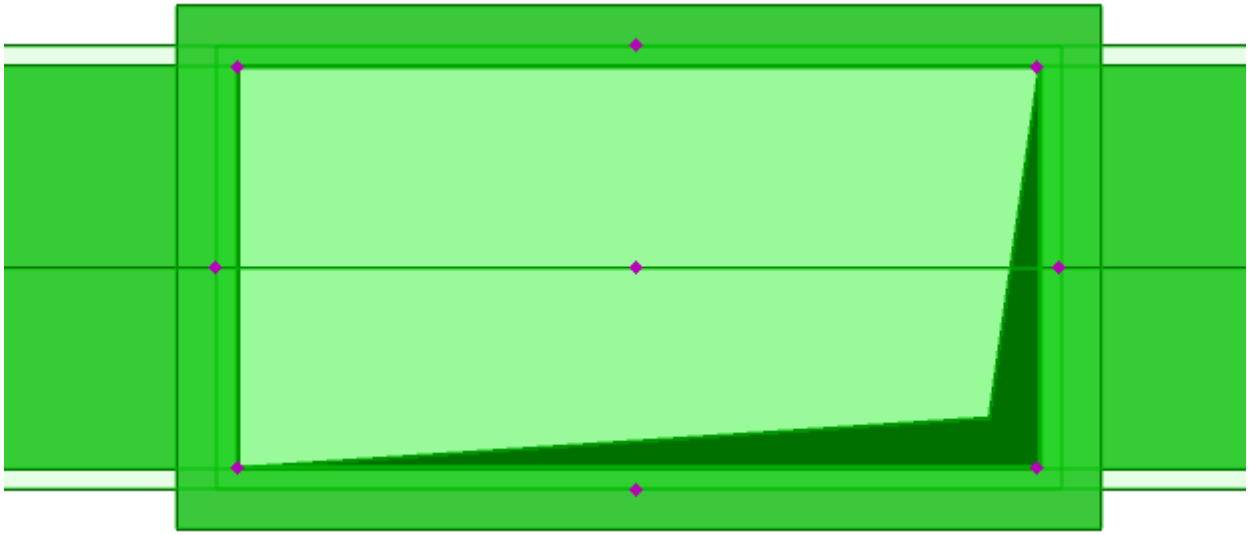
You can modify the external dimensions of the element with the center point of the cross-section. This point turns black, if the cross-section is connected. In some special cases the dimension cannot be modified with this point. In this case there is no purple Hotspot, if the cross-section is not connecting there is no Hotspot at all, but if it is connecting there is a black Selection Dot. There is always a Hotspot at the end of the centerline, ArchiCAD indicates this with a checkmark cursor (an ArchiCAD line is always perceived with the Mercedes cursor – even if the centerline is switched off).

You can modify the size which is displayed on Floor Plan (the width or height, depending on the position of the element) with the outer Hotspots of the cross-section same way, as in 3D.

The insulation thickness can be adjusted with the cross-section's dimension adjusting points, and at the insulation as well.

c) Hotspots on Floor Plan Display – rectangular cross-section in horizontal position

In such position, the available Hotspots are similar to the ones available in 3D:



It is valid here as well, that in the center point of the cross-section:

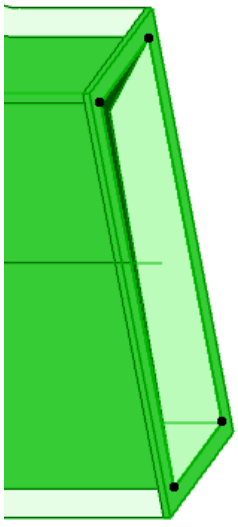
- either you can modify an overall dimension – the Hotspot is purple when it is adjustable, and it is marked with black when the cross-section is connected,
- or you cannot modify the size – there is no Hotspot when it is not connected, and there is a black Hotspot when the cross-section is connected.

If there is connection, the hole symbol does not appear on the cross-section.

In the four corners you can find the dimension modifier Hotspots of the cross-section, and they can be operated same way, as described at the 3D.

The thickness of the insulation can be adjusted with the midpoints of the cross-section, with all of these points the only insulation thickness, of the whole element.

d) Hotspots on Floor Plan Display – rectangular cross-section in general position



If the cross-section (element) is in general position – except for a few cases – there is no adjustable Hotspot, only Selection Dots in the corners of the cross-section. Of course ArchiCAD perceives the end point of the centerline with a checkmark cursor, and the centerline with a “Mercedes” cursor, even if the centerline is switched off.

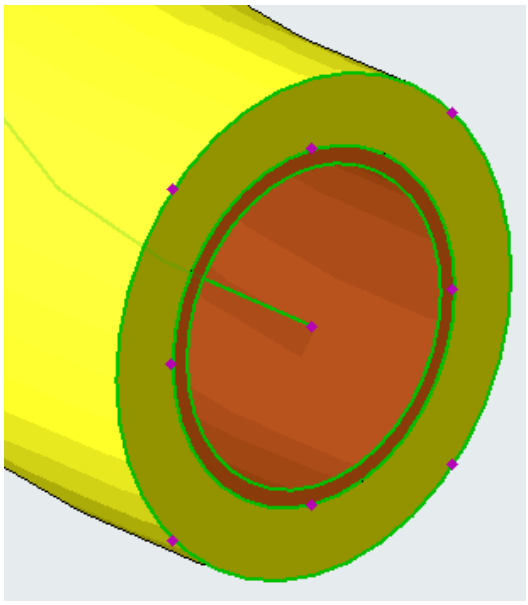
If the cross-section is connected, a black Selection Dot appears in this centerline point as well.

If the cross-section is connected, the hole symbol, which you can see on the cross-section, does not appear.

1.4 Circular cross-sections

a) 3D Hotspots

In general case, in 3D, a circular cross-section has the following modifiable Hotspots:

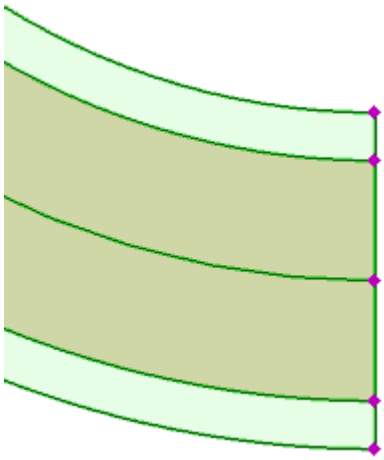


You can adjust a main dimension of the element usually with the center point of the cross-section. If the cross-section is connected, this point turns to black color.

You can adjust the size of the cross-section by using the four orthogonal points of the circle (in the horizontal and the vertical axis of the element). If there is a modification, the centerline – center point of the cross-section – remains in place. The radius can be adjusted by dragging and snapping, and the diameter by entering the desired value while dragging – same as in the User Interface.

You can adjust the thickness of the insulation with the four diagonal Hotspots (the Hotspots that are rotated by 45 degrees), with any of these Hotspots the only insulation thickness, of the whole element.

b) Hotspots in Floor Plan Display – circular cross-section in vertical position

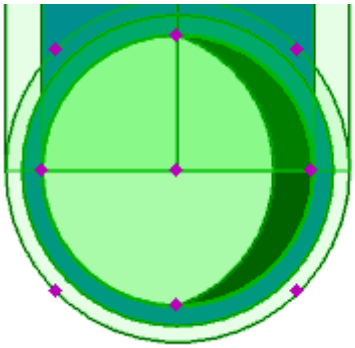


You can modify an overall dimension of the element with the center point of the cross-section. If the cross-section is connected, this point turns to black. In some special situations the dimension cannot be adjusted in this point. In this case, there is no purple Hotspot. If the cross-section is not connected there is no Hotspot, if it is connected there is a black Selection Dot indicating it. At the end of the centerline there is always a Hotspot, which is indicated in ArchiCAD with a checkmark cursor (ArchiCAD always perceives a line at the centerline with the Mercedes cursor – even if the centerline is switched off).

You can adjust the radius by dragging and snapping the outer points of the cross-section, and the diameter can be adjusted by entering the desired value while dragging – same as in the User Interface – same way, as in 3D.

The thickness of the insulation can be adjusted with Hotspots which are available for adjusting the dimensions of the cross-section, or at the insulation.

c) Hotspots in Floor Plan Display – circular cross-section in horizontal position



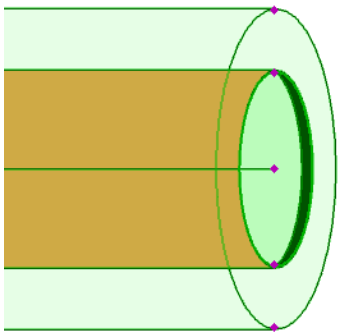
It is valid here as well, that in the center point of the cross-section
– either the overall size can be adjusted – the Hotspot is purple when it is adjustable and it is marked with black when the cross-section is connected,
– or the size cannot be modified – there is no Hotspot when it is not connected and there is a black Hotspot, when the cross-section is connected.

If there is connection, the hole symbol which you can see on the cross-section, does not appear.

The dimensions of the cross-section can be modified with the four Hotspots on the inner contour of the circular cross-section. If there is a modification, the centerline – the center point of the cross-section – remains in place. You can adjust the radius by dragging and snapping, and the diameter by entering the desired value while dragging – same as in the User Interface.

You can adjust the thickness of the insulation by using the four diagonal Hotspots (the ones which are rotated by 45 degrees). With any of these Hotspots, you can modify the only insulation thickness, of the whole element.

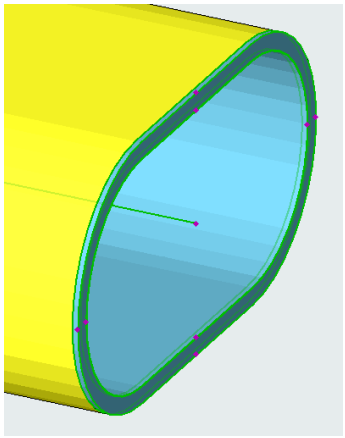
d) Hotspots in Floor Plan Display – circular cross-section in general position



If the cross-section (element) is in general position – usual case – the dimensions of the cross-section and the thickness of the insulation can be adjusted the same way, as in vertical position. You can find modifiable Hotspots at some elements at the centerline point – see later, described at each element.

1.5 Oval cross-sections

a) 3D Hotspots

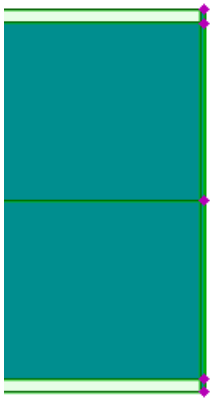


You can adjust the overall dimensions of the cross-section with its center point. If the cross-section is connected, this point turns to black color.

The internal dimensions of the cross-section can be modified with the mid Hotpots. If there is a modification, the centerline – the center point of the cross-section – remains in place. By dragging and snapping, basically the dimensions of the half cross-section are modified, and by entering the desired value while dragging – same as in the User Interface – the whole's dimensions are modified.

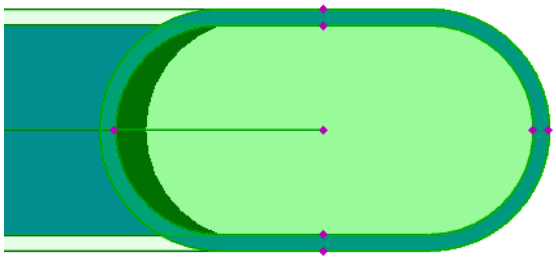
Here as well, the thickness of the insulation can be adjusted with the mid Hotspots, all of these Hotspots modify the only insulation thickness, of the whole element.

b) Hotspots in Floor Plan Display – oval cross-section in vertical position



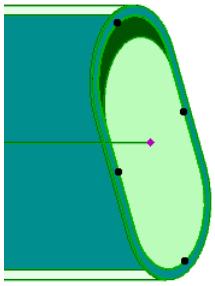
The operation of the Hotspots of the vertical oval cross-section are equal to the ones described at the circular cross-sections – of course those dimensions are adjustable, which are visible in top view.

c) Hotspots in Floor Plan Display – oval cross-section in horizontal position



The oval cross-section in horizontal position is very similar to the rectangle cross-section in horizontal position, but here the Hotspots are in the midpoints, and you can set one value with one Hotspot at a time.

d) Hotspots in Floor Plan Display – oval cross-section in general position



The operation of the Hotspots of oval cross-sections in general position is the same, as described at the circular cross-section.

2. The “Versatile Duct Tee” element

This element can have three shapes that are imaginable based on the cross-sections (rectangle, circle, oval) that the MEP tool knows, and which are possible shapes for mechanical as well. The different sections cannot be mixed – same as during the creation of a product, the sections are not mixed there either. For example, a circular cross-section branch coming out from a rectangular main pipe is not possible – that is not a Tee.

You can place the Tee element with following methods into the model:

- simple placement,
- snapping to an existing cross-section,
- placing into an existing duct,
- starting from an existing duct’s centerline with MEP Routing
- arriving to an existing duct with MEP Routing.

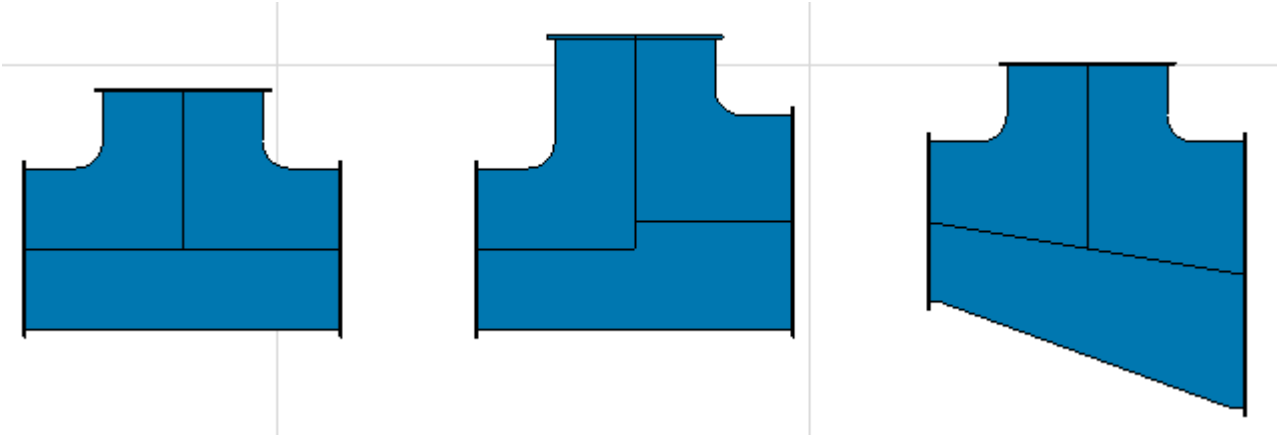
By presenting the Tee element, first we get familiar with the element, its usage and its abilities, and after this knowledge we continue with the methods, how to place it into the model.

2.1 “Versatile Duct Tee” element, rectangular cross-section

At a rectangular cross-section, the usual three shapes can be created:

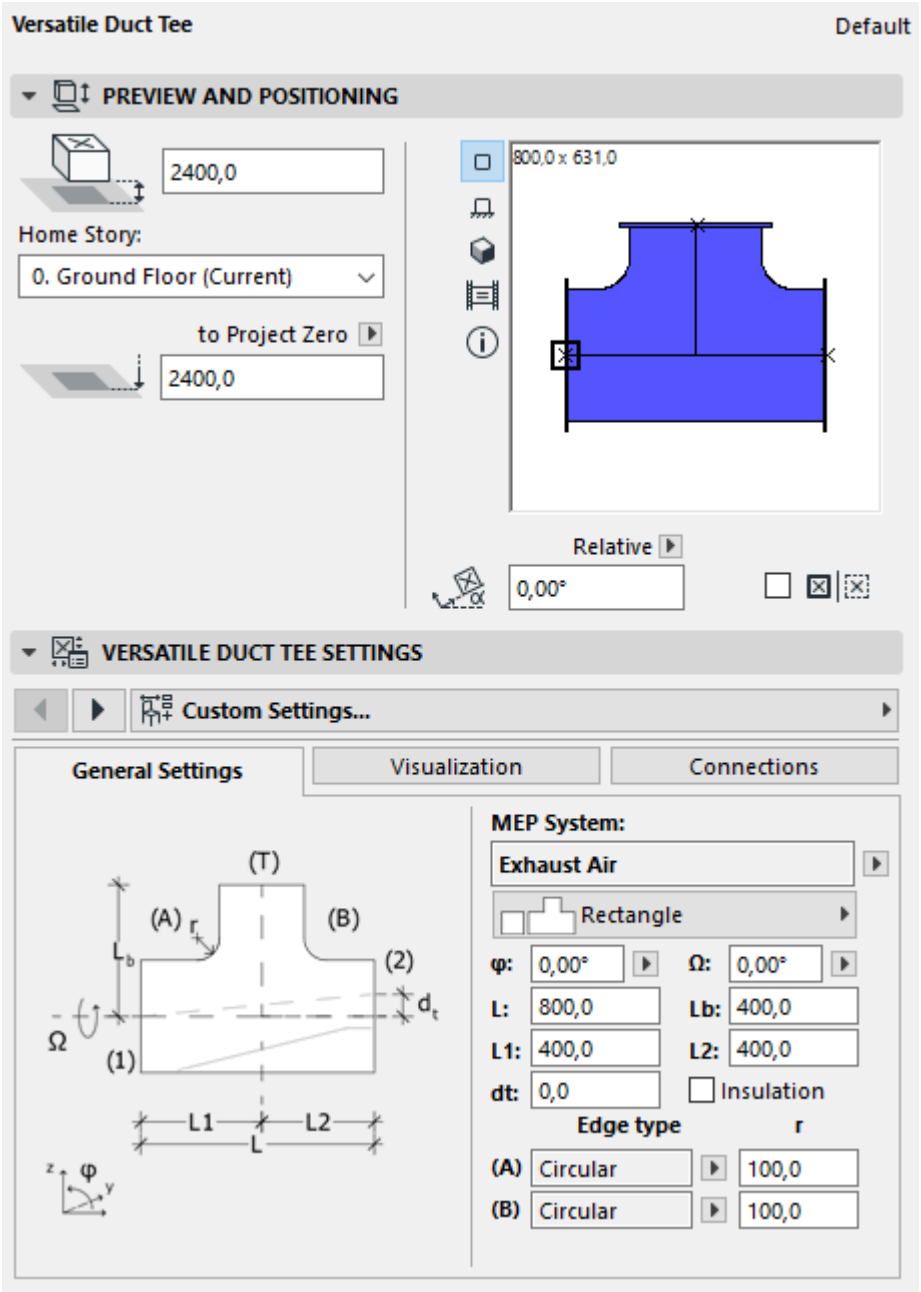
- symmetrical,
- asymmetrical, with straight backplate
- asymmetrical with sloped backplate.

These shapes can be created by dragging the centerline points of a cross-section of a placed element, and by using the Hotspots to adjust the dimensions (or by entering the values at the UI). See the mechanically correct shapes:

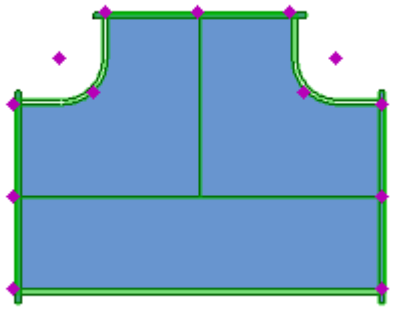


a) Quick exercise – Overall dimensions of the element

1. Place a Tee element with Default Settings on the Floor Plan:

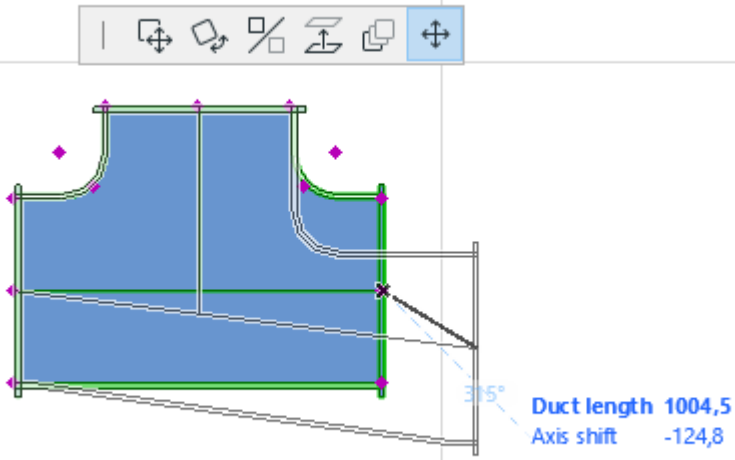


2. Select the placed element:

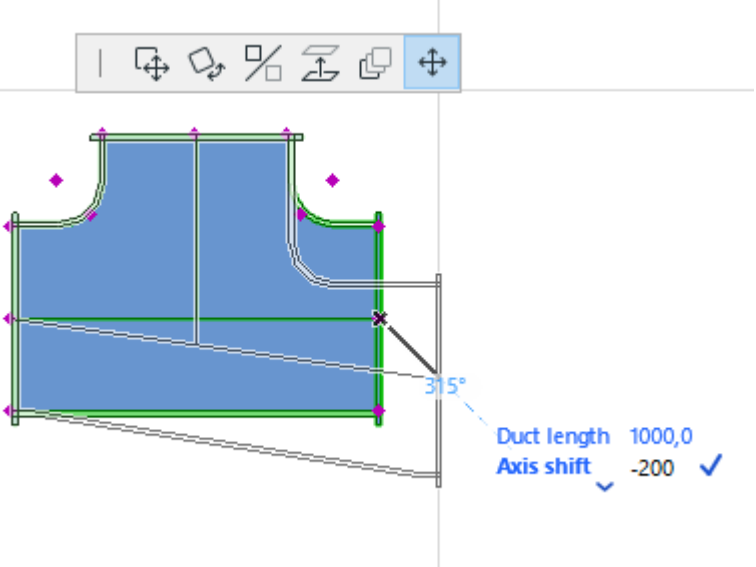


This is a mechanically correct, symmetrical Tee element.

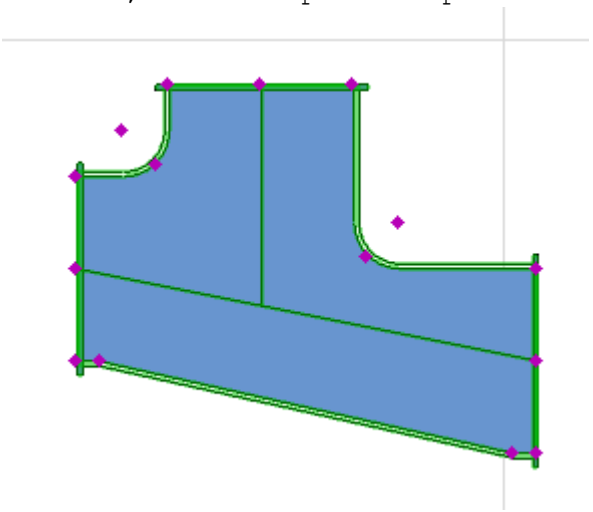
3. Select and drag the centerline point of the right cross-section (the "Move node" option should be selected as visible on the illustration):



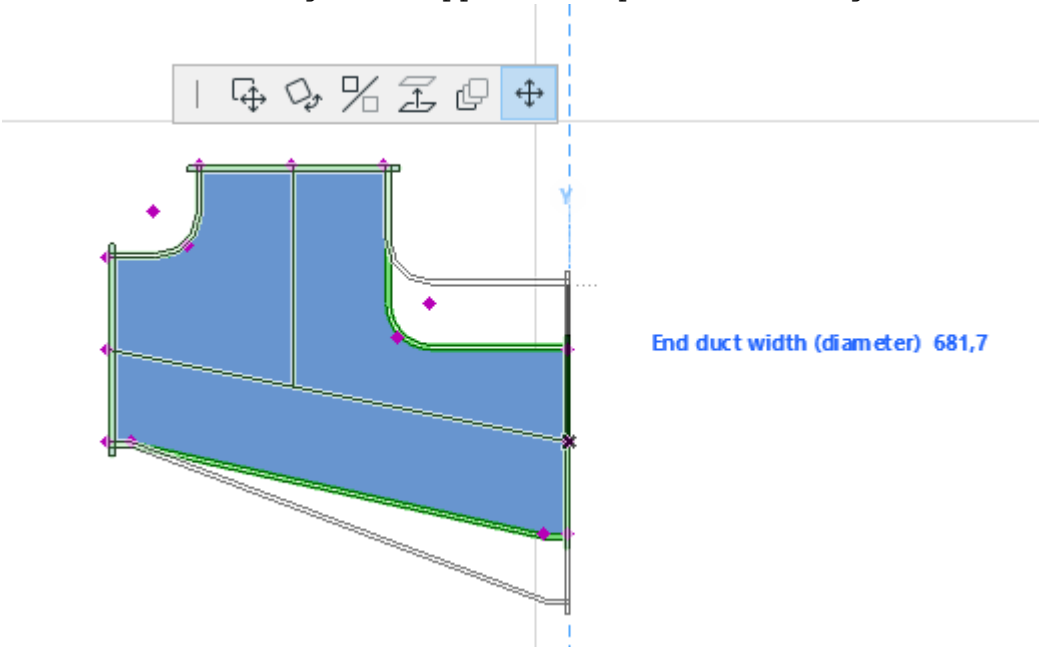
4. After pressing TAB, set the following values:
   Duct length: 1000 mm,
   Axis shift: -200 mm:



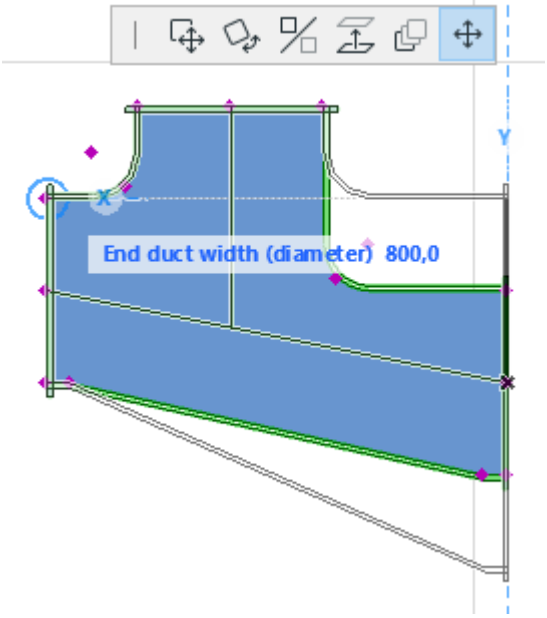
then press ENTER. This way a mechanically incorrect, asymmetrical Tee element, with sloped backplate will be created:



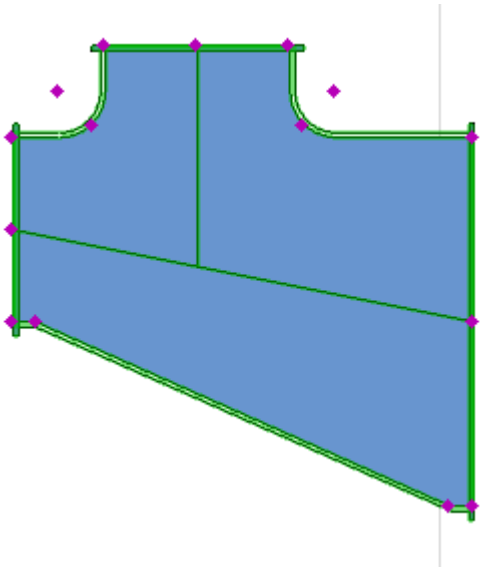
5. Select and drag the "upper" Hotspot of the right cross-section:



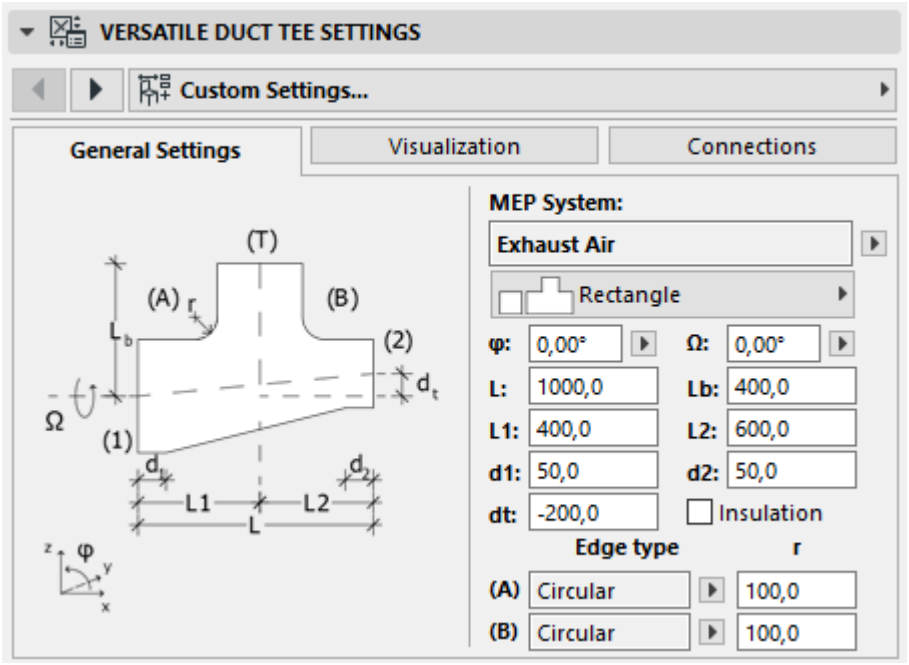
6. Adjust the stretch to the "upper" Hotspot of the left cross-section:

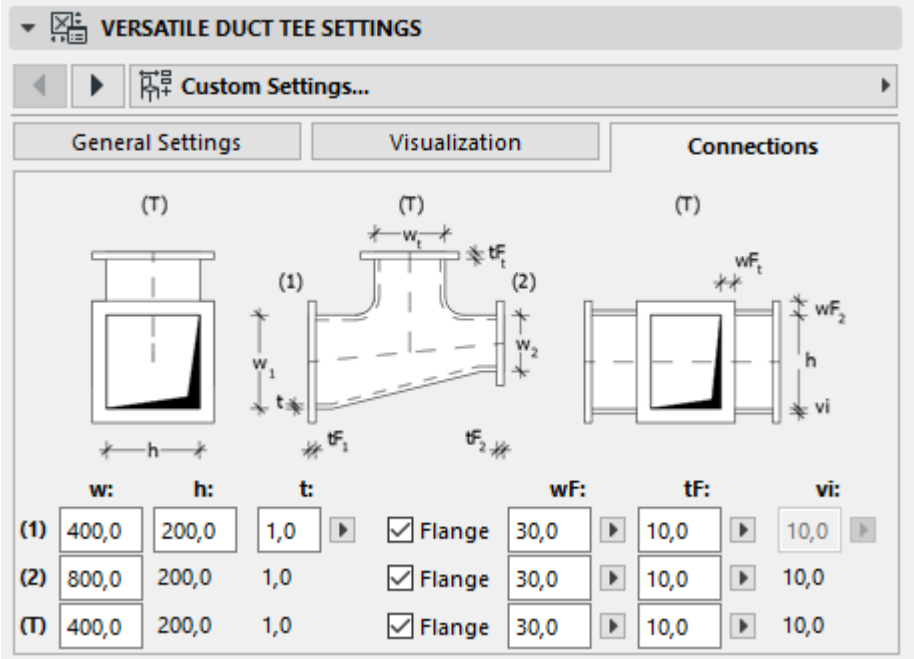


This way a mechanically correct, asymmetrical Tee element is established, with sloped backplate:

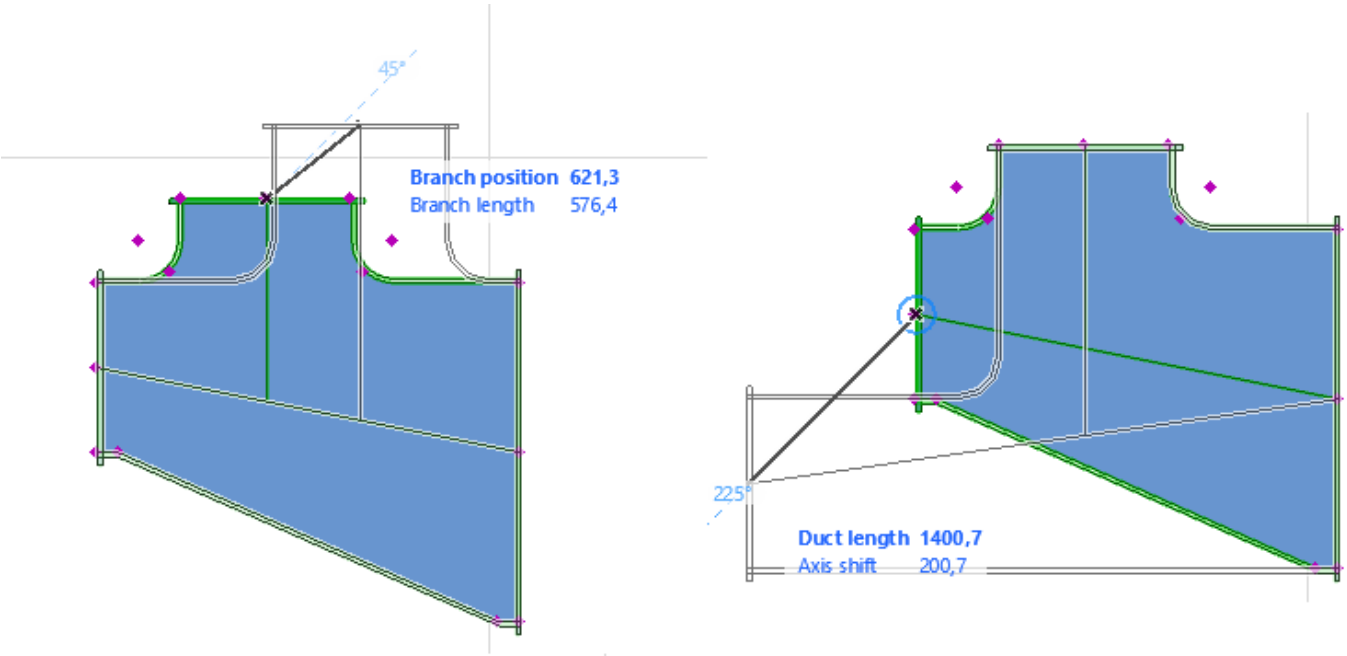


7. Have a look at the dimensions and the cross-sections of the element in the Settings Window:

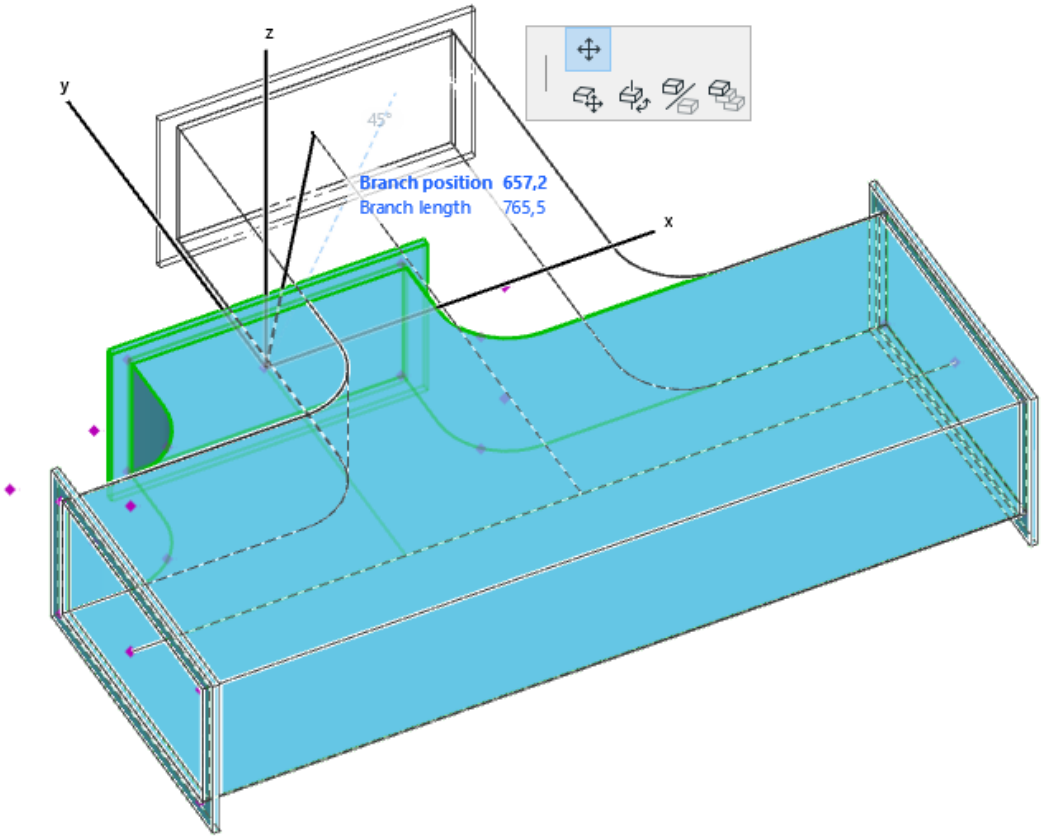




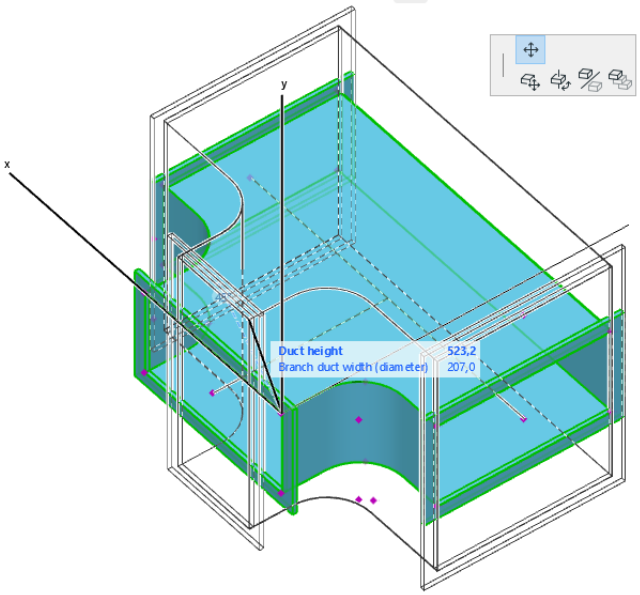
8. Try to drag the centerline points of the other cross-sections of the element as well, and modify the dimensions of the cross-sections – soon you will achieve great practice to reach your goals.



You can do these shape-modifications in the 3D Window as well:



You can adjust the cross-section dimensions spectacularly in 3D with the corner Hotspots:

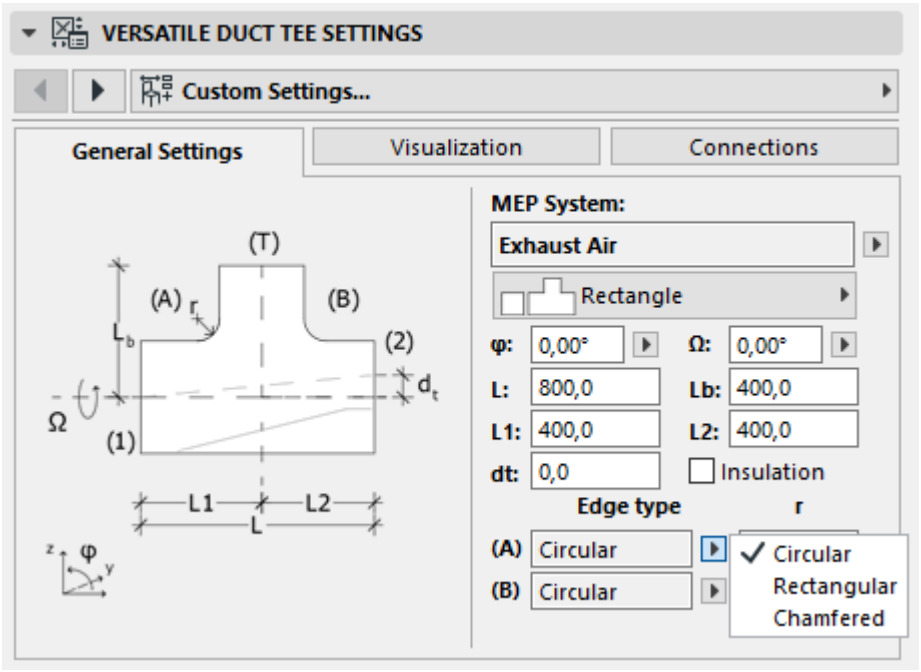


b) Branch connection options

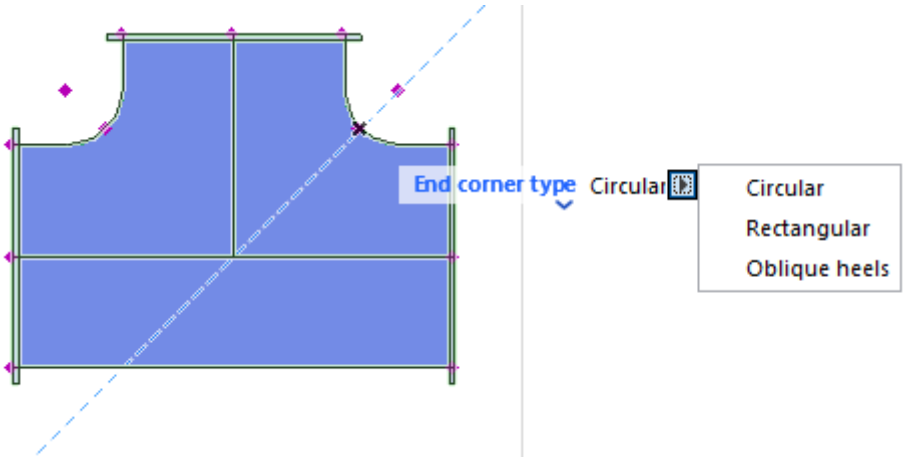
In (A) and (B) positions, the connection of the T-branch to the main pipe can be three kinds of:

- Circular,
- Rectangular,
- Chamfered.

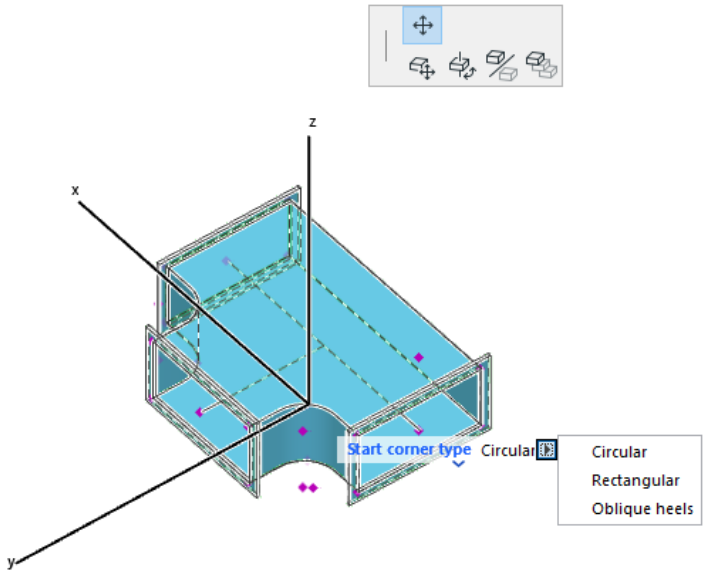
On the “General Settings” tab page of the User Interface, you can choose from parameter options. In 2D and 3D you can choose by using the Hotspots, the Hotspots are at the connection points. If you adjust with the Hotspots, after pressing TAB, you can choose from text values. User Interface:



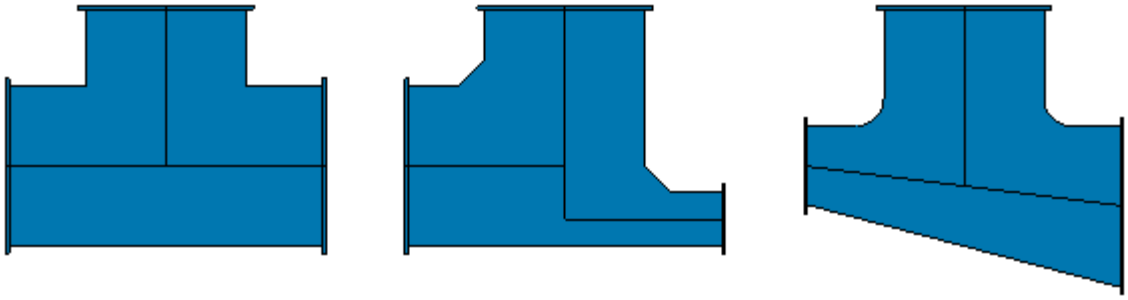
2D:



3D:



Here some examples:



In case of “Circular”, the value of the radius can be modified with a Hotspot (2D, 3D). You can adjust this value in case of the other two shapes as well (Rectangular, Chamfered). After trying it, soon you can discover how it operates. Of course, you can set this value at the User Interface as well.

The Tee element (and the other elements of the library) can be in any position in the space. Two angle values enable this:

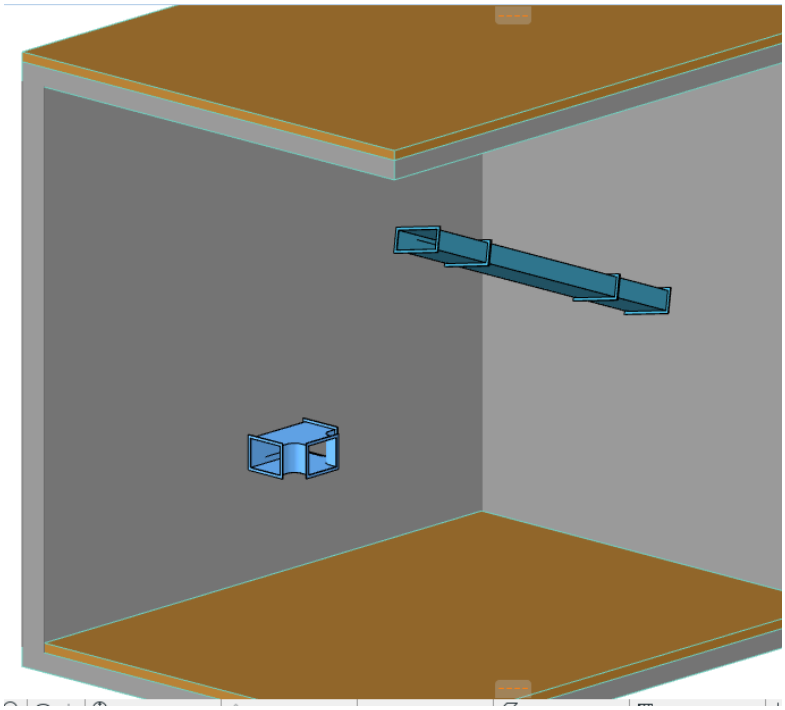
- the angle representing the tilt of the main axis (ϕ),
- the angle representing the rotation about the main axis (Ω).

These angle values are understood on the first cross-section, on the left side. These values can be set at the User Interface as well as in 3D with rotation. The elements can be placed freely in space with their position (X, Y, Z) and by rotating them on Floor Plan. The two spatial angles described above (ϕ, Ω) are additional options to these. To represent the use of these angles, please find below an example.

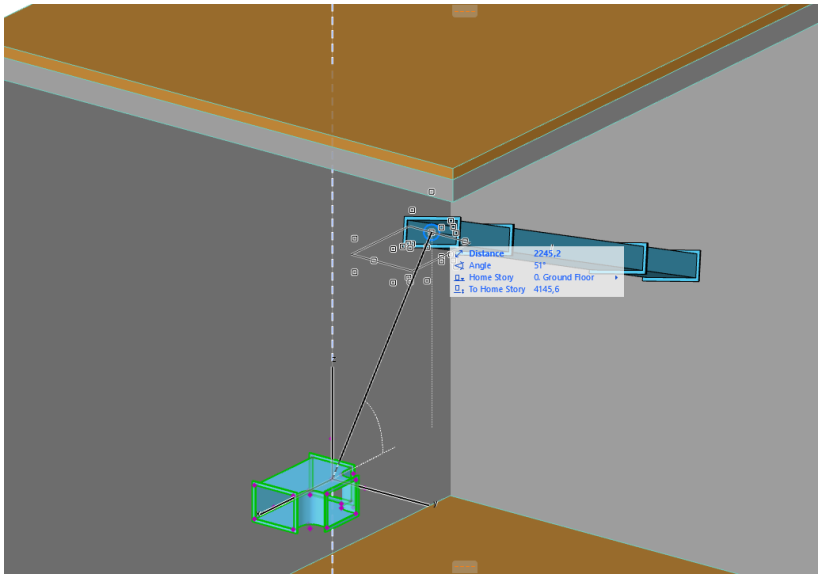
c) Example: Connection to an element in general position

The duct shown on the 3D illustration below has an axis tilt and a rotation about axis as well. You can find numerous examples of such cases at buildings with special – sharply tilted – slabs, and in parking lots where the slab is used for drainage (the slab is tilted because of this). In the example, the Tee element is in general position, and the task is to connect the Tee element to the duct (note: currently the MEP tool cannot connect any element to a duct which has such a cross-section and is in such position). The centerlines of the two

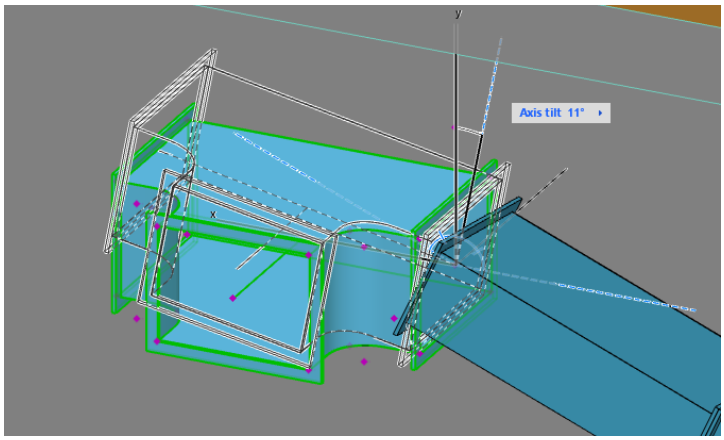
elements are parallel on Floor Plan. We cannot show this method as an exercise, but we can provide step by step illustrations and descriptions – the explanation has a similar style to the previous exercise.

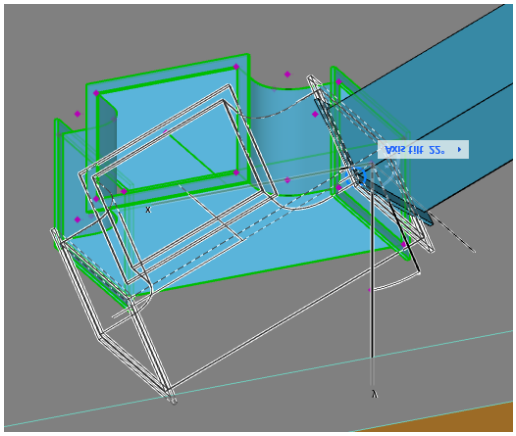


1st step: place the selected element by its centerline point to the centerline point of the duct:

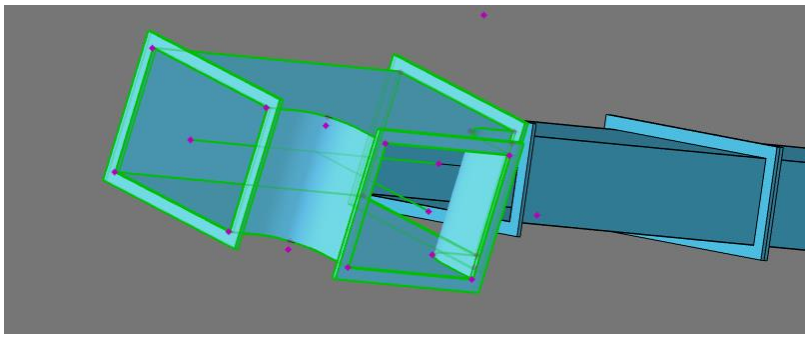


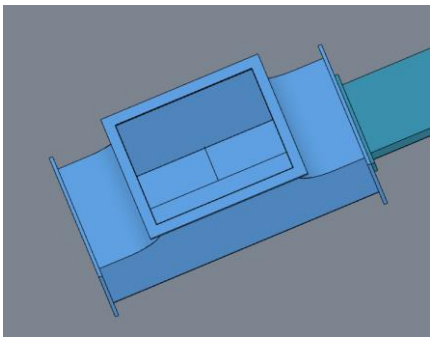
2nd step: observing the operation from a better viewpoint, rotate the element with the Axis tilt Hotspot which you can find above the Tee element – first freely, just trying it, and afterwards snap it to the upper point of the duct:



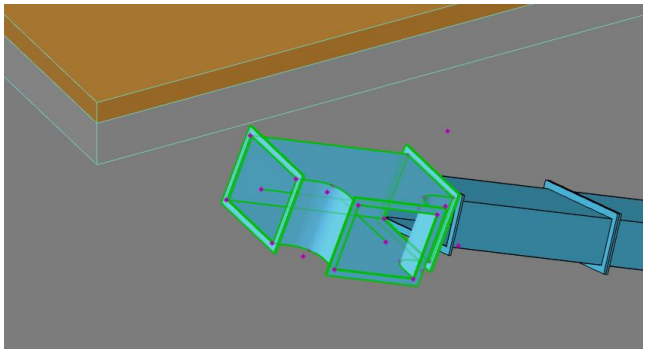


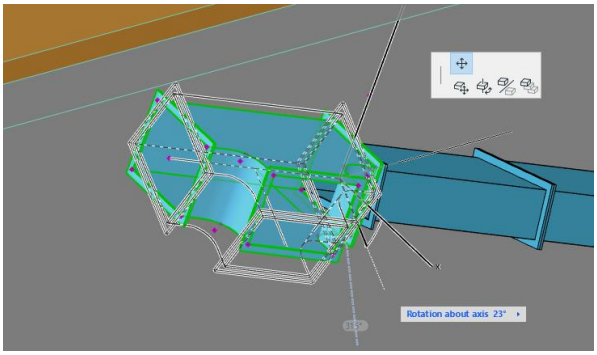
This way the tilt of the duct and Tee element's centerline became the same, and they connect in one point, and their cross-sections are here in one plane:



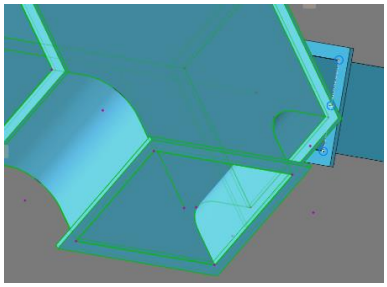
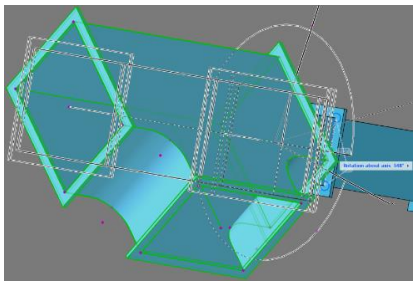
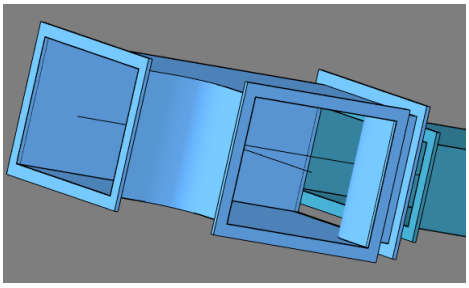


3rd step: discover the Hotspot which is visible on the image, not above the cross-section, but to the right of it; this Hotspot is for Rotation about axis.

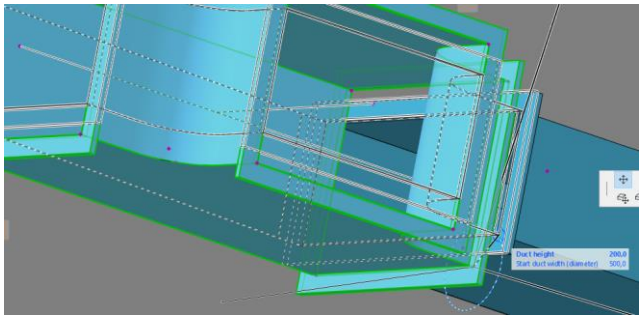
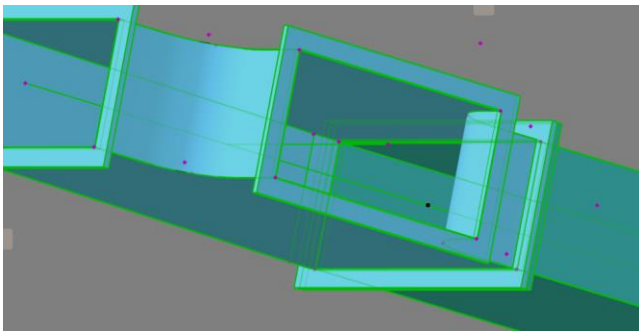




After trying it, step out from the operation, and create on the cross-section of the duct the midpoints of the lines that connect the cross-sections above each other, you need to rotate the Tee element here:

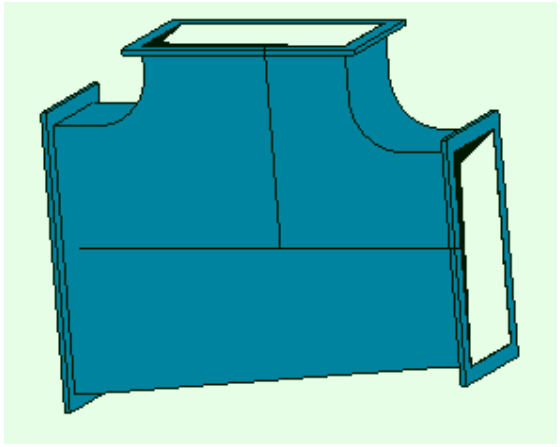
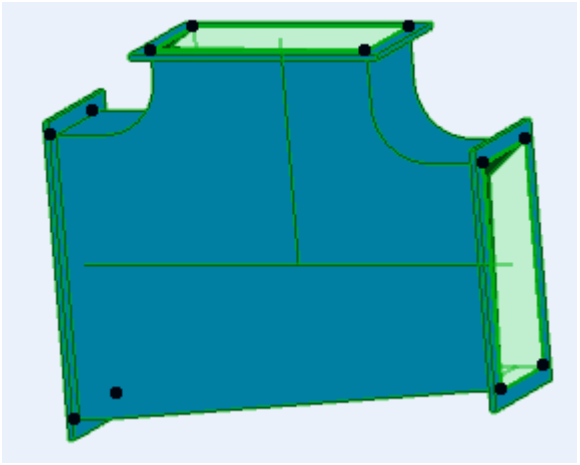




4th step: the only remaining reason why the two cross-sections don't connect, is because of the different dimensions of their cross-sections; so grab any of a cross-section modifier point of the Tee element, and snap it to the duct's point:

You can see that the elements are connected by a fix Hotspot appearing in the connection point of the centerlines, and the duct appears as selected.

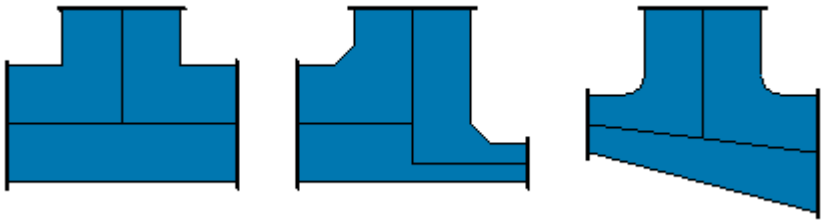
If we observe the Tee element on its own – without the duct – on the Floor Plan, and by selecting it, we can see:

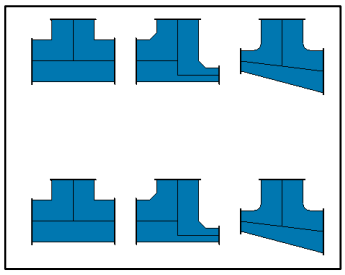
An element in such general position cannot be modified on the Floor Plan with Hotspots. These Hotspots, which cannot be modified, indicate the corner points of the cross-sections; but other elements can be connected to the centerline points. It is a different situation to modify on Floor Plan elements in special position, we present this in the next exercise.

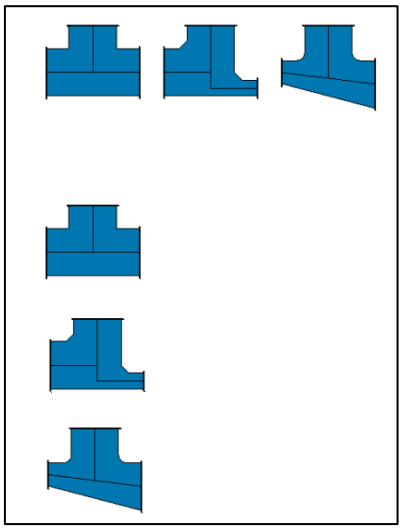
d) Quick exercise – 2D Hotspots

1. Create the 3 Tee shapes shown on the illustration below, based on what you have learned:

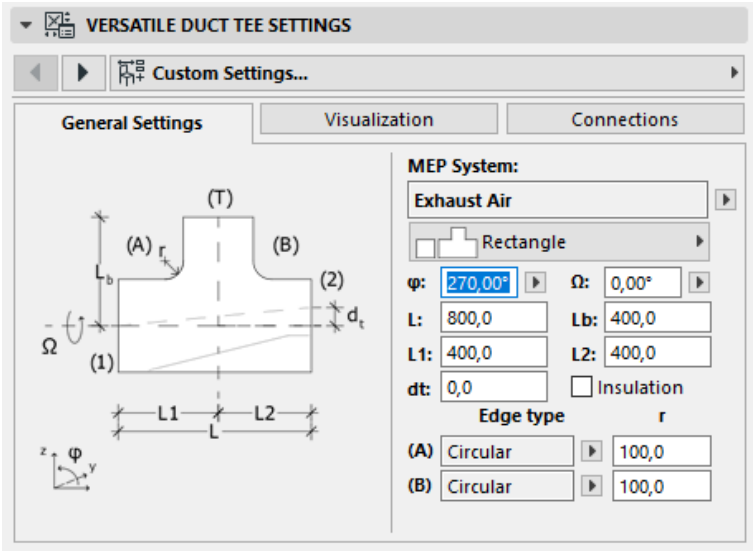


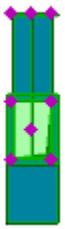
2. Make a copy of these three elements, and rearrange the three copies:





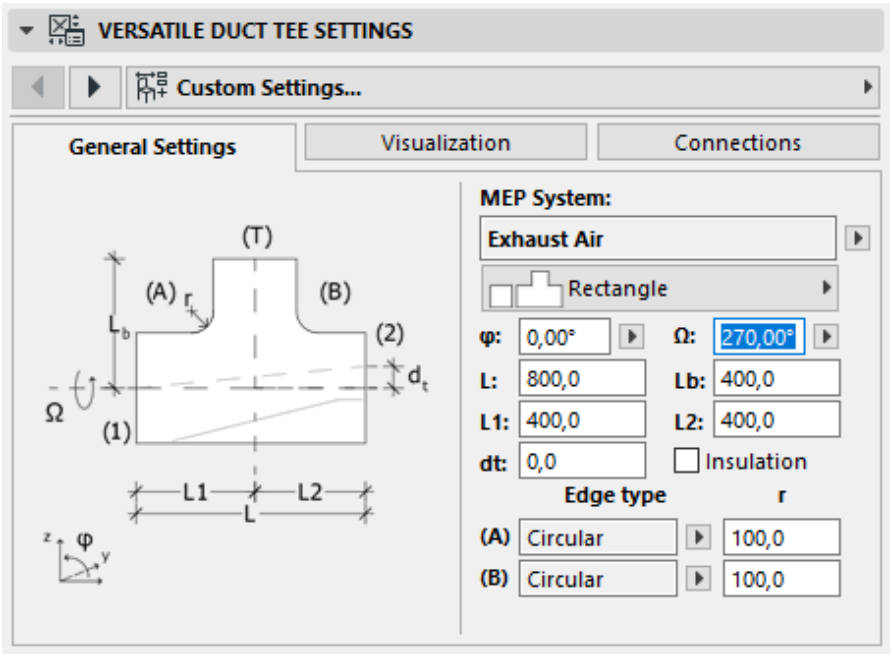
3. Set the "φ" value to 270 degree on the User Interface for the first 3 elements:

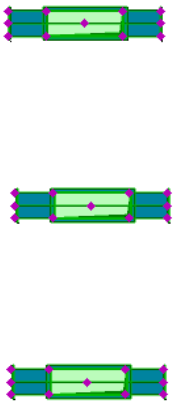




Try the Hotspots, soon you will understand the operation of the element.

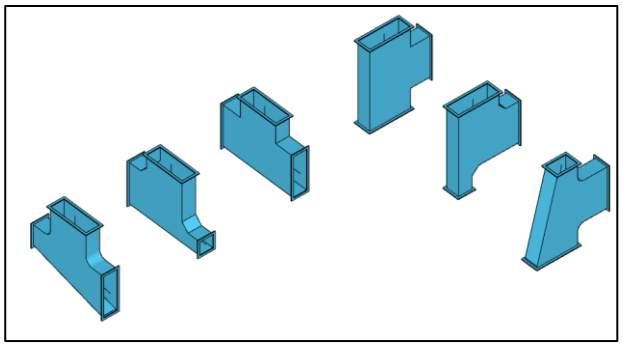
4. For the Tee elements arranged vertically under each other, set the "Ω" value to 270 degree as well on the User Interface:

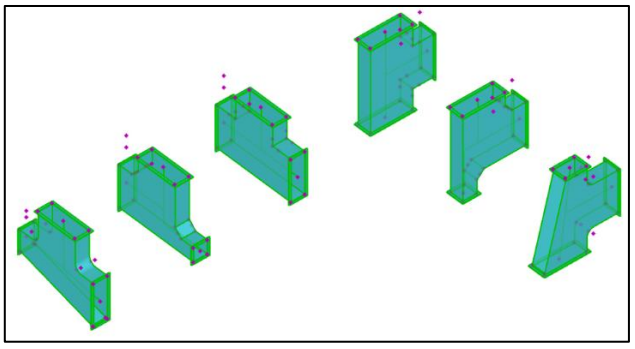




Try the Hotspots in this position as well and discover how freely the element can be adjusted.

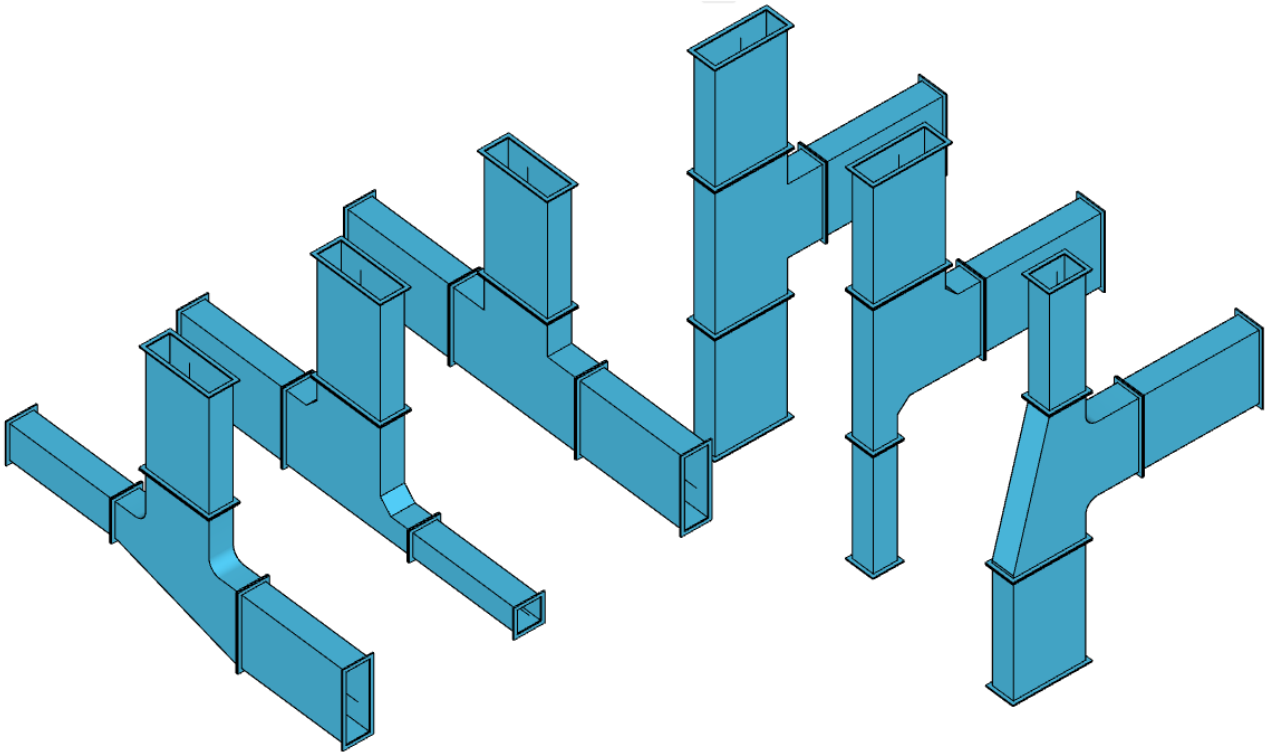
5. Select all 6 Tee elements, have a look at them in 3D, and select the elements there as well:



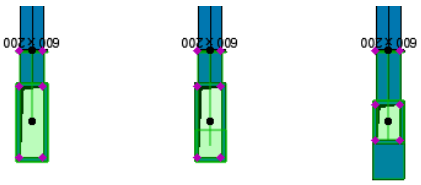


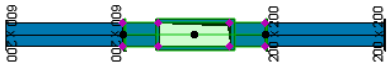
There is no difference how to handle the Hotspots in 3D; they operate the same way in any position of the element. You can notice a difference in the operation of the Hotspot on Floor Plan, depending on the position and the connection.

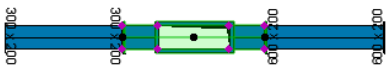
6. Connect a duct to every cross-section of every Tee element:



7. Have a look and notice the difference in the operation of the Hotspots on Floor Plan, not everything is adjustable at the connected cross-sections:

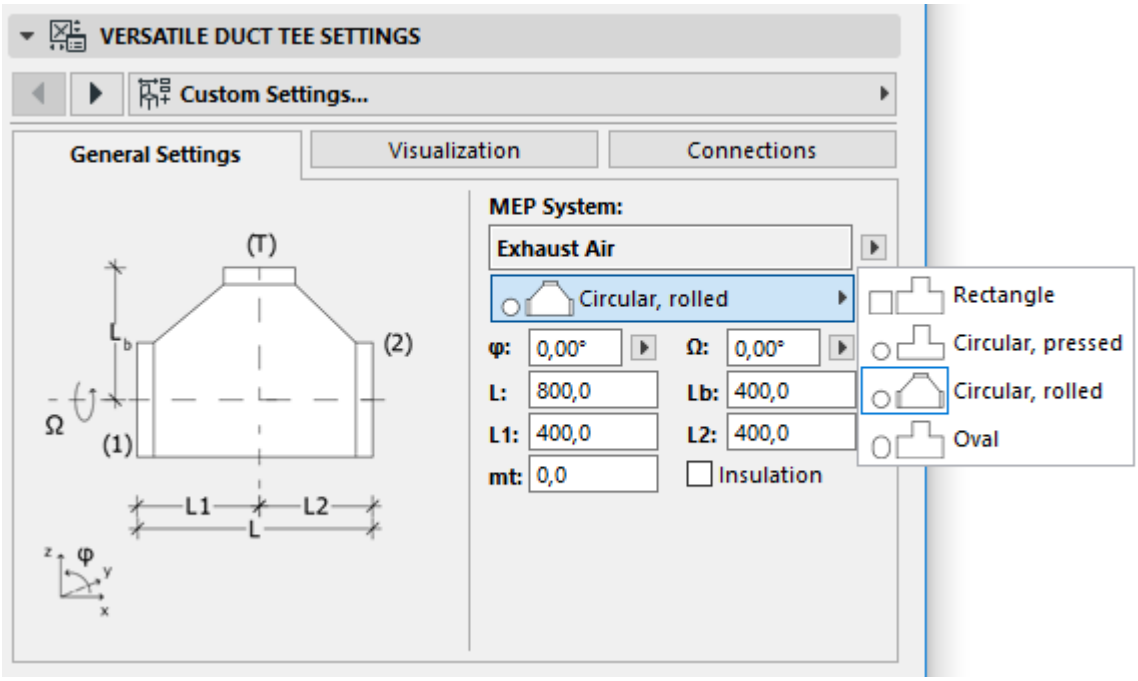




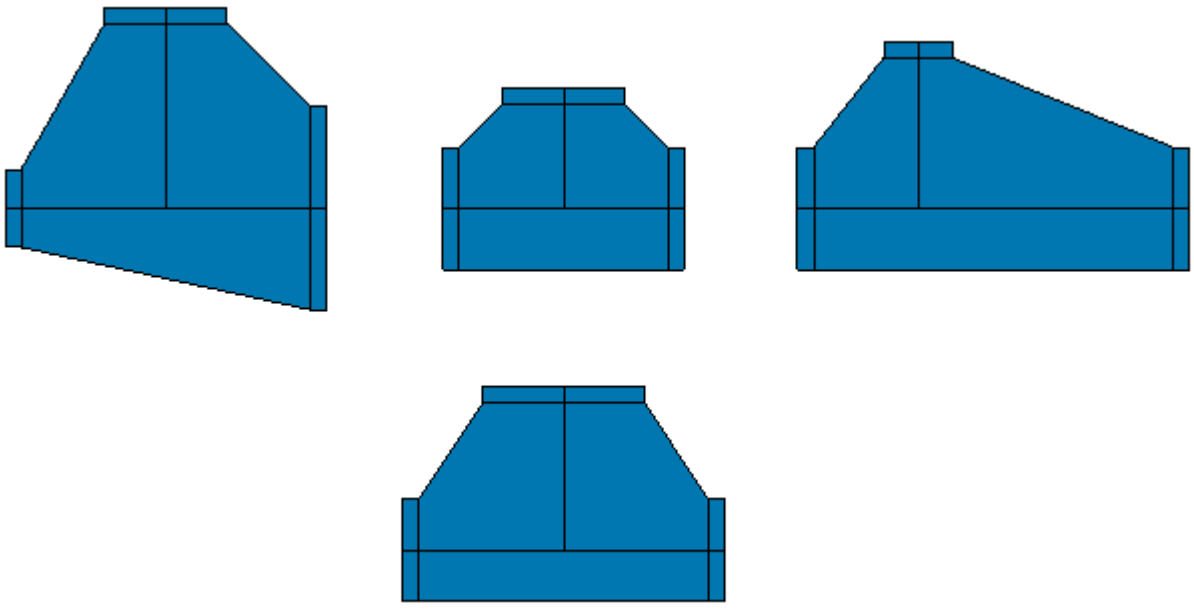


2.2 “Versatile Duct Tee” element, circular cross-section

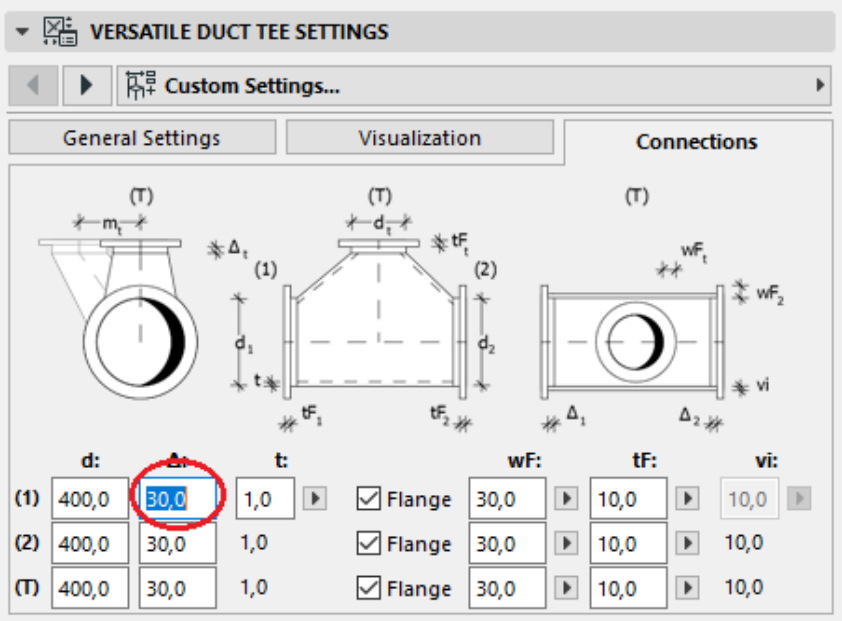
There are two circular Tee elements, these two, and you can choose rectangle and oval shapes as well on the User Interface:

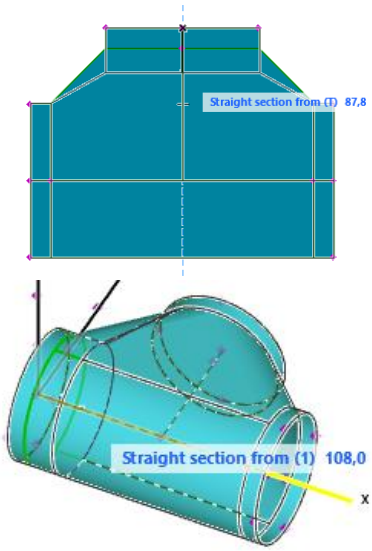


The rolled shape can be set in many aspects similar way as the cross-section with rectangle shape (of course there is no height), this element variant has three different cross-section dimensions as well. Limitation is, that the main centerline is always straight and perpendicular to the two main pipe cross-sections. Let’s see some variants on Floor Plan:

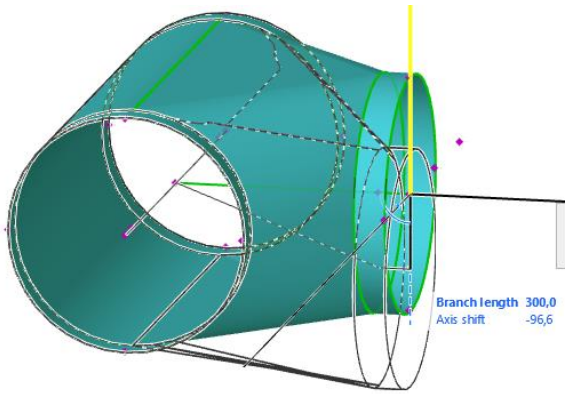


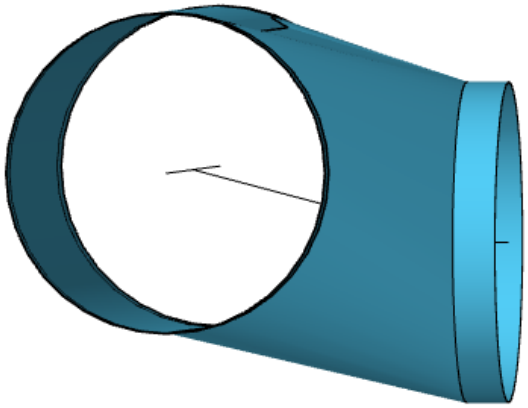
In case of all three cross-sections, you can adjust the collar length, which is illustrated with ”Δ” on the ”Connections” tab page of the User Interface, by using Hotspots, in 2D and 3D as well:



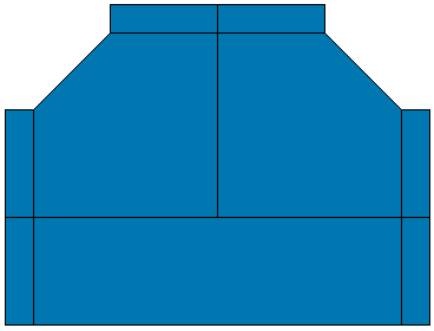


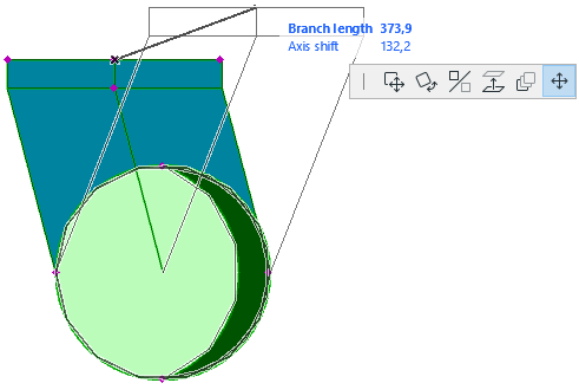
Additionally to the asymmetry represented on Floor Plan, this element variant can shift the branch vertically – compared to the horizontal understood in baseline –, it is easier to show this in 3D:





This asymmetry appears in the User Interface as well; on a rotated (ϕ=270) element, and can be adjusted on Floor Plan as well:





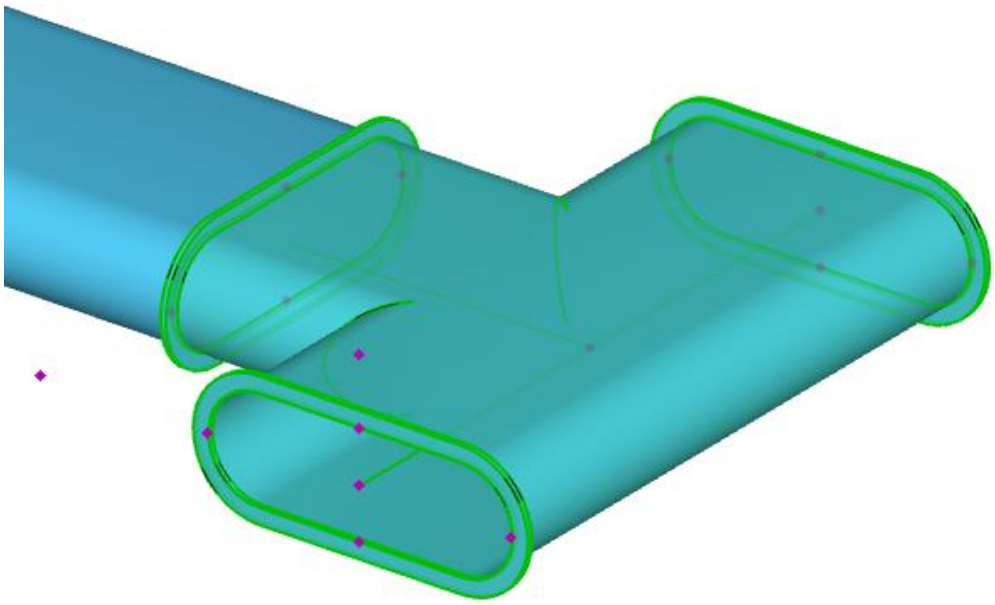
We recommend you to practice with this rolled element variant the (1) and (2) exercises as well, discover the operation of the element.

The simple Circular Tee shape seems really simple compared to the rolled shape. This shape variant represents the “normal” T-profile. The two cross-sections of the main pipe are of same size, there is no asymmetry (the branch can be dragged on the main pipe of course), there are no collar lengths (because they are unnecessary, the branches are straight) and the branches cannot be dragged vertically. We recommend you to practice this element as well before using it, you can do the exercises also on this element.

Like every element in this library, these shape variants can also be placed in space in any position, you can set this with the two angles graphically in 3D, or you can enter the values at the User Interface as well.

2.3 “Versatile Duct Tee” element, oval cross-section

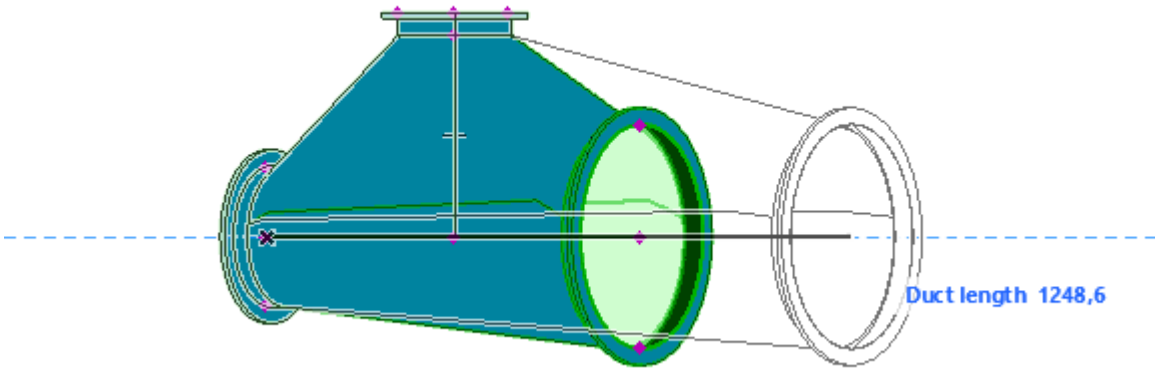
This shape variant operates the same way in almost every aspect as the simple circular Tee shape variant; the two cross-sections of the main pipe are the same, the branch can be dragged along the main pipe, other asymmetry is not possible. You can notice the adjustability of the cross-sections’ dimensions as the main difference:



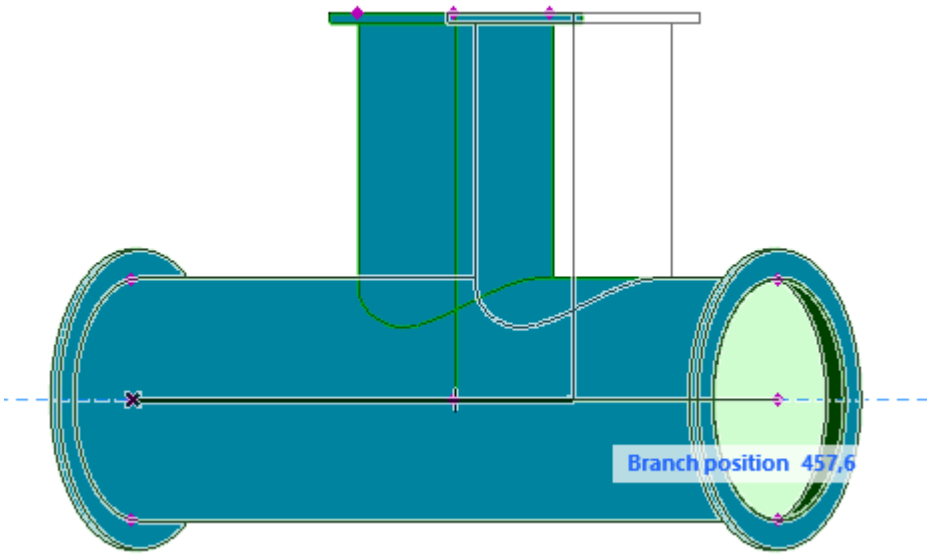
If you will use this cross-section shape, then it is recommended for you to get familiar with this element, its Hotspots, their operation, try it!

2.4 Length of a main pipe in sloped position, on Floor Plan

In case of a Tee element with the two circular or the oval cross-section, its length can be adjusted on Floor Plan, even if the main centerline is tilted. In this case, the projected length can be adjusted by dragging, and the real length by entering the value:



Same way, the branch position projected on the Floor Plan can be adjusted:



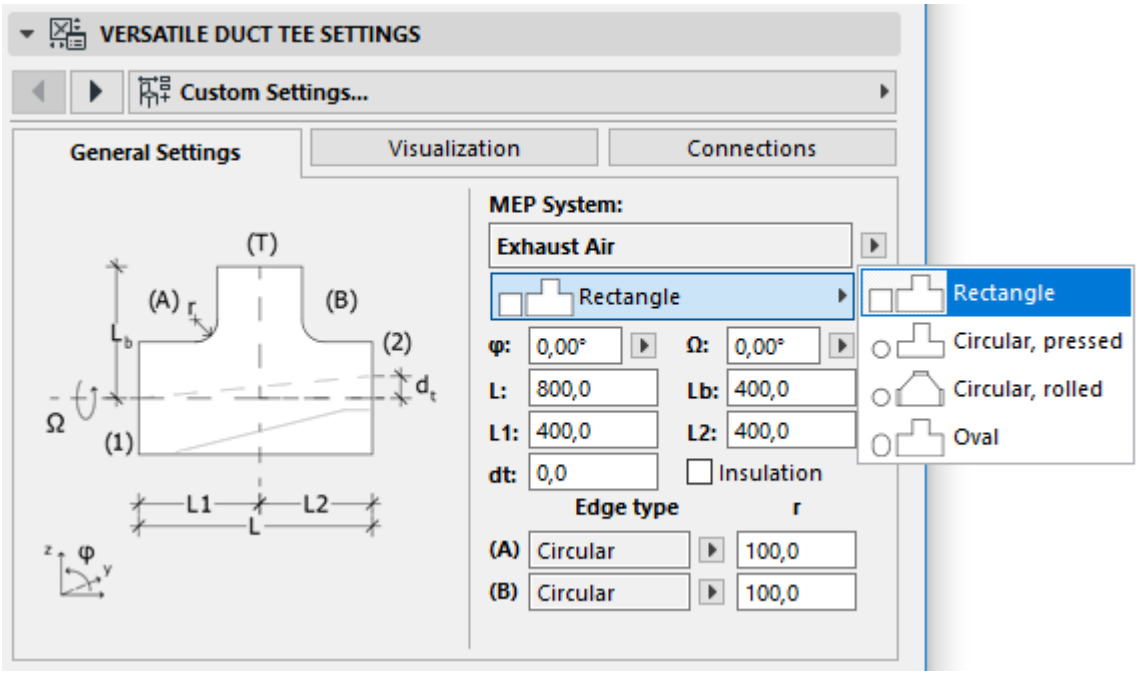
These options facilitate snapping on Floor Plan, of any entities known and available only on Floor Plan.

2.5 “Versatile Duct Tee” element - Options to place into the model

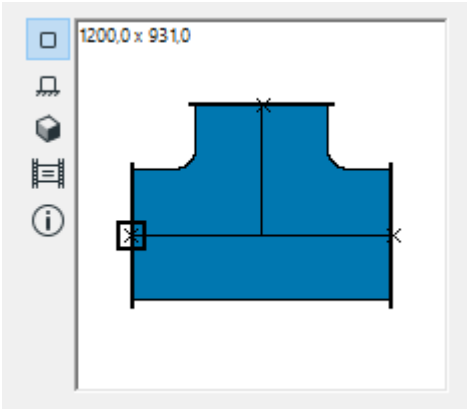
Revision: the Tee element can be placed with following methods into the model:

- simple placement
- snapping to an existing cross-section
- placing into an existing duct
- starting from the centerline of an existing duct with MEP Routing
- arriving into an existing duct with MEP Routing.

During “Quick exercise – Overall dimensions of the element” we experienced the simple placement. During this placement method, the Tee element is placed into the model with those custom parameters, which have been set by the User in the User Interface. The shape of the element is among these Settings as well; the shape can be selected on the “General settings” tab page of the User Interface:

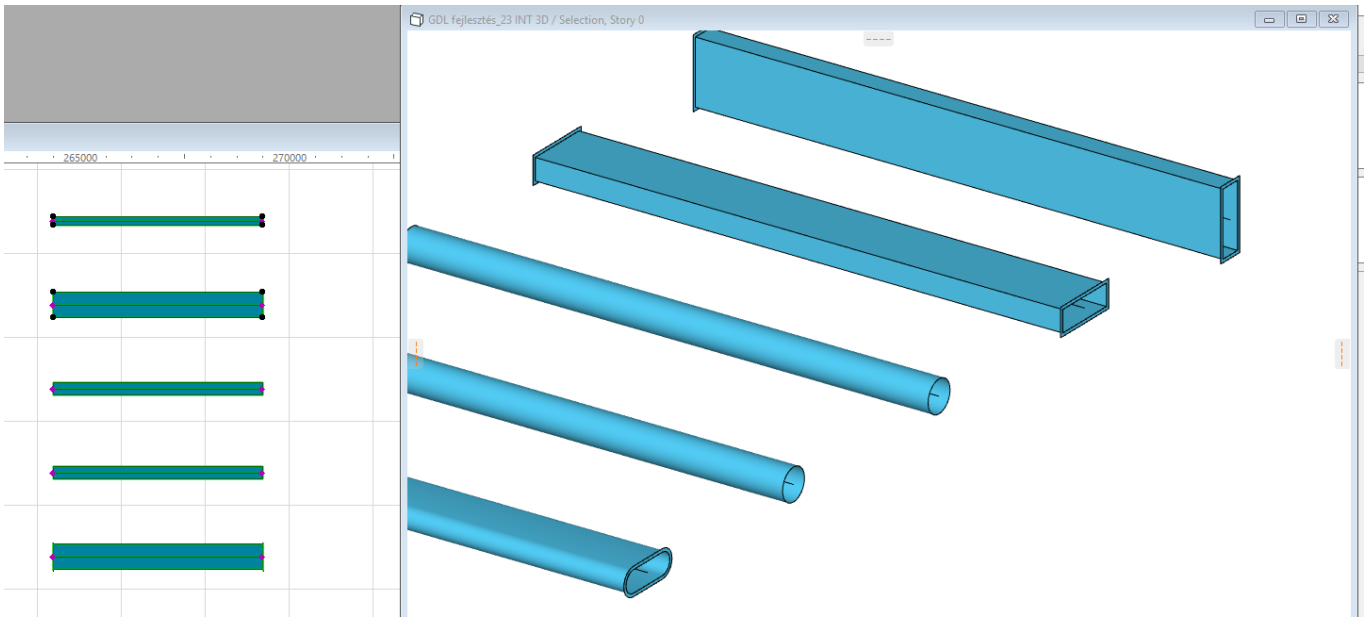


A Tee element can be snapped with any of its three cross-sections to an existing cross-section. The element will be snapped to the existing cross-section with that cross-section, which is selected in the Settings Window (Floor Plan view – “Plan”). In the following example the left cross-section is selected:

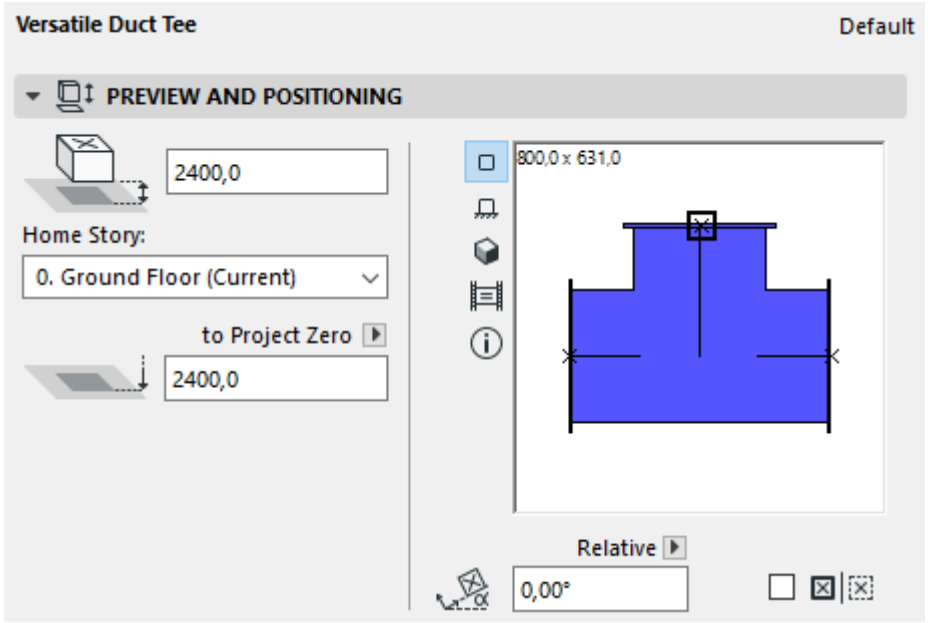


a) Quick exercise – Snapping

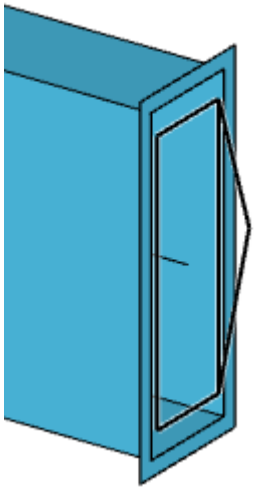
1. Place five Duct Straight elements in 2000 mm distance from each other, from top to bottom two rectangles, two circles and an oval. The vertical rectangle shall be 200 x 600 mm, the second rectangle and the oval 600 x 200 mm, and the two circles 300 mm:



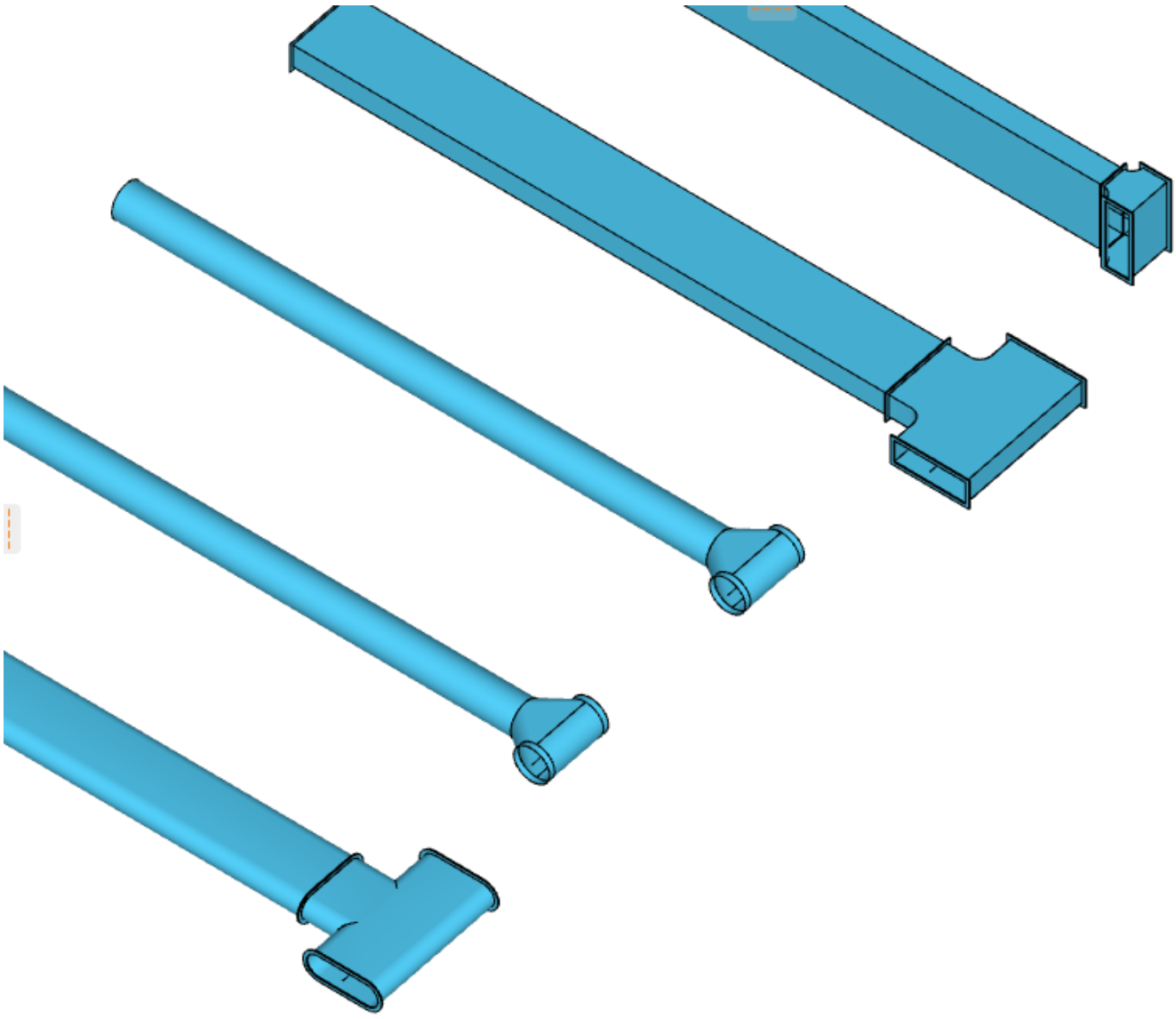
2. Leave the "Versatile Duct Tee" element on Default Setting, but the active cross-section shall be the branch cross-section:



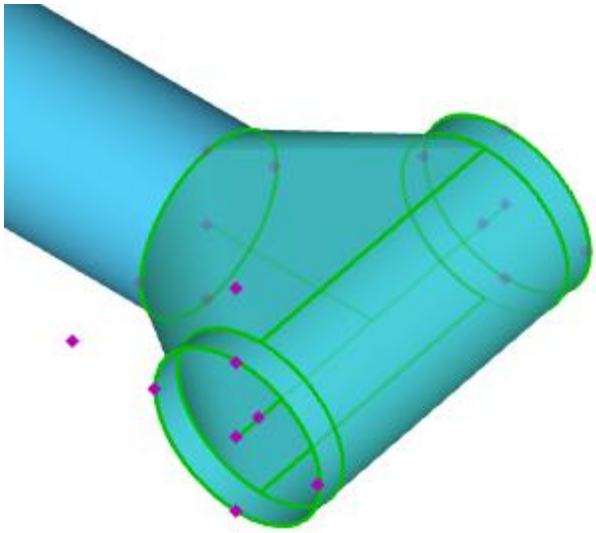
3. Snap a Tee element to all of the ducts' end cross-sections, and select the "horizontal" direction:



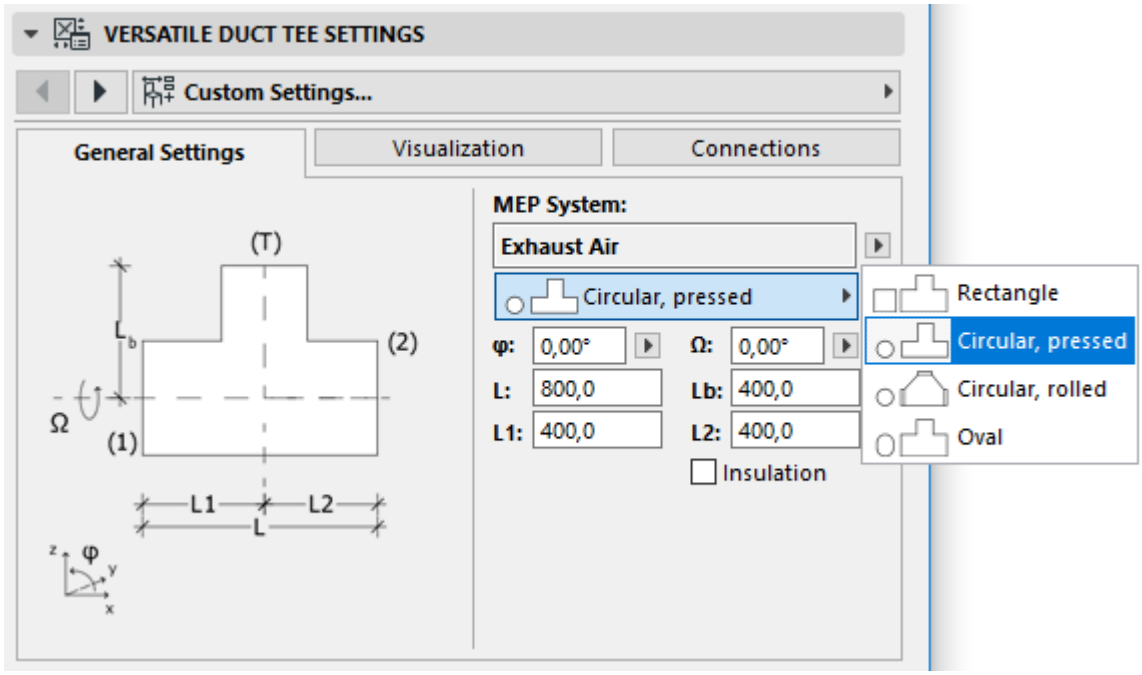
If you snapped a Tee element to every duct, then you should see the following:



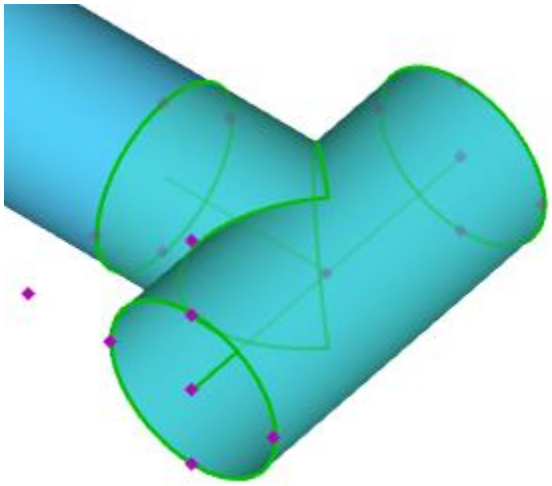
4. Choose one of the Tee elements with circular cross-section:



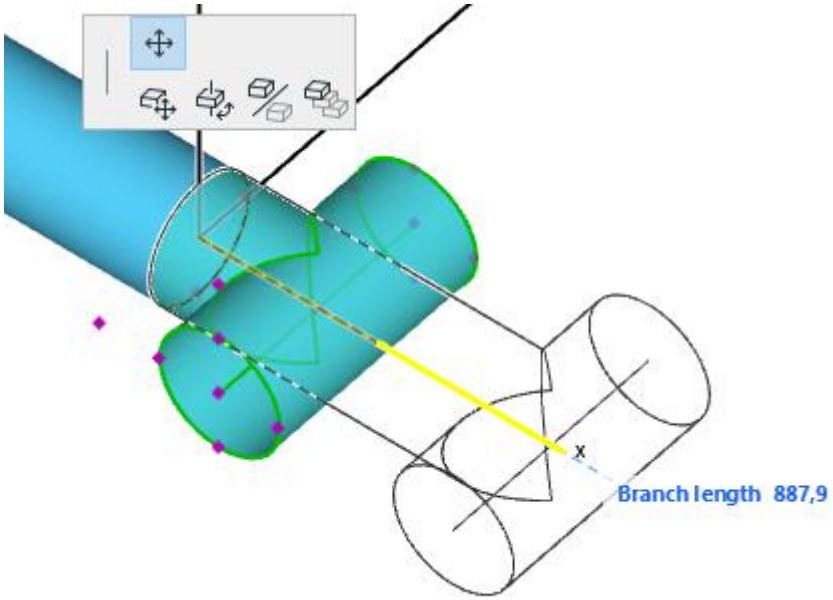
and go to the Settings Window to modify the shape to "Circular, pressed":



You will get this shape:



5. Try to snap the other cross-sections and try dragging the Hotspots of the snapped elements to experience what is the function of each Hotspot. For example, you can adjust the distance between a duct and a circular cross-section element, if it is snapped with its "T" cross-section to the duct:

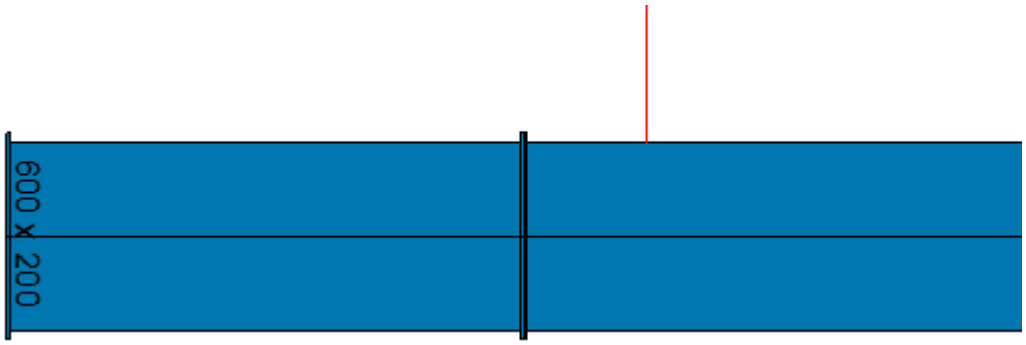


During this exercise you could experience, that when a Tee element is snapped to an existing cross-section, it is placed into the model as a symmetrical element, and the further dimensions of it will evolve during a certain logic to create an element. Main characteristic of this logic is to derive the lengths from the snapping cross-section.

The element placed this way into the model, can be adjusted by using its Hotspots, or by modifying its parameters in the User Interface.

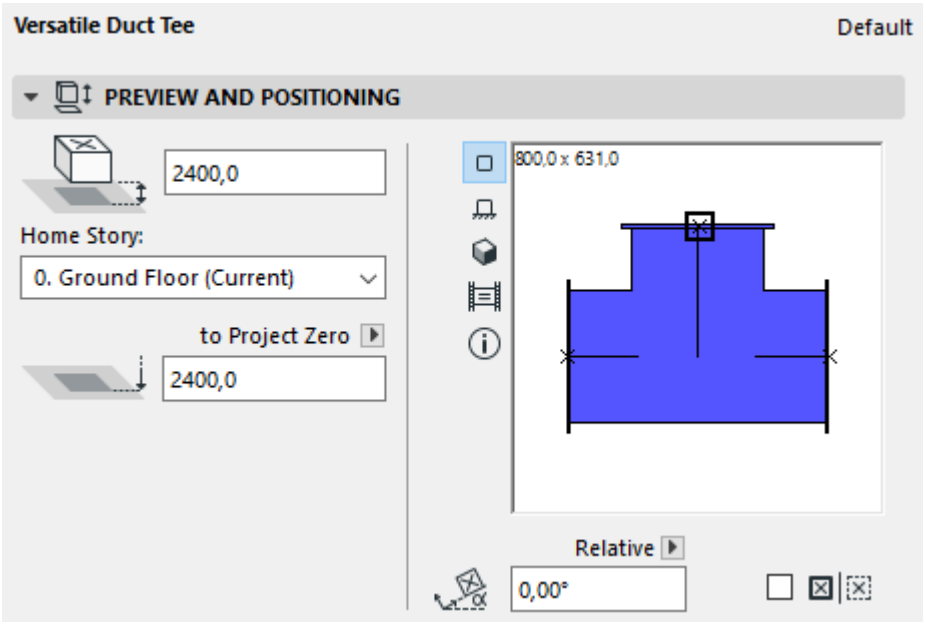
b) Quick exercise – Placing into an existing duct

1. Create a duct with any kind of shape and size:

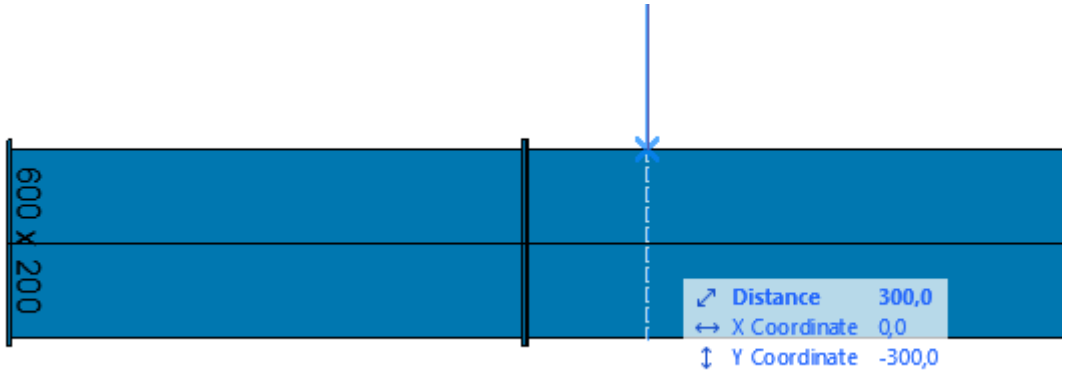


On this figure the future branch is indicated with a red centerline.

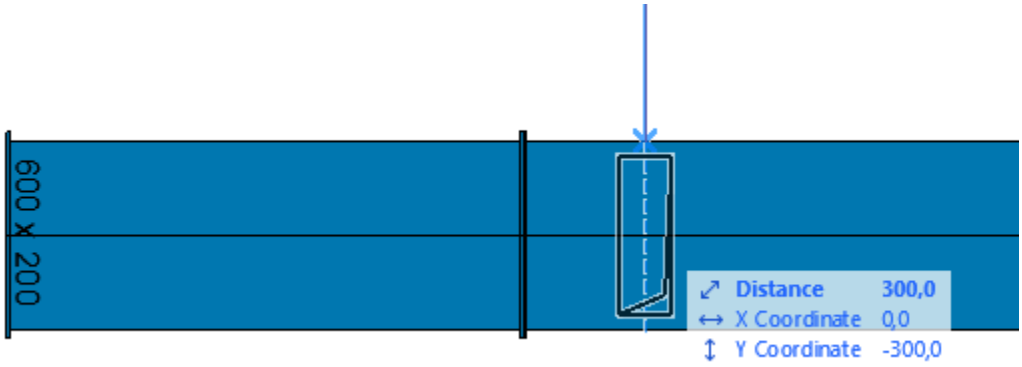
2. If you would like to place the branch of the Tee element on this centerline, choose the branch cross-section in the Settings Window:



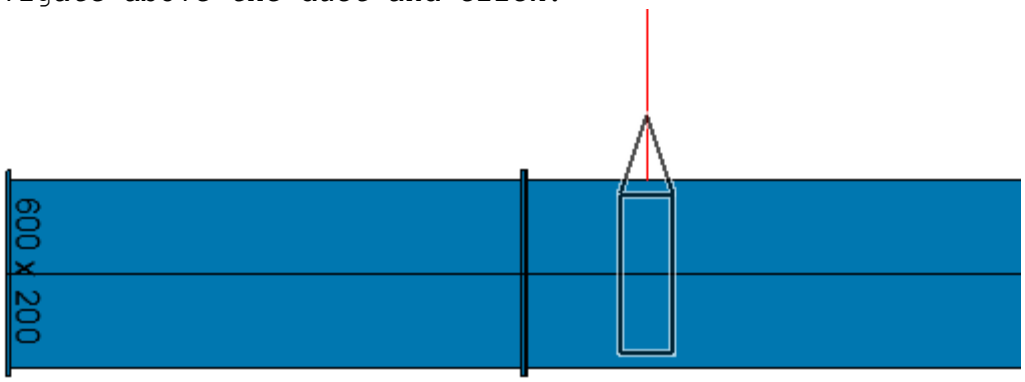
3. Lead the red line's continuation with the cursor until the centerline:

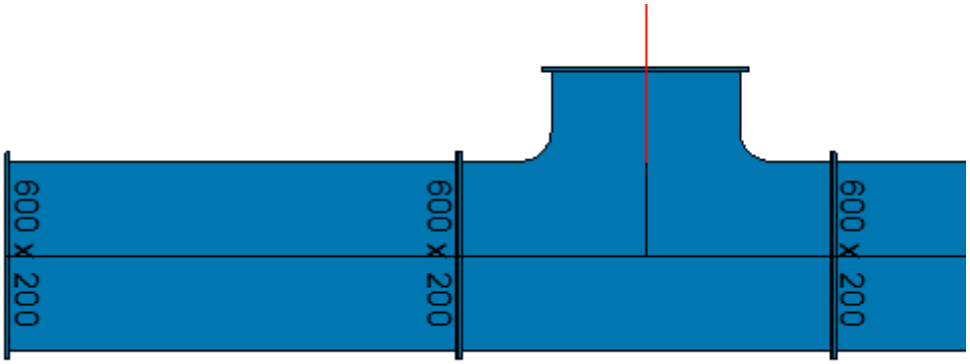


then click with the Mercedes cursor on the centerline:



then navigate above the duct and click:





This way the Tee profile is placed into the desired position. Try, if another cross-section is selected, where the profile will be placed.

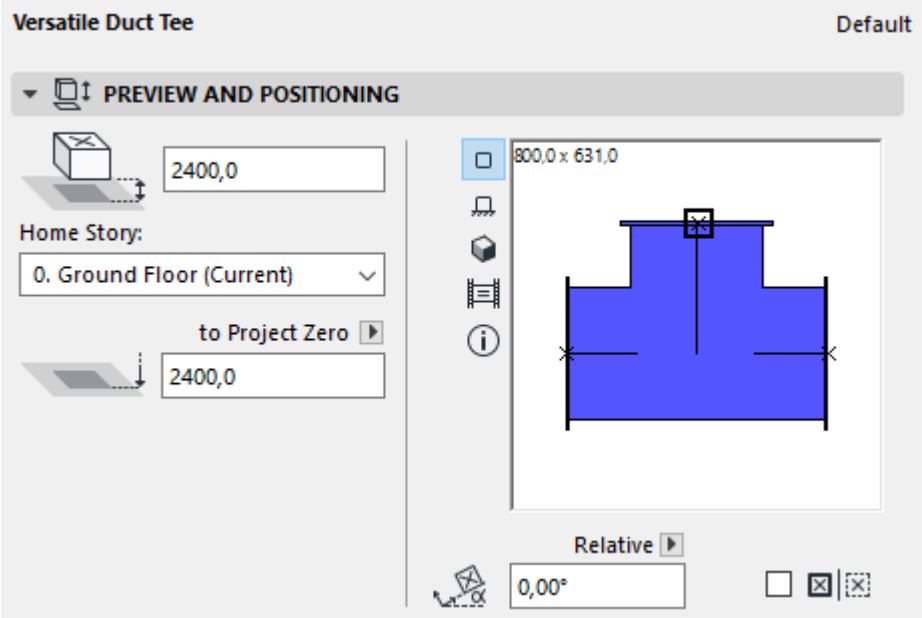
The establishing logic adjusts the branch cross-section to the same size, as the main pipe. The situation is the same, when we would like to branch from an existing duct with Routing: the cross-section of the branch will be the same size as the main pipe. The MEP tool does not enable yet, that the branch cross-section and the duct appearing in its continuation get their values from the Routing Window, therefore we suggest to

- place the Tee into the existing duct,
- set the size of the branch cross-section to the desired dimension,
- start Routing from the branch cross-section.

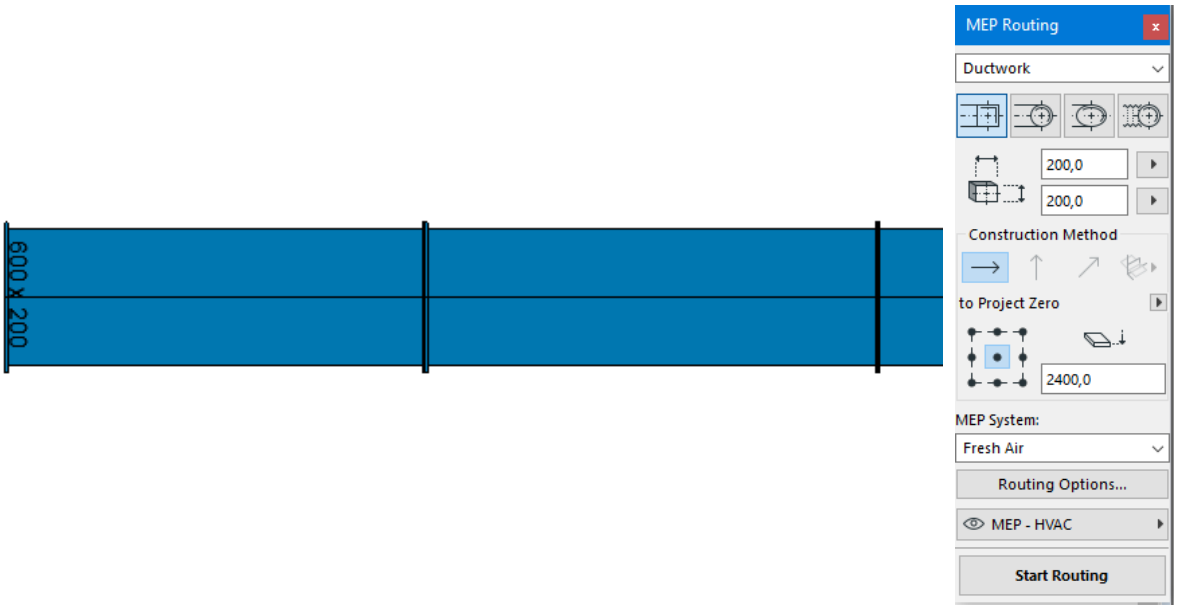
It is a different situation, when a Routing, that is independent from an existing duct, is lead into it – this is feasible, and the result is adequate.

c) Quick exercise – Arriving into an existing duct with MEP Routing

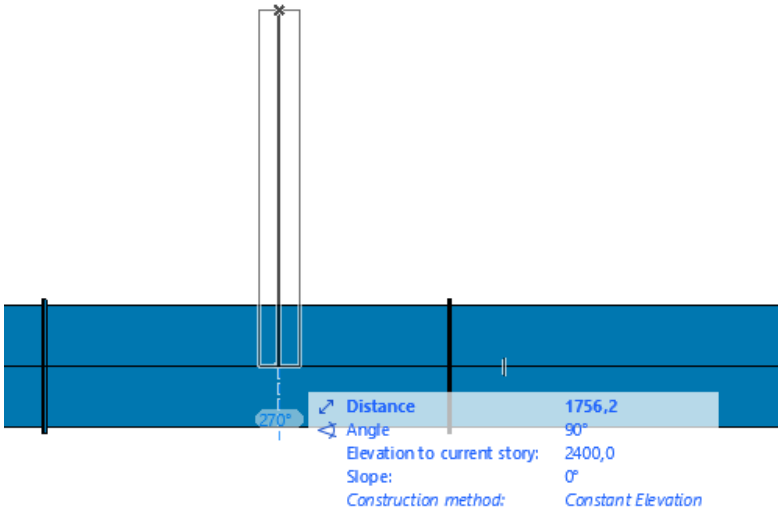
1. In the Settings Window of the Tee element select the branch cross-section:



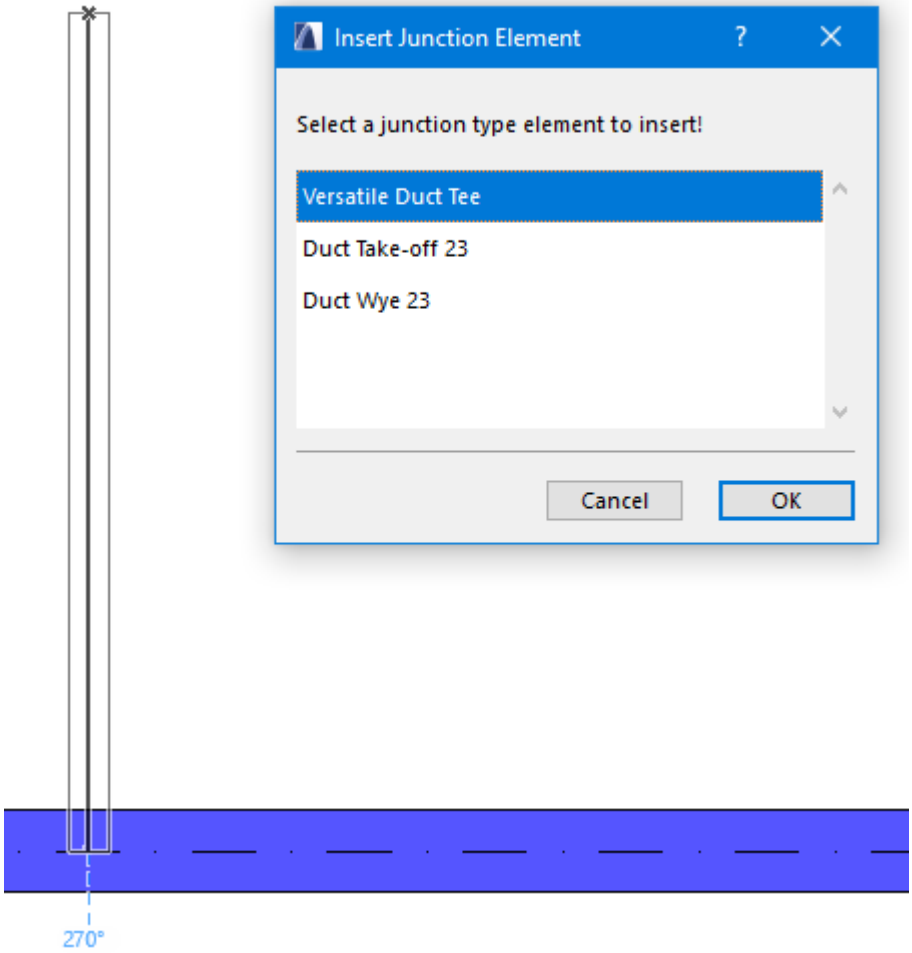
2. Place a 600x200 air duct with rectangle shape on the Floor Plan, and set an air duct with 200x200 size on the MEP Routing palette. Pay attention, that the height of the placed duct, and the height in the Routing Window are equal (here 2400):



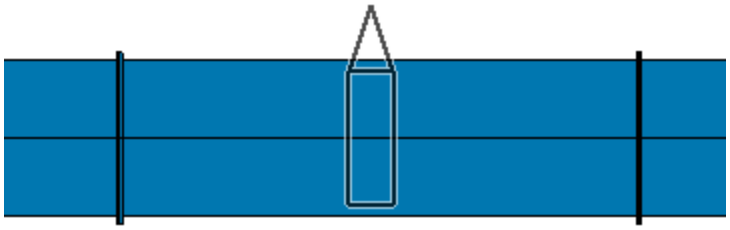
3. Start drawing the route perpendicularly to the placed duct:



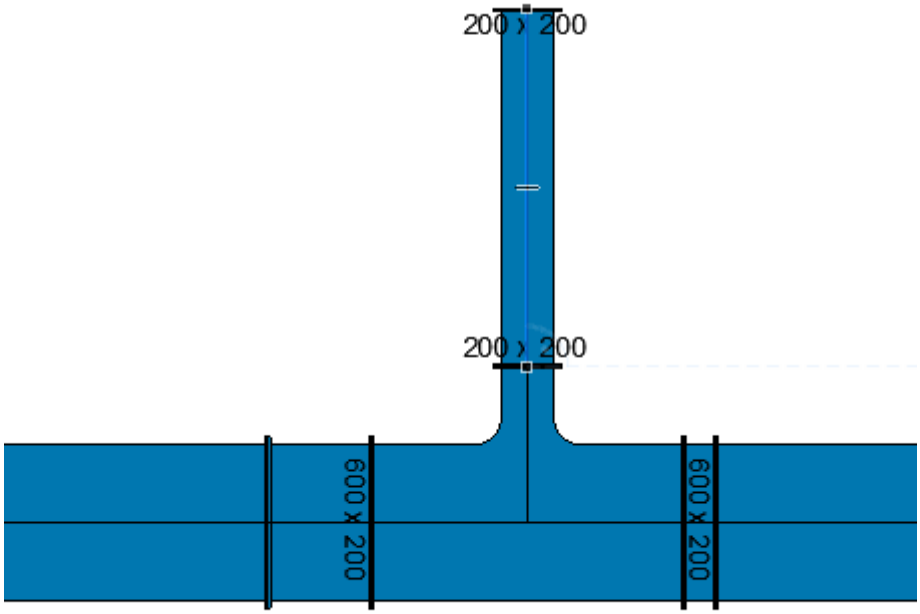
4. Click on the centerline of the duct, and in the "Insert Junction Element" pop-up window choose the "Versatile Duct Tee" element:



5. After pressing "OK", choose the direction of the Routing:



6. After clicking, the desired result will appear:



3. The “Versatile Duct Bend” element

This element exists in the three cross-section shapes known by the MEP tool (rectangle, circular, oval). The rectangle cross-section can be symmetrical and asymmetrical as well, in case of latter shape, the heights in the two endpoints are equal and the width can differ. The Bend angle of an asymmetrical element can only be 90 degrees, the other shapes can have a Bend angle between 0 and 90 degrees.

The Bend element can be placed into the model with following methods:

- simple placement,
- snapping to an existing cross-section,
- with MEP Routing.

During the presentation of the Bend element, first we get familiar with the element itself, how to use it and what it can do, and with this knowledge we continue with the methods, how to place it into our model.

3.1 “Versatile Duct Bend” element, rectangular cross-section

The symmetrical Bend element can have following shape on its inner- and outer side:

- Circular,
- Rectangular,
- Chamfered.

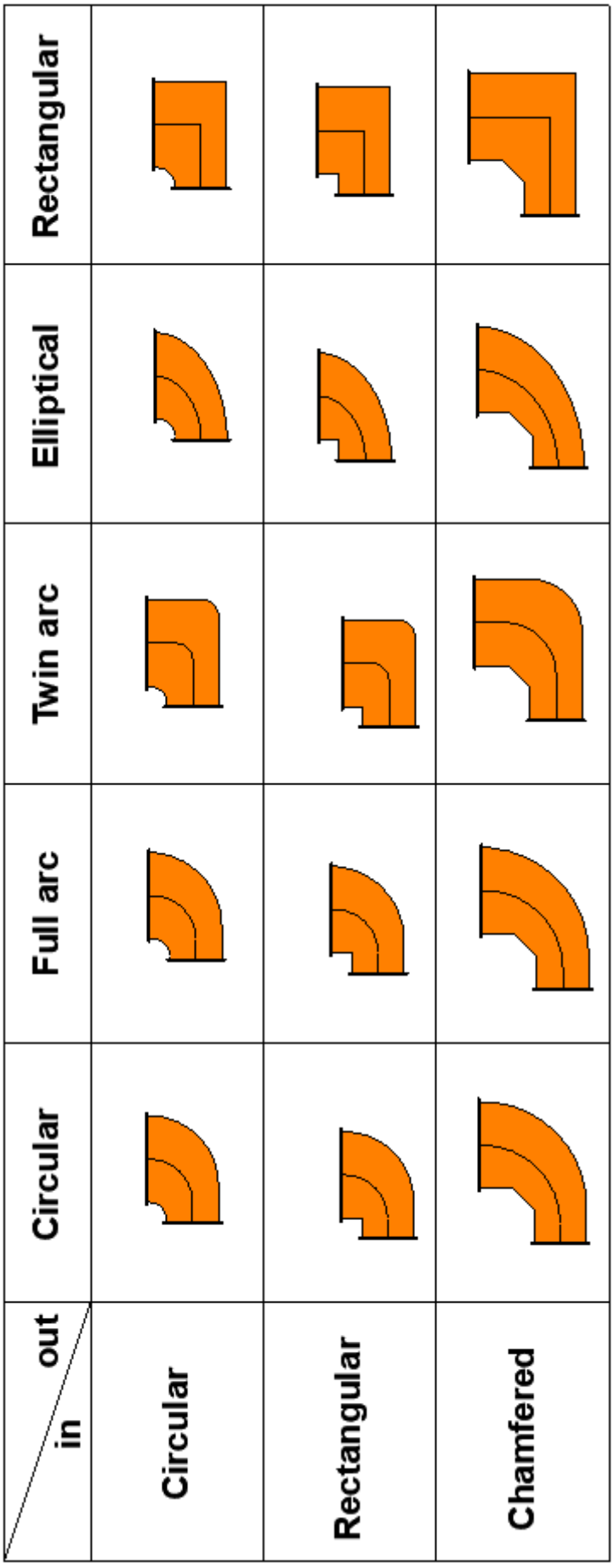
The following shapes can be created:

in \ out	Circular	Rectangular	Chamfered
Circular			
Rectangular			
Chamfered			

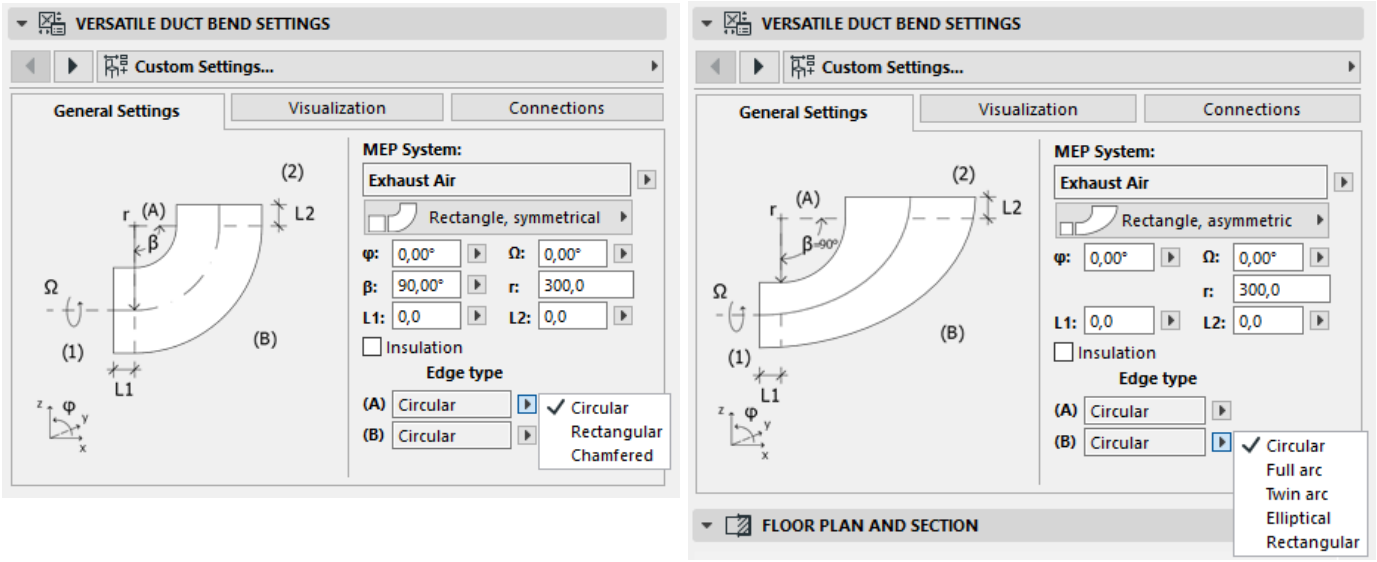
The asymmetrical Bend element enables the same shape options on the inner side, as the symmetrical element; and on the outer side you can choose from following options:

- Circular,
- Full arc,
- Twin arc,
- Elliptical,
- Rectangular.

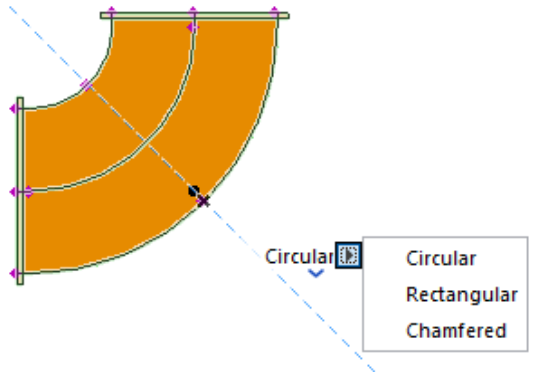
The following shapes can be created in case of an asymmetrical Bend element:

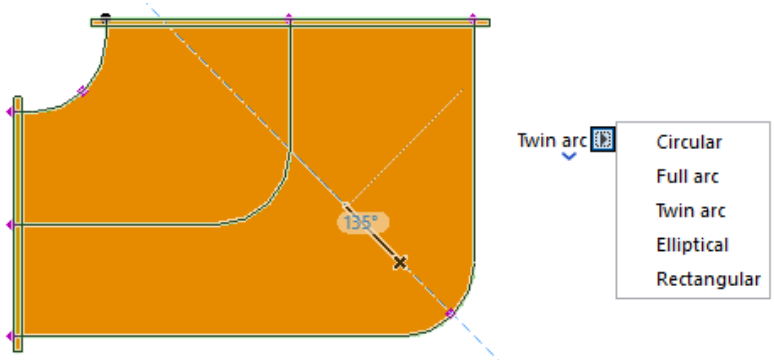


In case of both the symmetrical and the asymmetrical shape, you can choose from parameter options in the User Interface on the “General Settings” page. In 2D and 3D you can choose by using the Hotspots, which are in the center of the corresponding side. If you would like to adjust with the Hotspots, you can choose from text values after pressing TAB. User Interface (difference from the Default Setting: L1=50 mm; L2=50 mm):

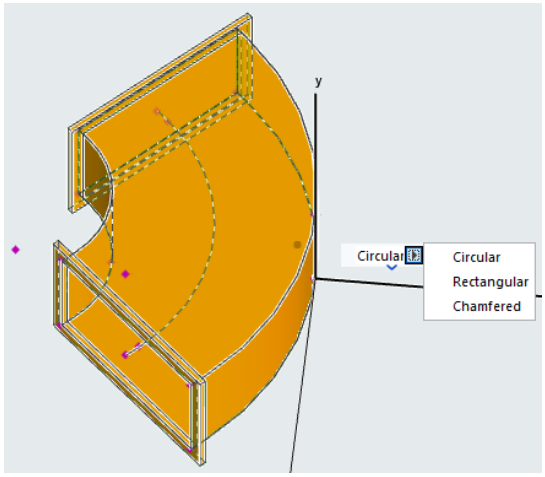


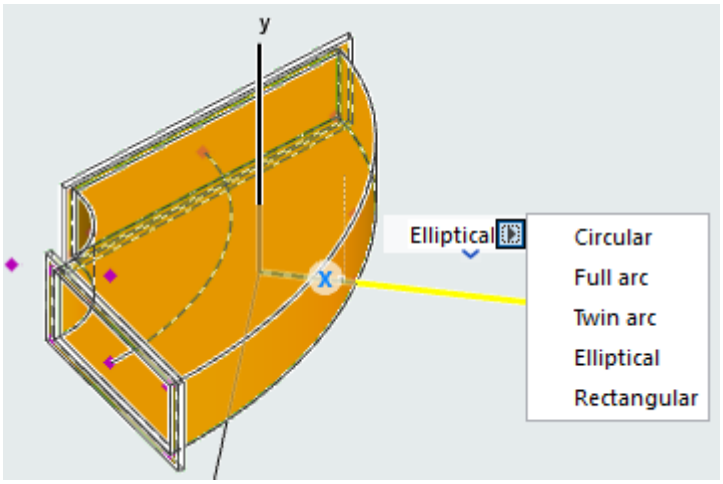
2D:





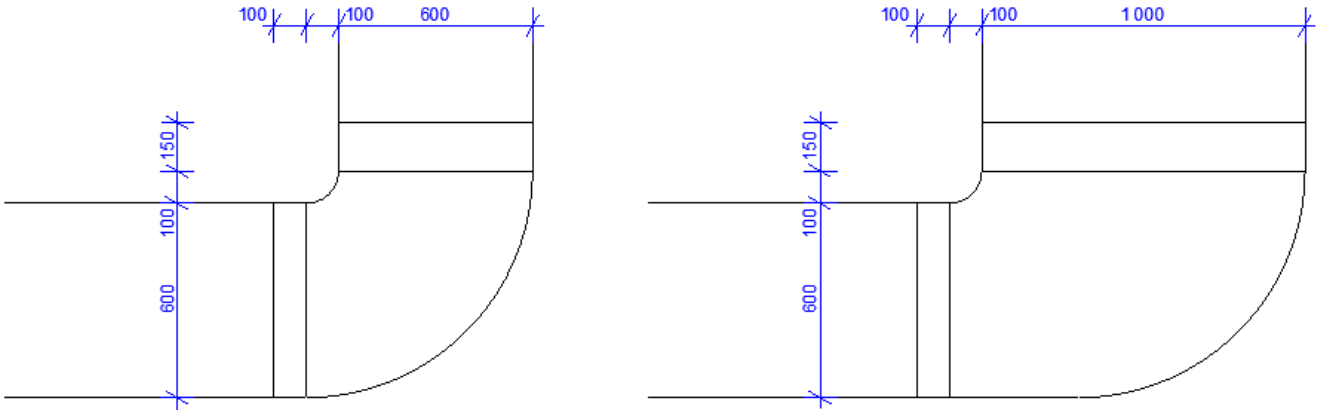
3D:





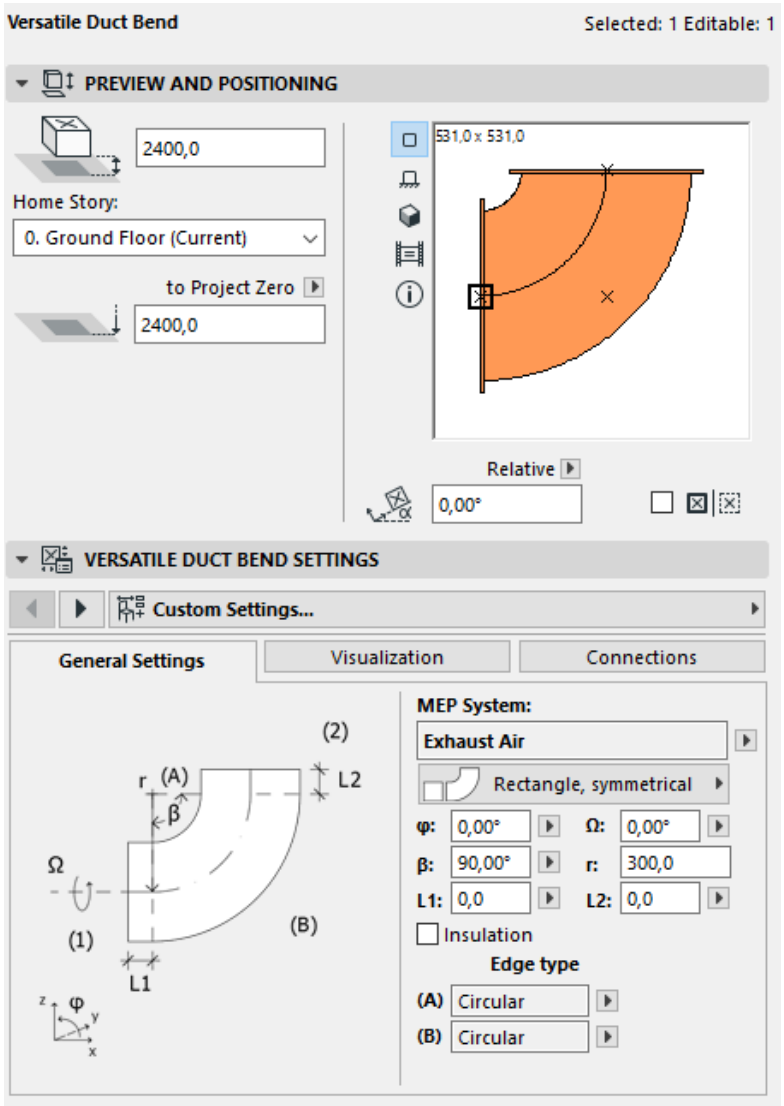
a) Quick exercise – Discovering the rectangle Bend

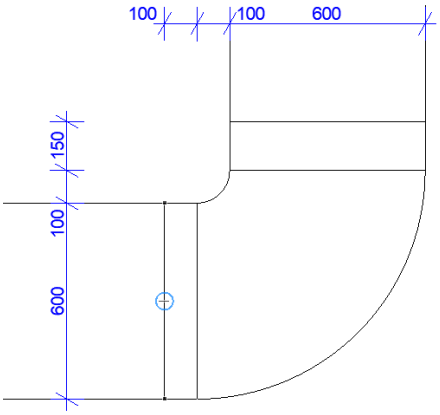
1. Create the following drawing, using lines and arcs:

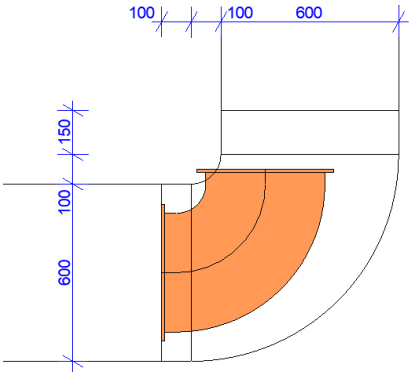


You can derive the right drawing easily from the left one. The task is to build this fictive air duct network. In the first version we only place the Bend, because now we would like to practice that.

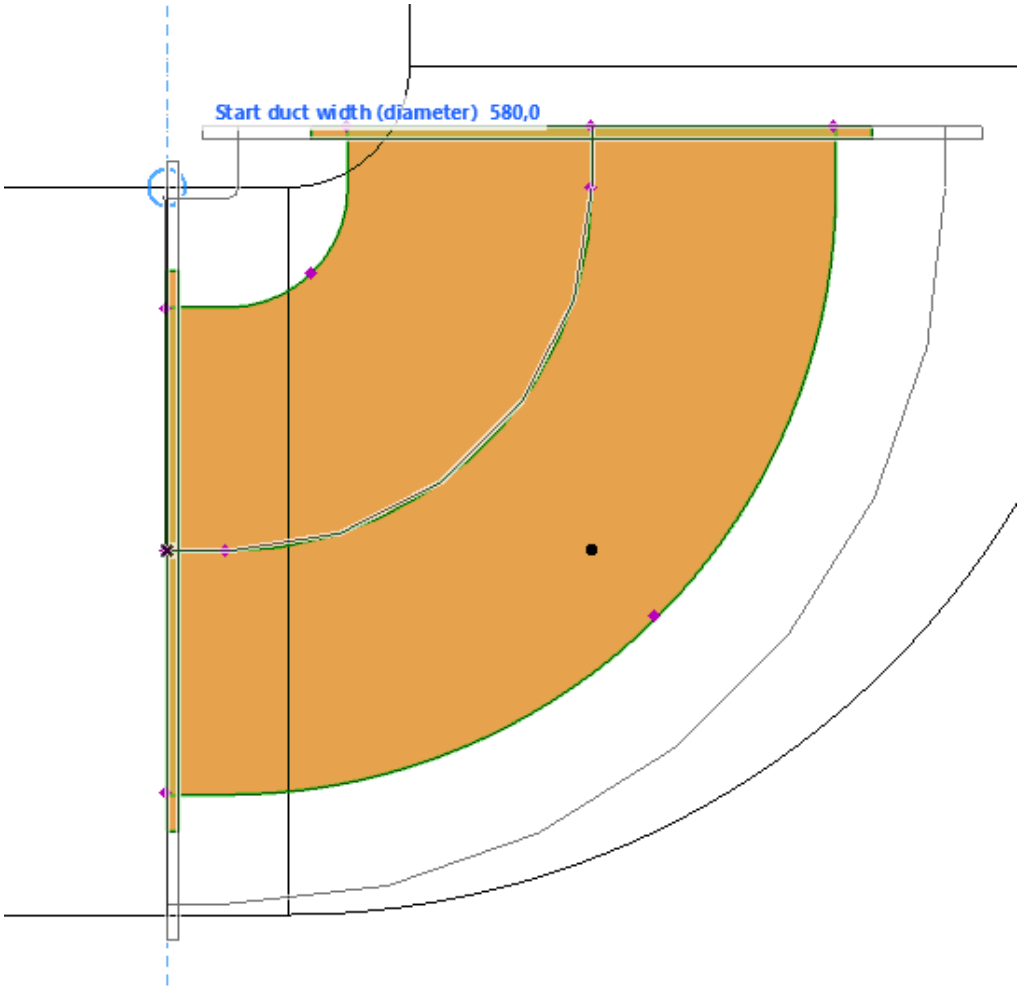
2. In the Settings Window select the left cross-section of the Bend, and place the Bend to the center of the left vertical line on the left drawing (L1=50 mm; L2=50 mm):





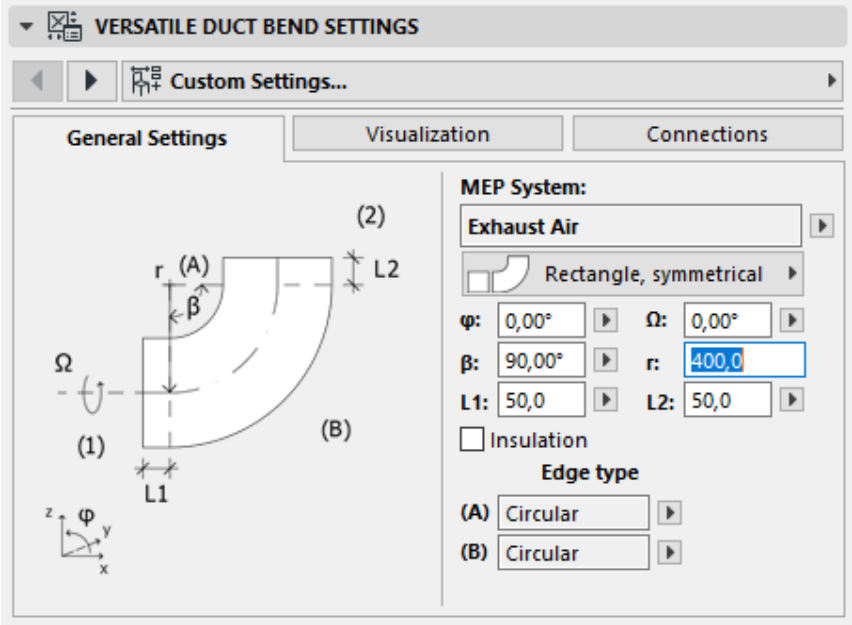


3. Select the element, and try to create a size of 600, by dragging the upper point of the left cross-section:

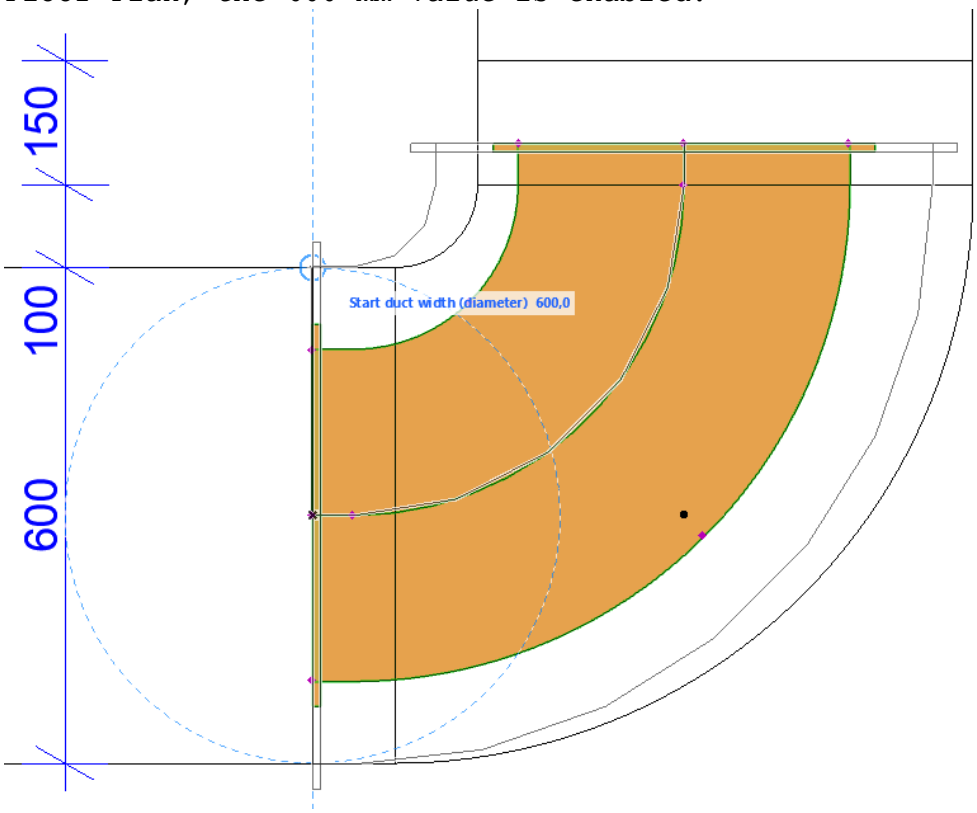


Adjusting this dimension stops at the value of 580, because the element enables to drag only until this value. You can see the reason of this on the User Interface by interpreting the radius and the size.

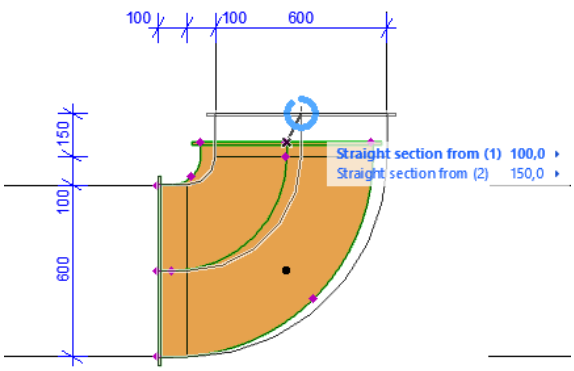
4. Press ESC and set the radius ("r") value in the Settings Window to 400 (this value is 100 mm more than the half of the future 600 value):

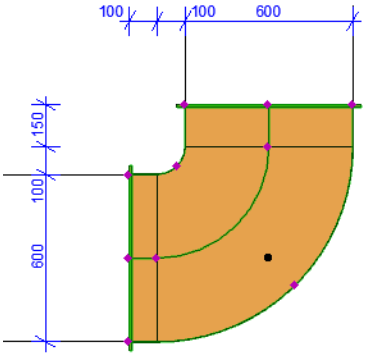


5. Now you can adjust the cross-section of the element by dragging on the Floor Plan, the 600 mm value is enabled:

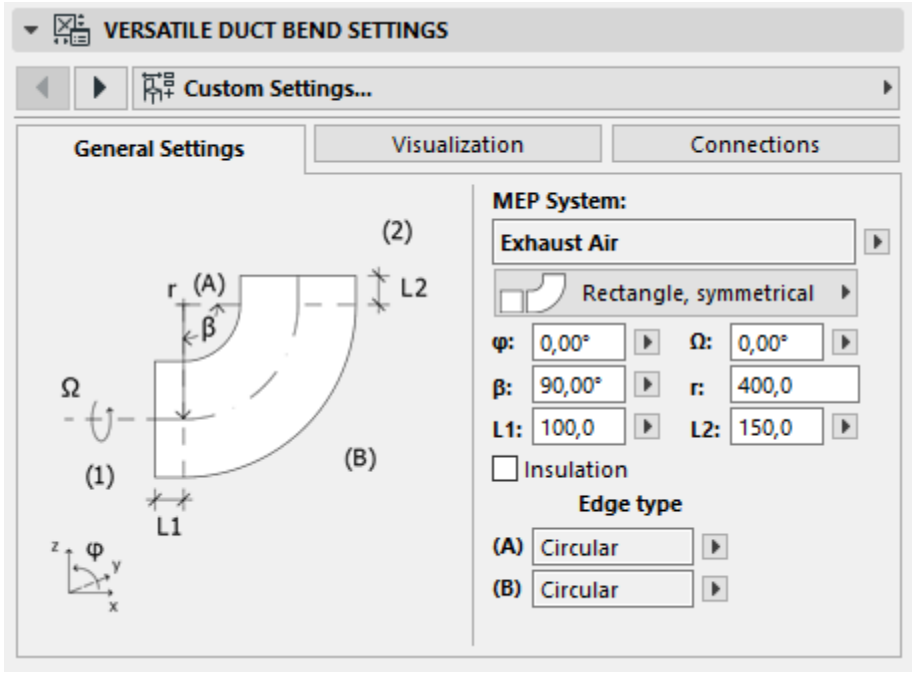


6. Adjust the centerline point of the element's 2nd cross-section to the adequate place on the drawing:

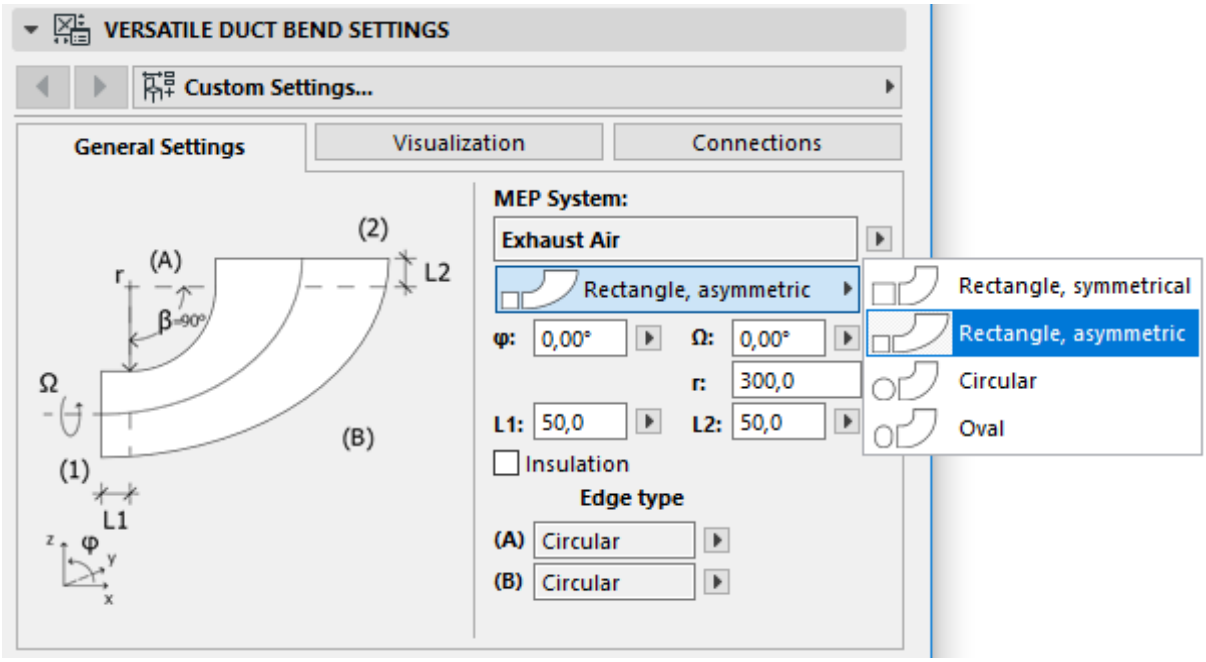




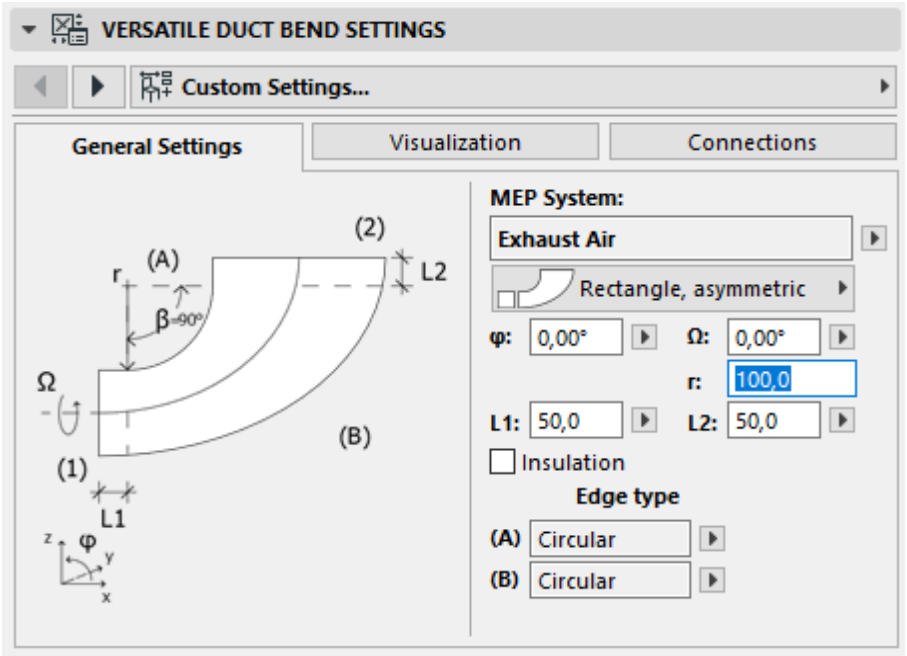
7. Have a look at the "L1" and "L2" values in the Settings Window, these are exactly the values as on the original drawing:



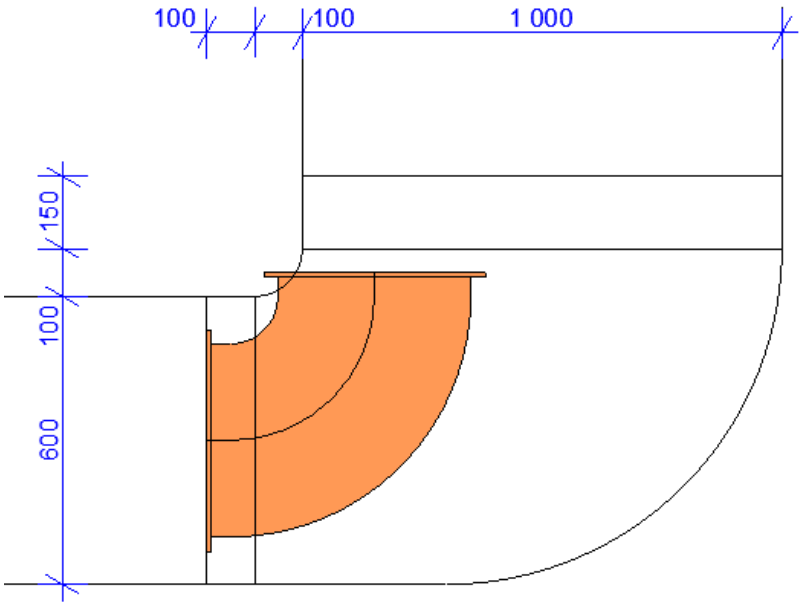
8. Deselect the element, and in the Settings Window, instead of the Bend that was set as General Setting, select the "Rectangle, asymmetrical" shape (L1=50 mm; L2=50 mm):



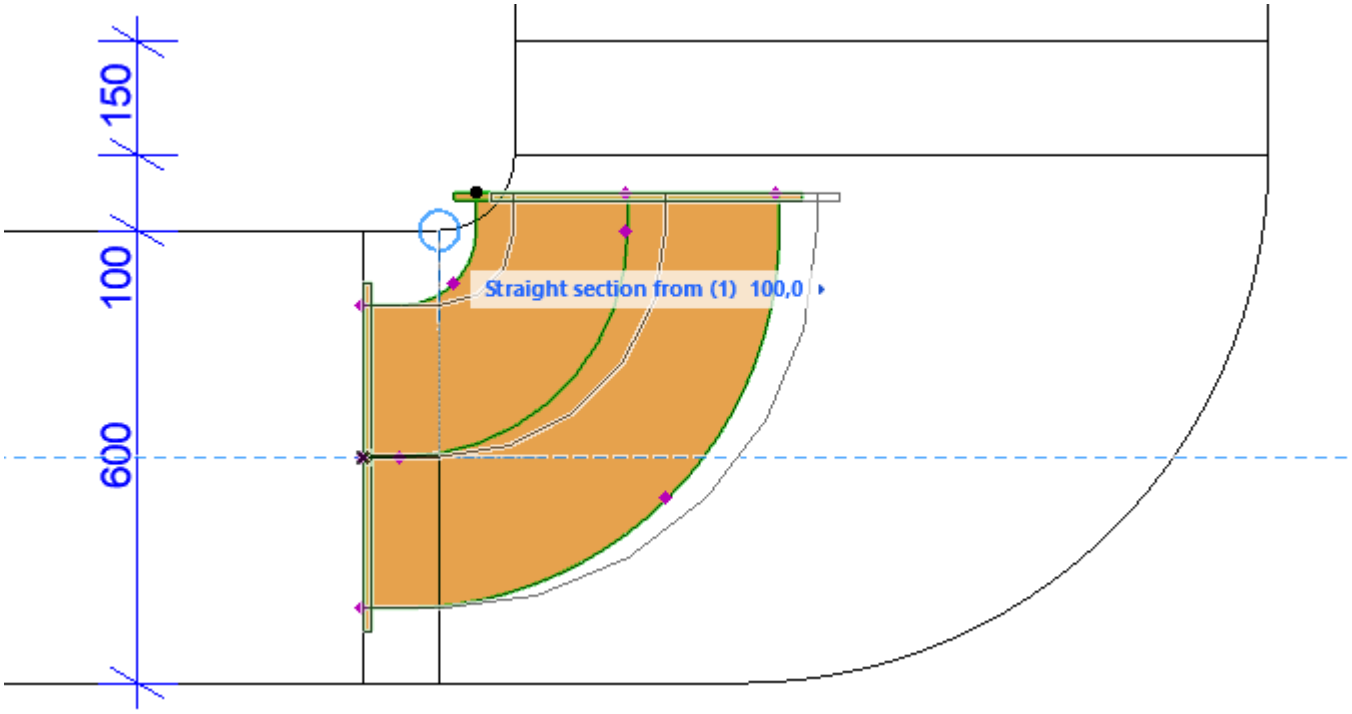
after this, set the radius ("r") to 100 mm:



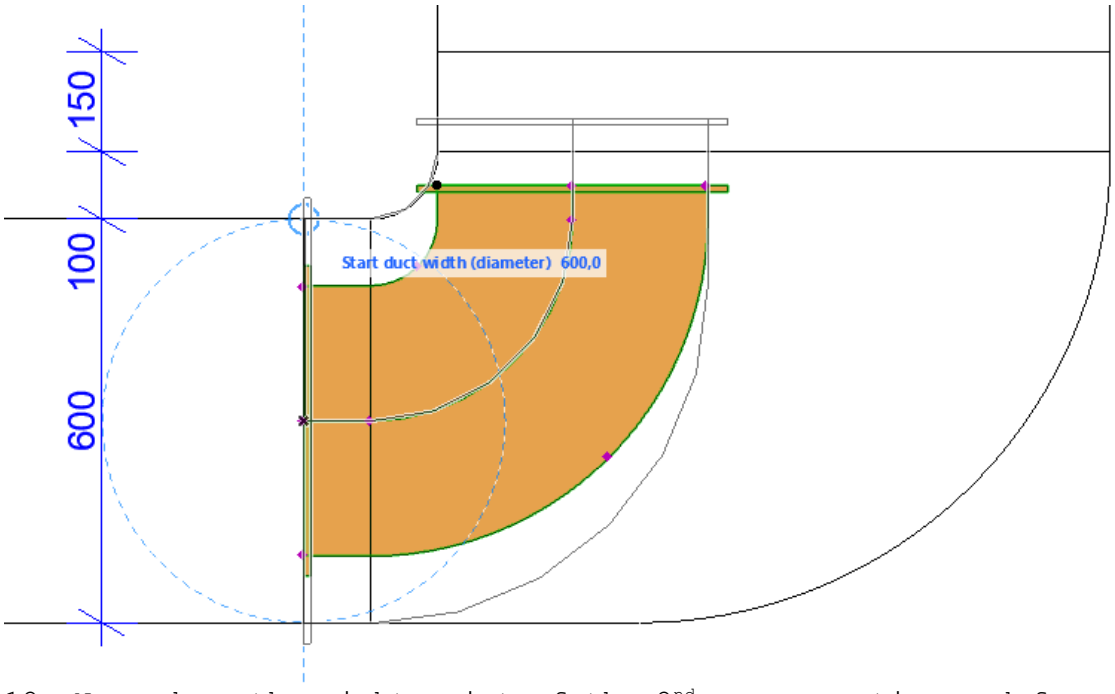
9. Place this Bend – also with the left cross-section – to the center of the left vertical line of the right drawing:



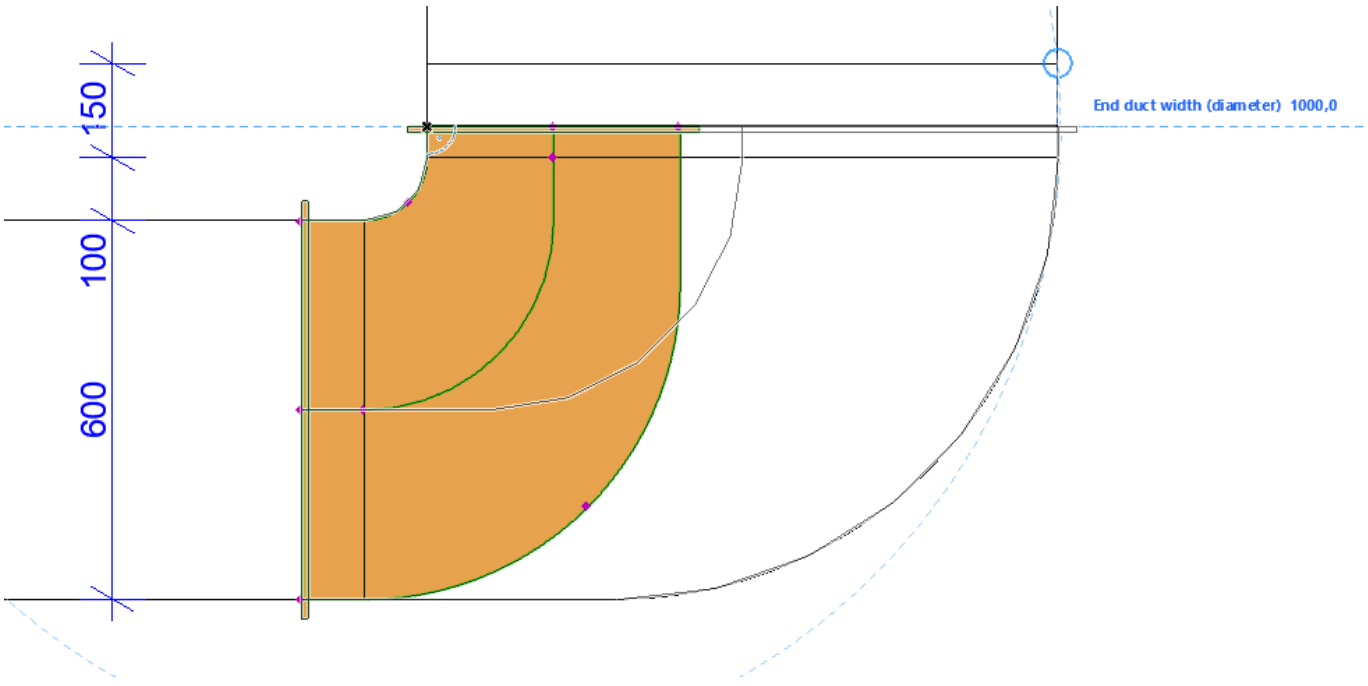
10. Select the element and drag the point which you can find a bit to the right from the centerline point of the left cross-section, and formulate the initial part of the Bend, on the drawing this is 100 mm. You can snap or enter the value as well:



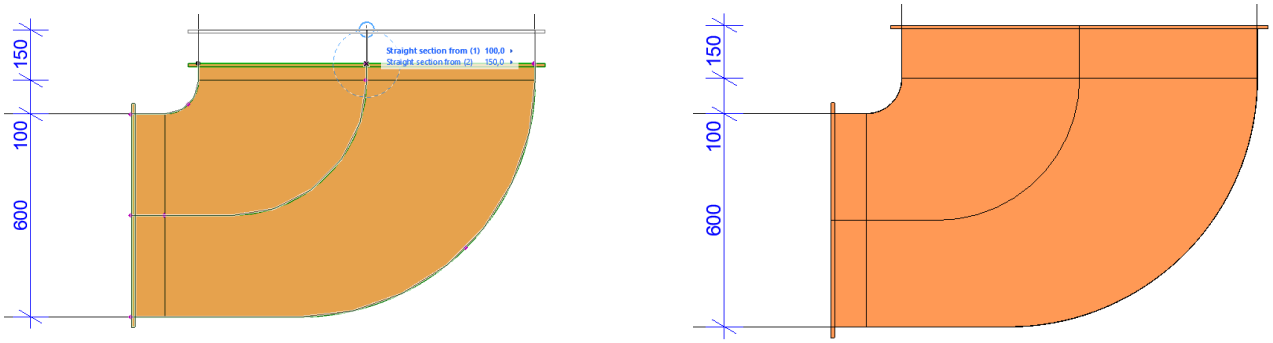
11. Same way, as in case of the symmetrical Bend, formulate the left cross-section's dimension by dragging (now you won't bump into a limitation caused by different interpretation of the radius):



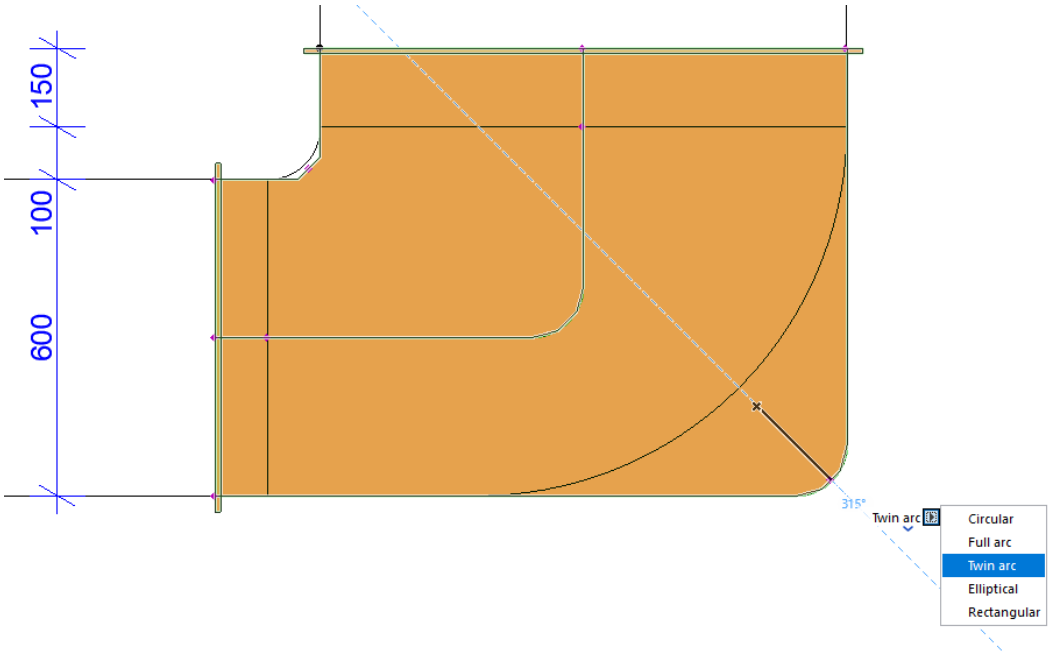
12. Now, drag the right point of the 2nd cross-section and formulate the 2nd cross-section's width:



13. Adjust the centerline point of the 2nd cross-section vertically to the drawing, and formulate the desired result this way:



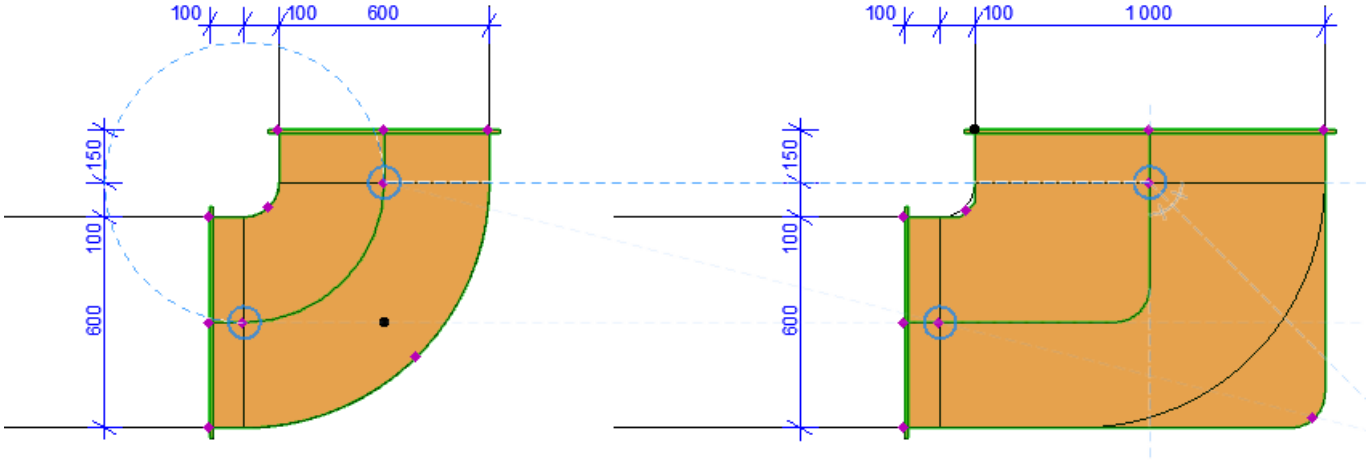
You can check the resulting dimensions in the Settings Window. Try the Hotspots on the inner- and on the outer side of both elements, choose another shape:



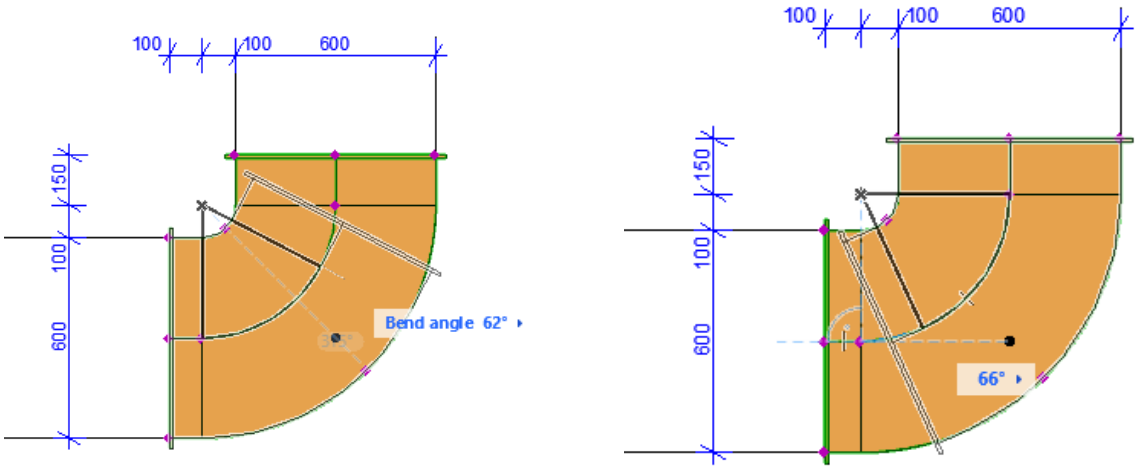
The same options are available in 3D as well. At the snapping exercise you will see the logic of creating the Bend radius and the benefits of it.

b) Quick exercise – Bend radius and the connection lengths

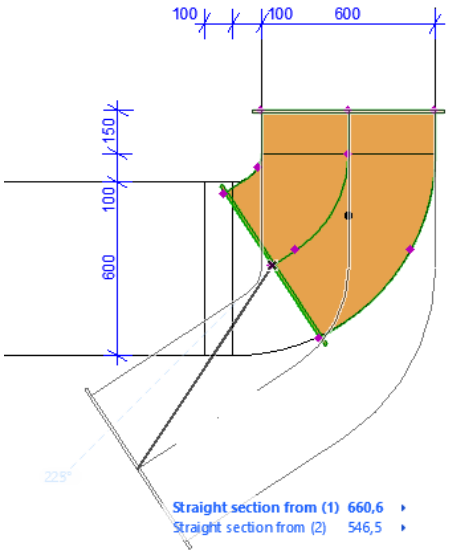
1. Select both elements, and discover the Hotspots close to the cross-sections on the centerline (the blue circles):

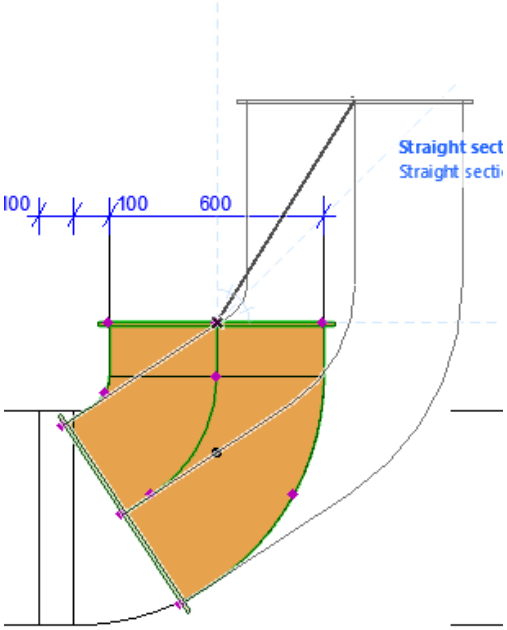


2. By dragging these points of a symmetrical Bend, you can set the angle of the Bend:

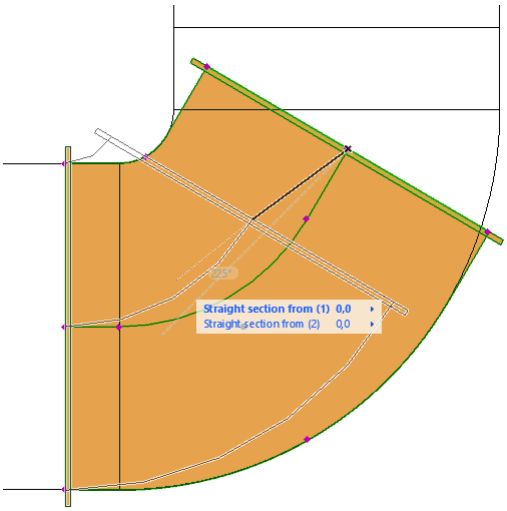


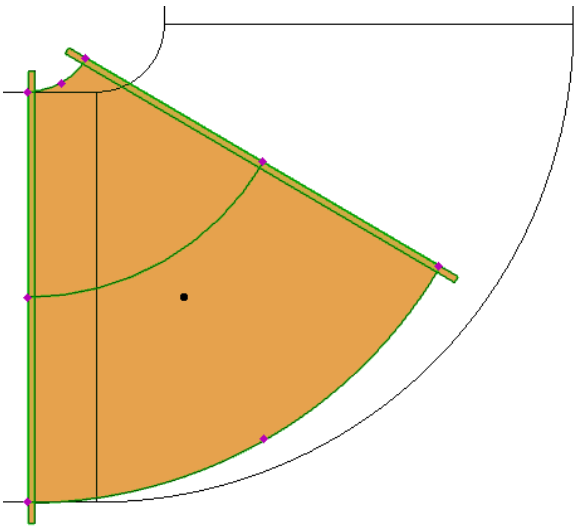
3. You can adjust the straight lengths connecting to the Bend with the centerline point of the cross-section – as you could see in the previous exercise –, in both points both lengths – enabling this way to navigate to the appropriate place:



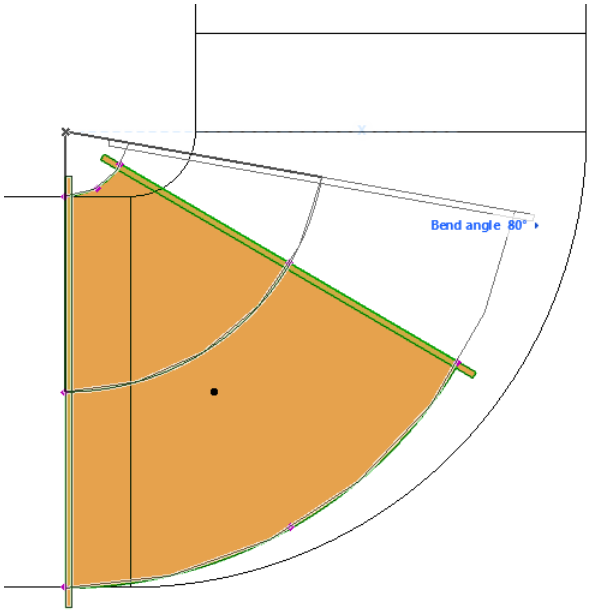


4. Now set these lengths to zero:



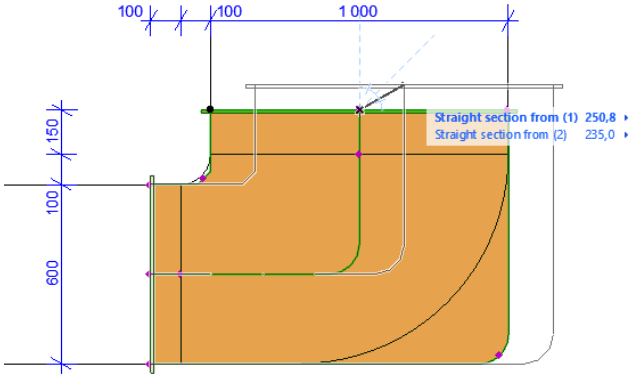


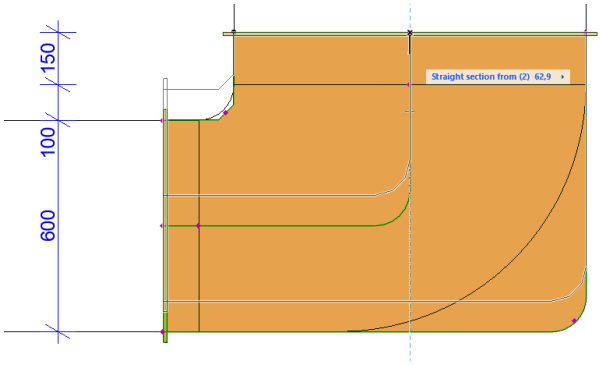
5. Grab again and drag any of the centerline points:



If the straight part is set to zero, you can adjust the Bend angle with this point.

6. Now discover the centerline points of the asymmetrical Bend, and the Hotspots close to these, which set in any case the straight lengths. The cross-sections can be navigated to the desired place with the outer Hotspots, and with the internal Hotspots you can adjust the lengths inside the element:





3.2 “Versatile Duct Bend” element, circular cross-section

The operation with Hotspots of the Bend element with circular cross-section is equal to the symmetrical rectangle Bend. Check the Introduction chapter for more information about the circular cross-sections and to find out more about the practice of placing it into the model.

3.3 “Versatile Duct Bend” element, oval cross-section

The operation with Hotspots of the Bend element with oval cross-section is equal to the symmetrical rectangle Bend. Check the Introduction chapter for more information about the oval cross-sections and to find out more about the practice of placing it into the model.

3.4 “Versatile Duct Bend” element - Options to place into the model

Reminder: The Bend element can be placed into the model with following methods:

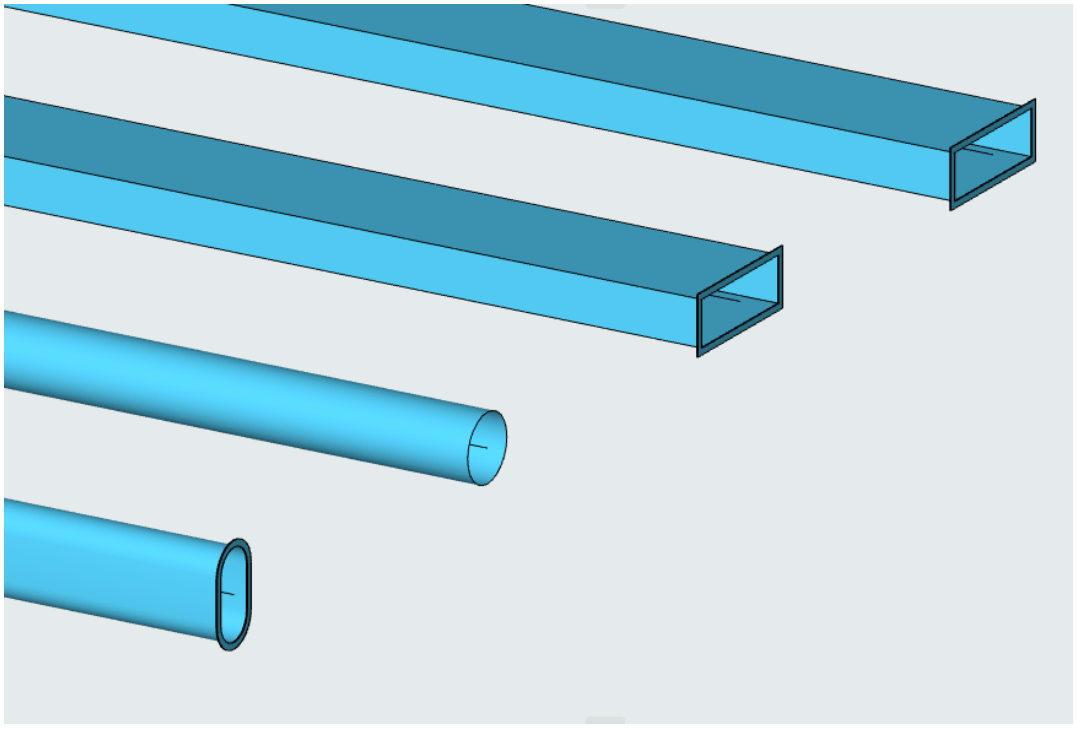
- simple placement,
- snapping to an existing cross-section,
- with MEP Routing.

During “Quick exercise – Discovering the rectangular Bend” we experienced the simple placement. During this method, the Bend element was placed into the model with the parameters that have been set by the User at the User Interface.

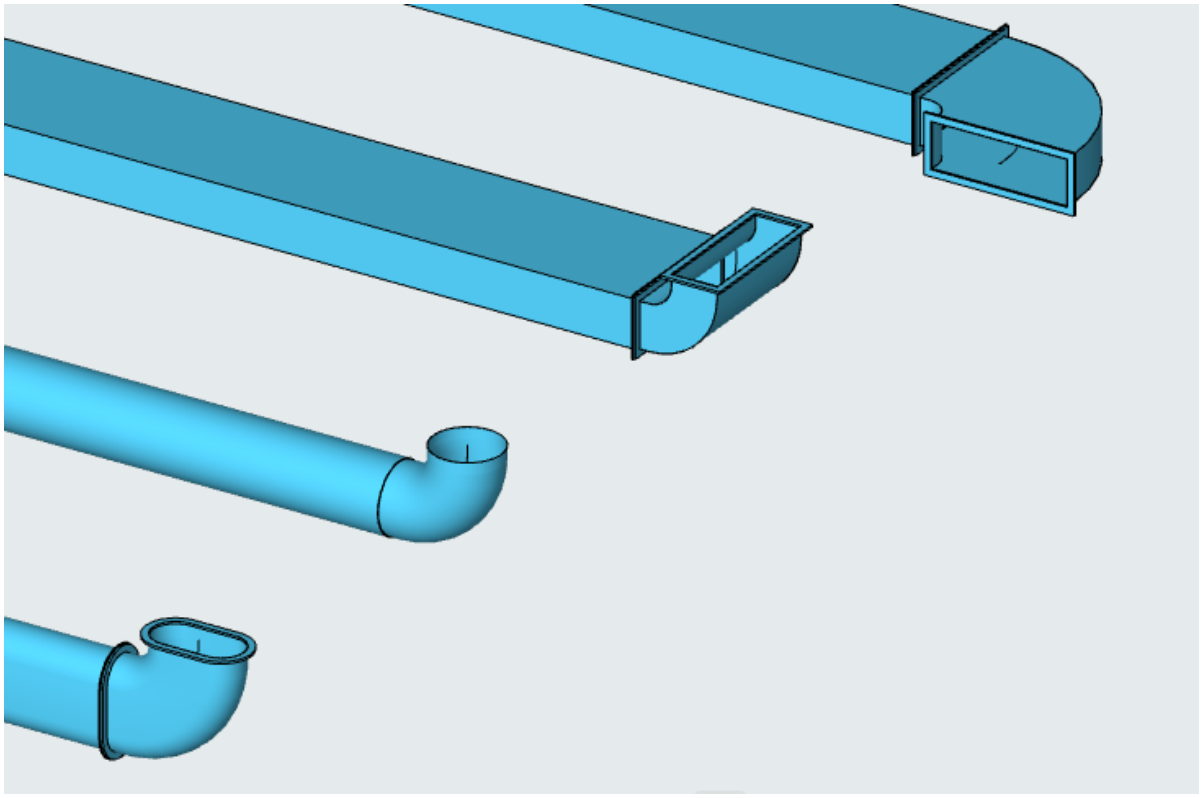
If a Bend is placed into the model with Routing, the L1 and L2 values must be set to zero. If these are not set to zero, the duct parts after the placed Bend – if there are more duct parts – will be shifted compared to each other. It might help, if the “Duct segment length limit” value is set quite high in the “MEP Preferences” window, for example to 200 meters.

a) Quick exercise – Snapping and rotating

1. Place four Duct Straight elements in 2000 mm distance from each other, from top to bottom two rectangles, a circle and an oval. The rectangles shall be of 600 x 200 size, the circle 300 mm, and the oval 200 x 400, and the circular should not have a flange (Connection Type = “Simple Body”):

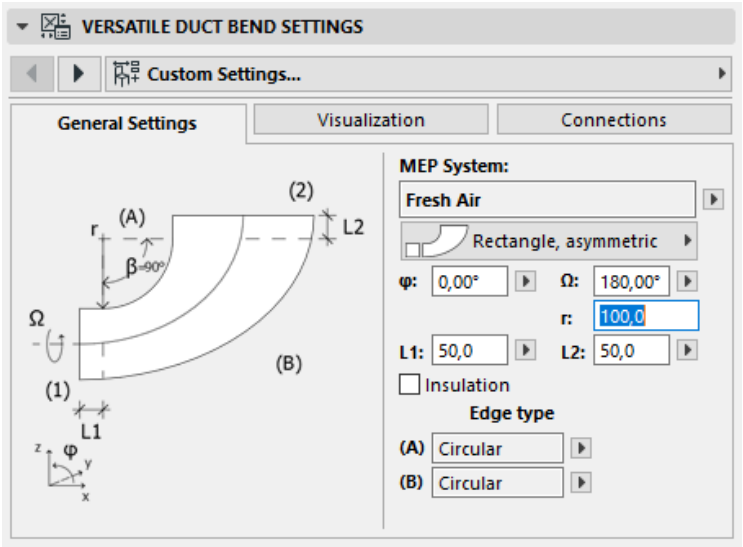


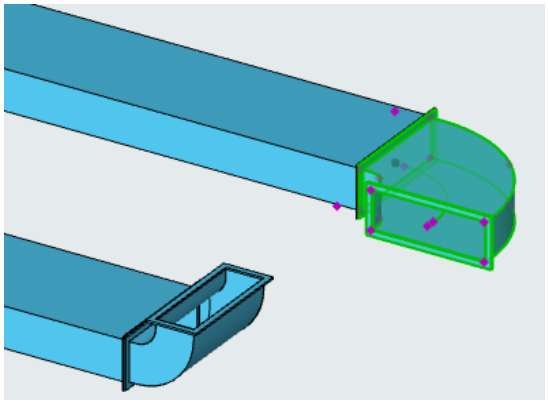
2. Snap a Bend with its left cross-section to the end of each air duct, in a way that you get the following result:



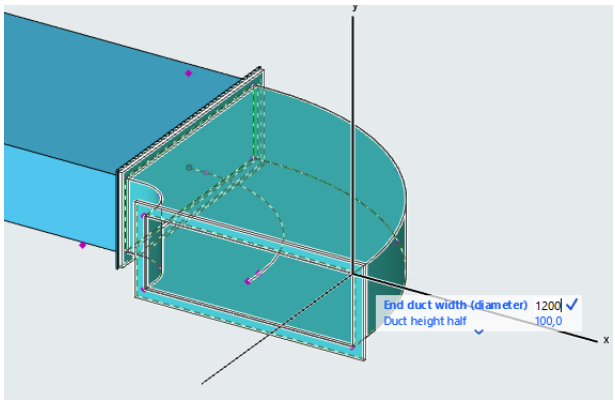
The Bends, placed this way, define the value of the Bend radius ("r"), depending on the cross-sections' size, so you don't have to figure out this in order to formulate the geometry (only if you would like to have a different radius). The created rectangular Bends are symmetrical. Observe, that the radiuses of the two rectangular Bends are created with a different value.

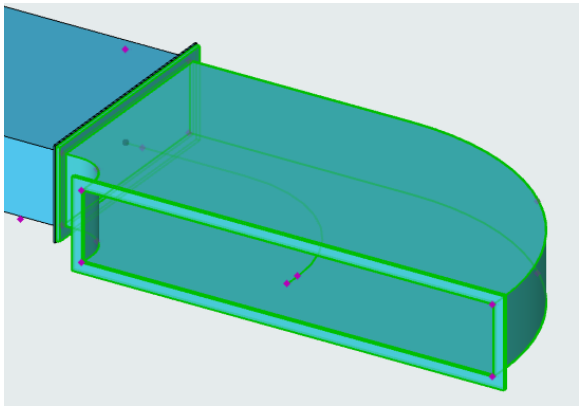
3. Select the first rectangular Bend, and modify it to asymmetrical in the Settings Window, and change the radius to 100 mm (with these modifications, the geometry of the element will remain the same):



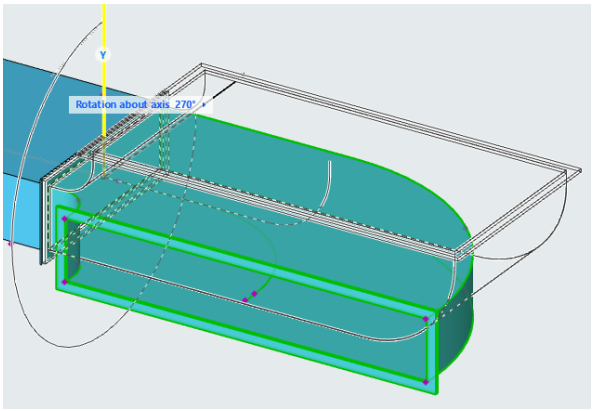


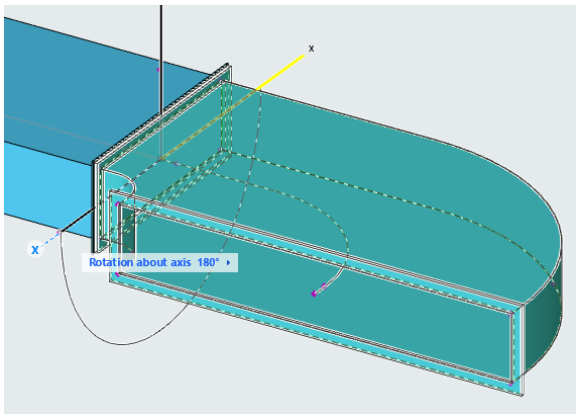
4. Click on the top right point of the free cross-section and set the value of the "End Duct width (diameter)" to 1200:





5. Try to rotate the Bend, with the rotating point of the connected cross-section, and discover that the

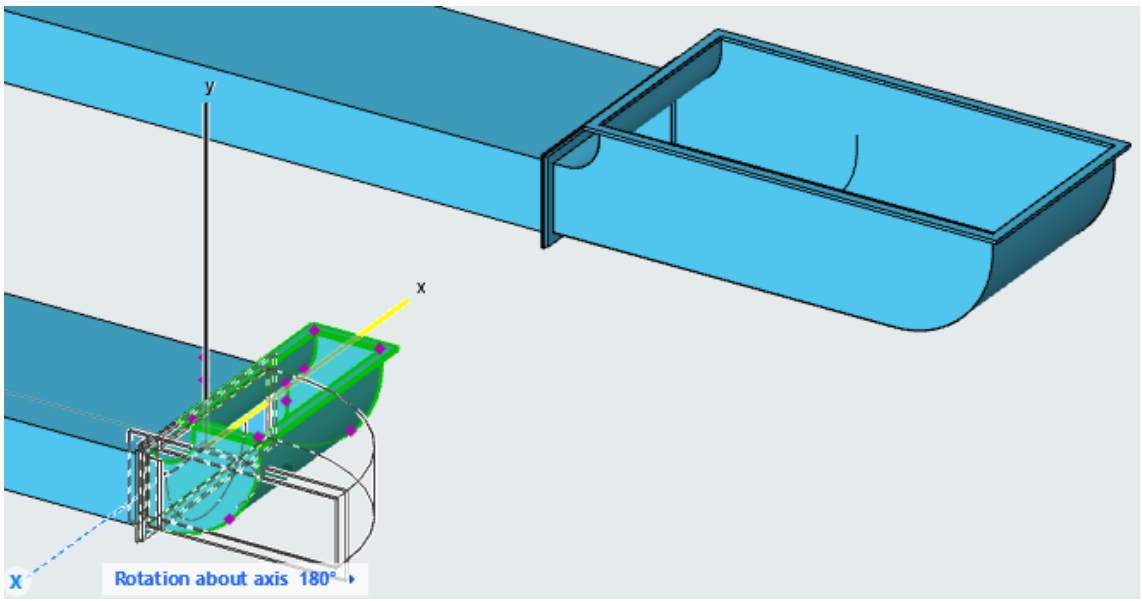




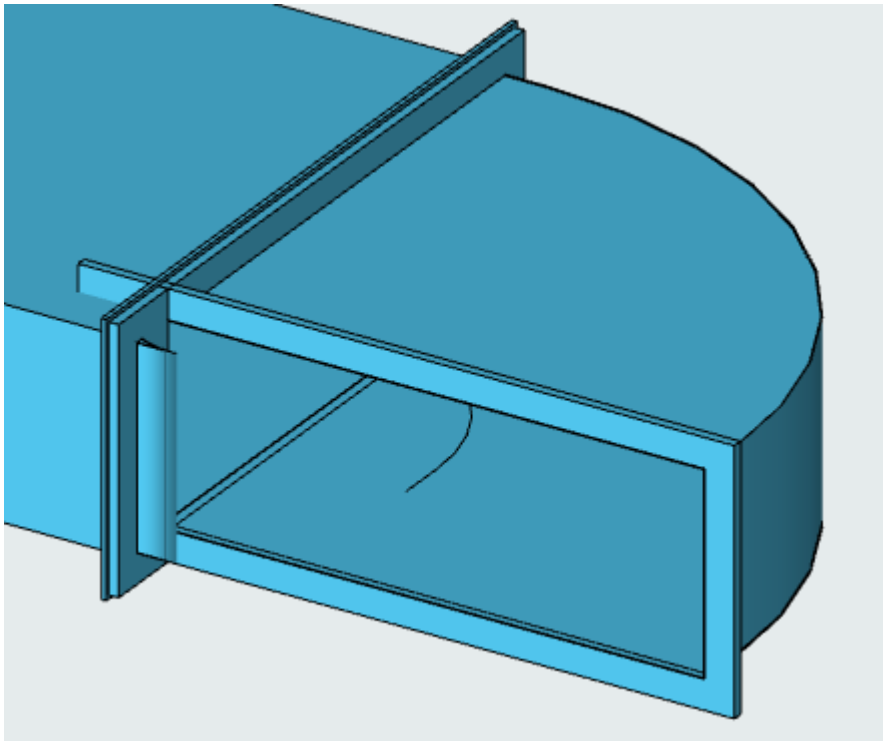
rotation is only possible with the multiplied values of 90 degrees:

Observe at the User Interface as well, how the Bend element keeps or modifies its cross-section values, depending on the Rotation about axis, whether it is 90 or 180 degrees.

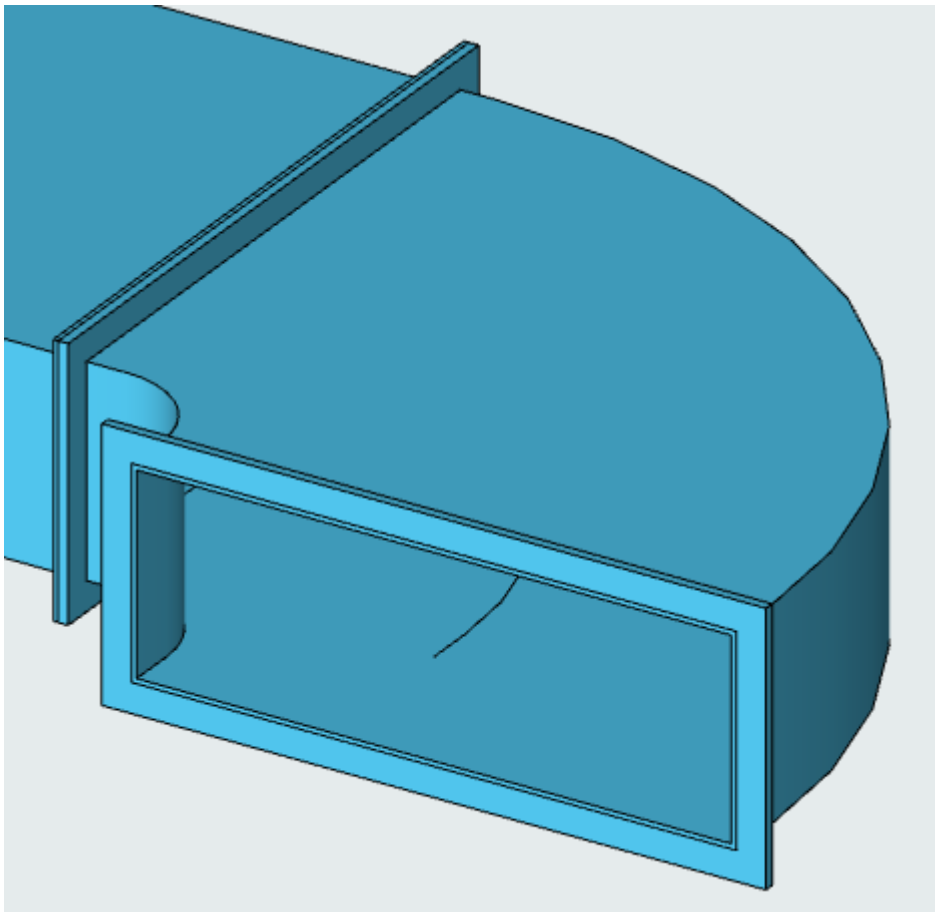
6. Now rotate the other rectangle Bend by 90 degrees:



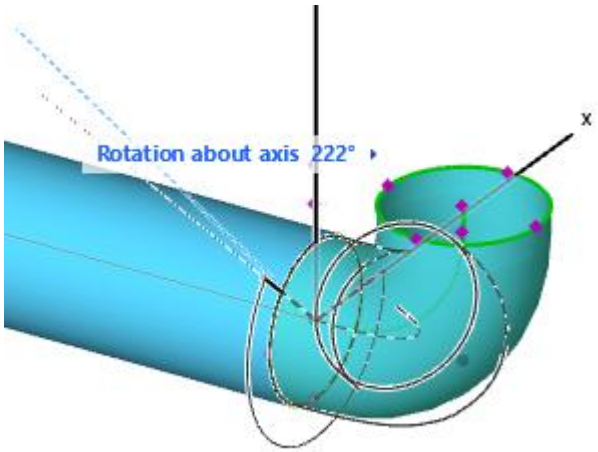
The shape of the rotated Bend is incorrect, intersecting itself (the rotation does not modify the Bend radius):

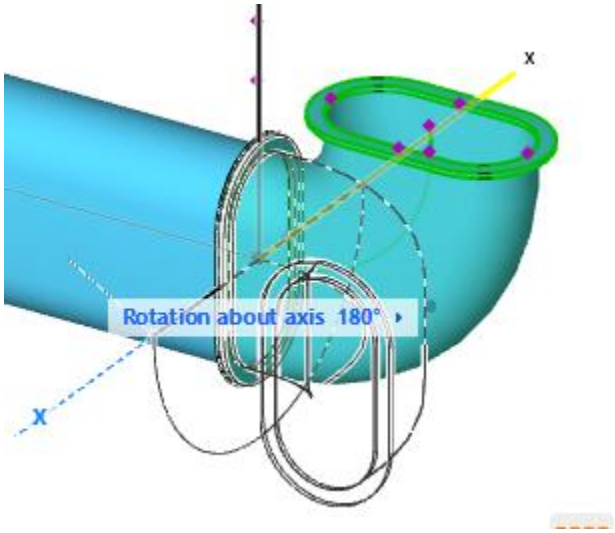


Rotation is an additional possibility; the Bend can be set into the correct direction originally when snapping it. You can set current Bend radius at the User Interface to 400, and the geometry will be flawless:



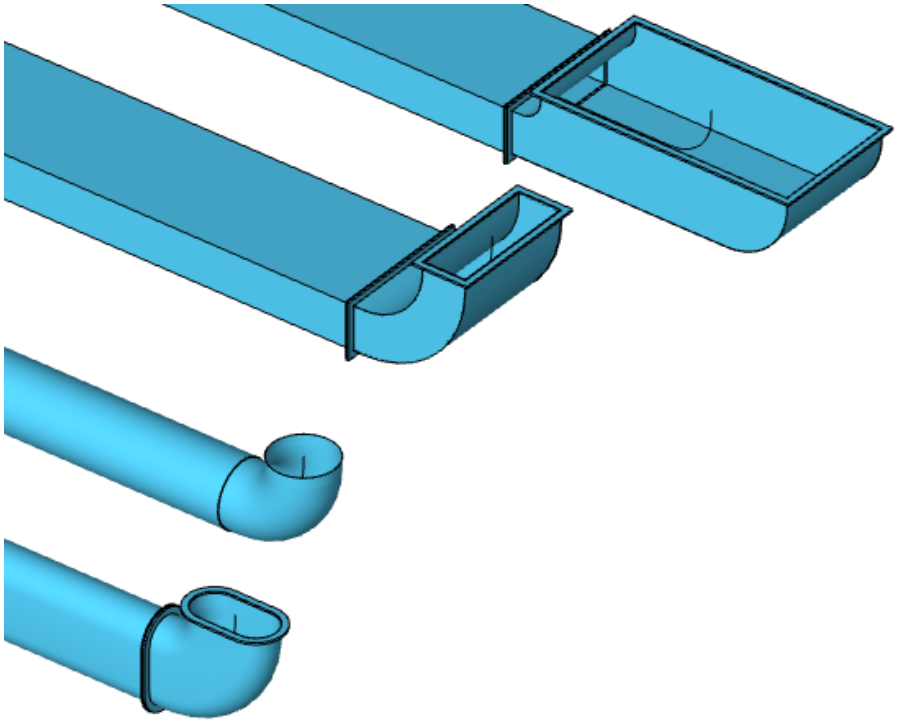
7. Discover, that you can rotate the Bend with circular cross-section to any angle, and the rotation of an oval Bend is similar to a rectangle Bend:



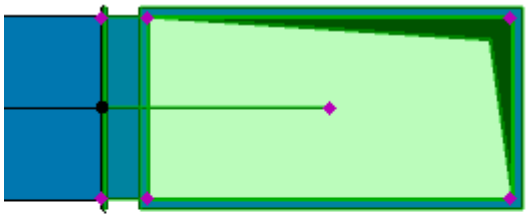


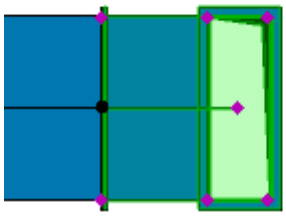
b) **Quick exercise – Hotspots on Floor Plan, in case of a rotated Bend**

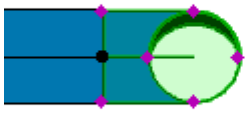
1. Set the Bends turning upwards and set all of them to 90 degrees:

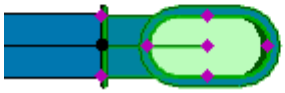


2. Discover on Floor Plan the operation of the Hotspots:



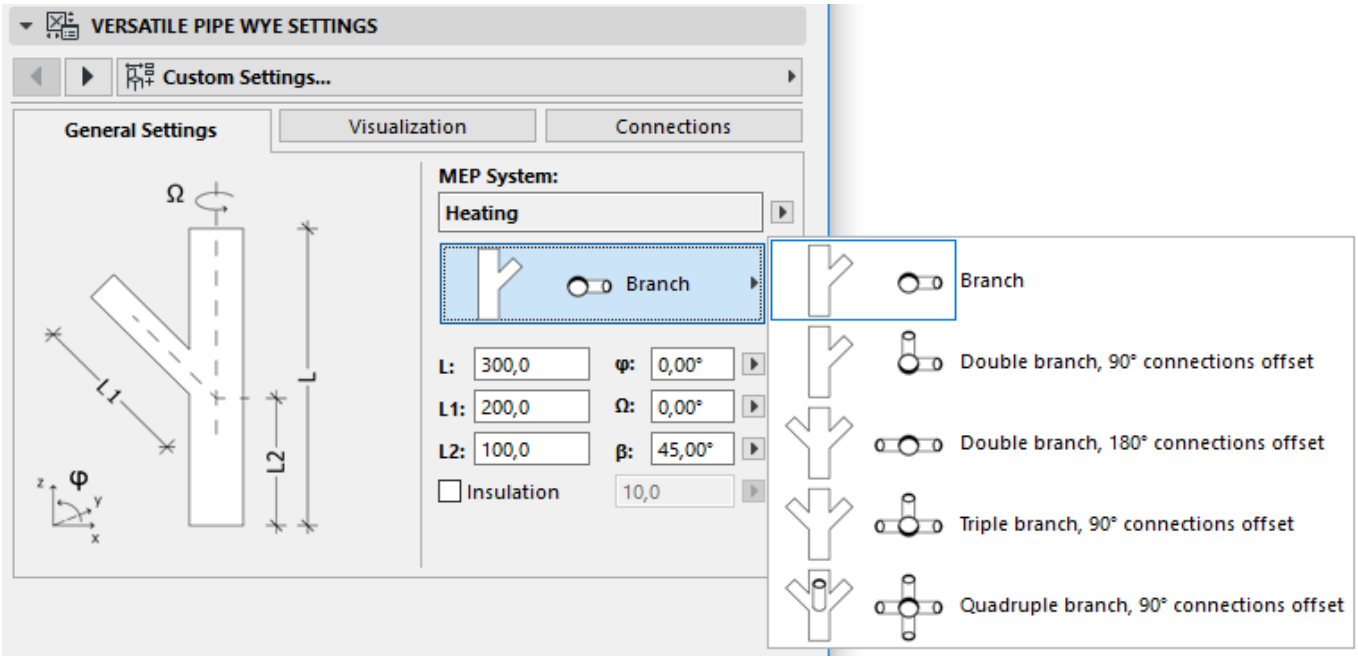






4. The “Versatile Pipe Wye” element

The “Versatile Pipe Wye” element was designed for Pipework with circular cross-section, to model Y branching. A main pipe can have 1-4 branches, and all of the data of the branches are the same (branch angle, length, cross-section size, connection type). You cannot set the number of branches directly, but you can choose the Y branch type, available at the User Interface:



The branches can be 90 or 180 degrees from each other – but Rotation about axis is possible.

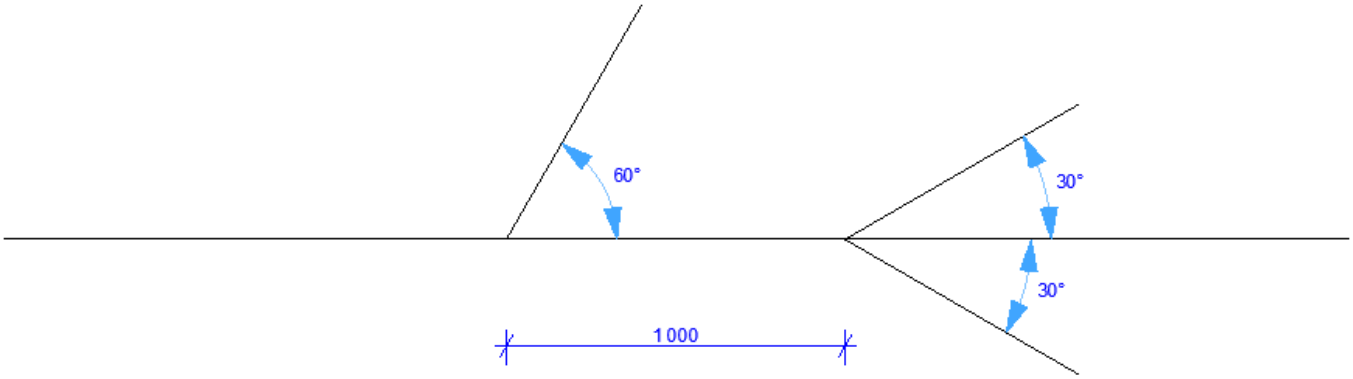
The “Versatile Pipe Wye” element can be placed into the model with following methods:

- simple placement,
- snapping to an existing cross-section,
- placing into an existing duct.

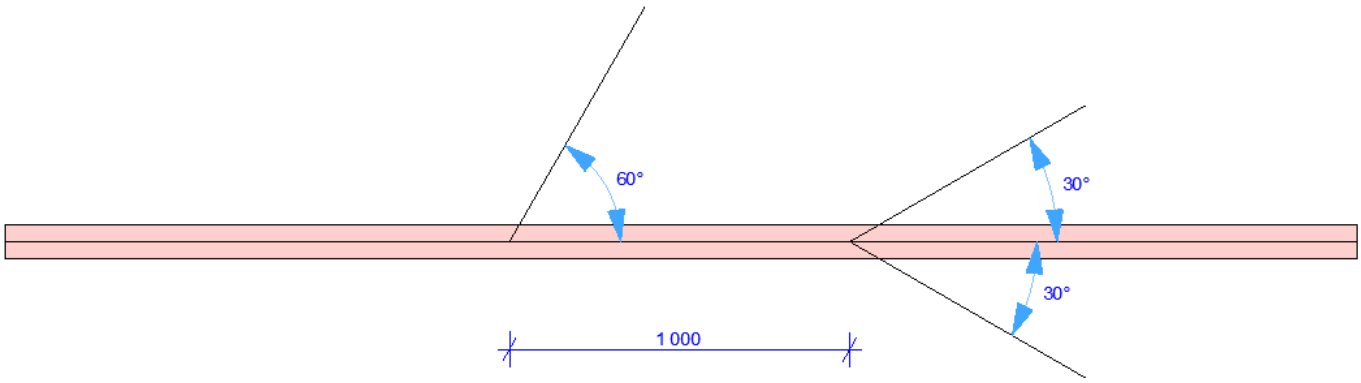
We can easily learn the simple placement, based on what we have learned at the Duct elements. Probably the element will be placed into the model by placing it into a pipe, therefore we present this method during an exercise, how to place it into the model, and after this we explain, how to snap to a cross-section.

4.1 Quick exercise – Placing into an existing pipe

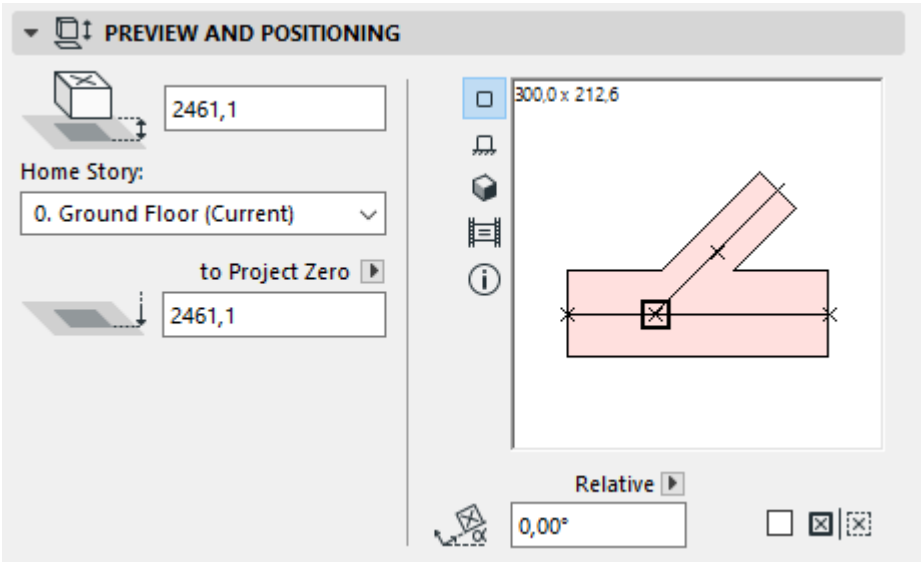
1. Create the following layout on the Floor Plan from lines:



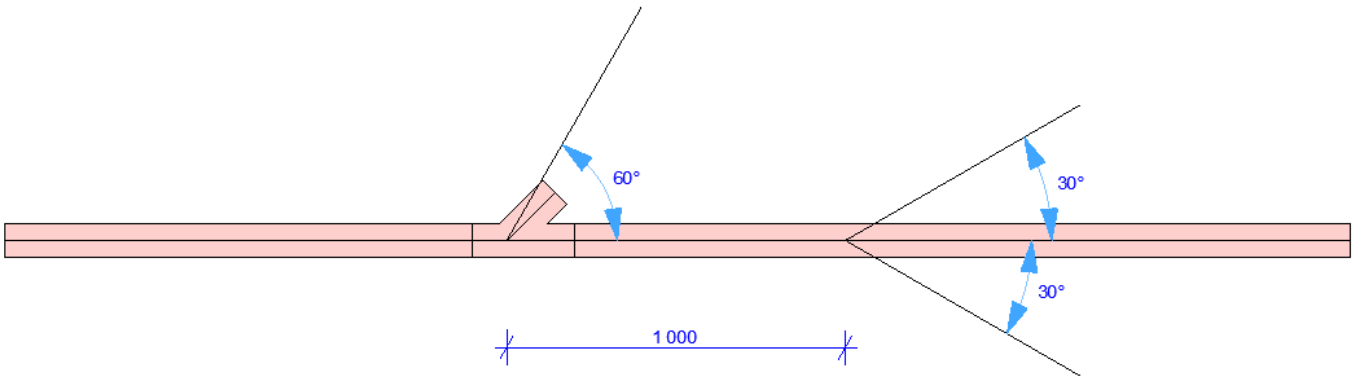
2. Place a Pipe Straight element with 100 mm diameter on the line that represents the main pipe:



3. Choose the intersection point of the centerlines of the "Versatile Pipe Wye" element with Default Settings:

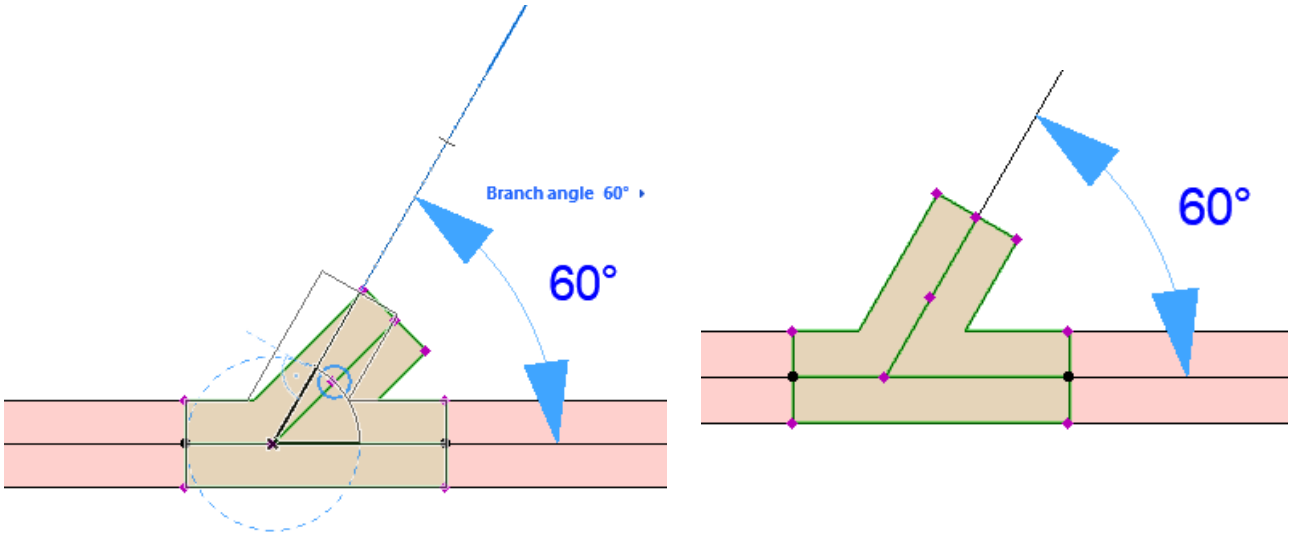


4. Place the Y Wye into the pipe to the left branch, and set the appropriate direction:

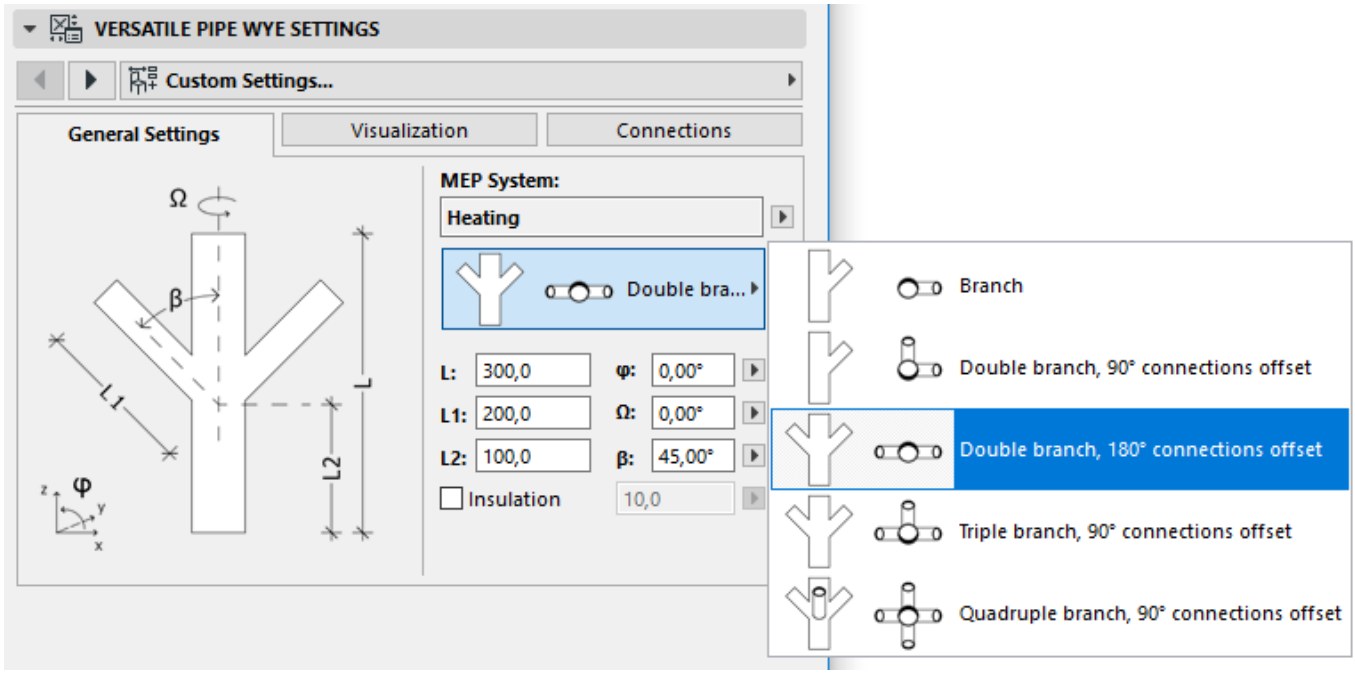


Observe, that the diameter of the Branch became the same as of the main pipe (you can modify this after placing it).

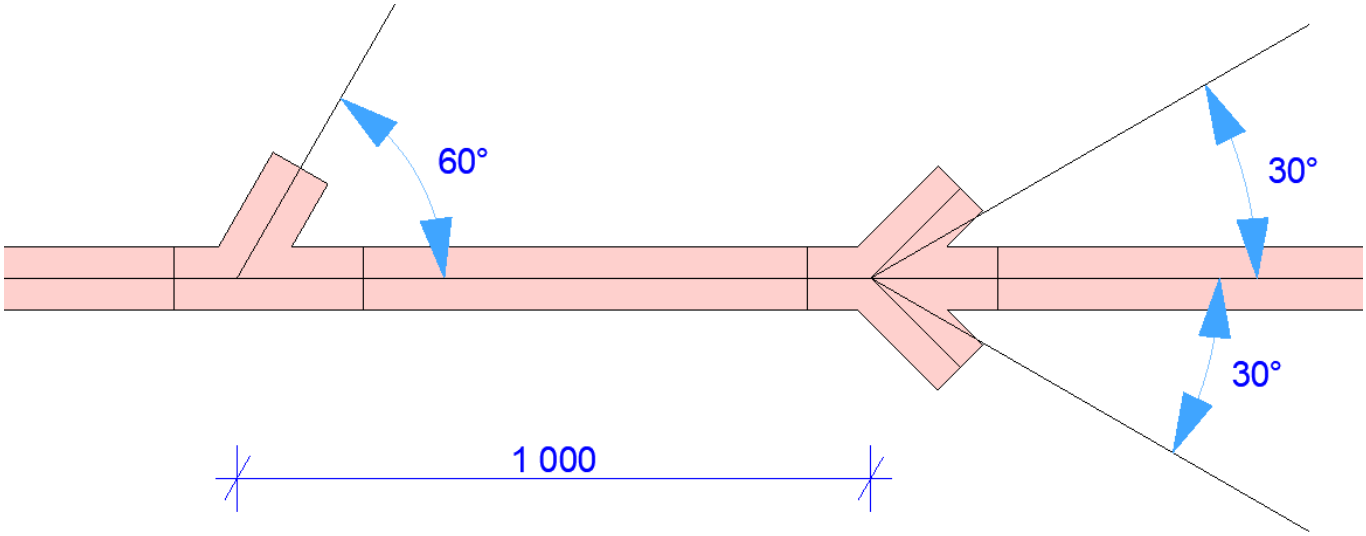
5. Select the Y Wye and rotate the branch, using the Hotspot that you can find in the middle of the branch, snapping the branch to the line which represents it:



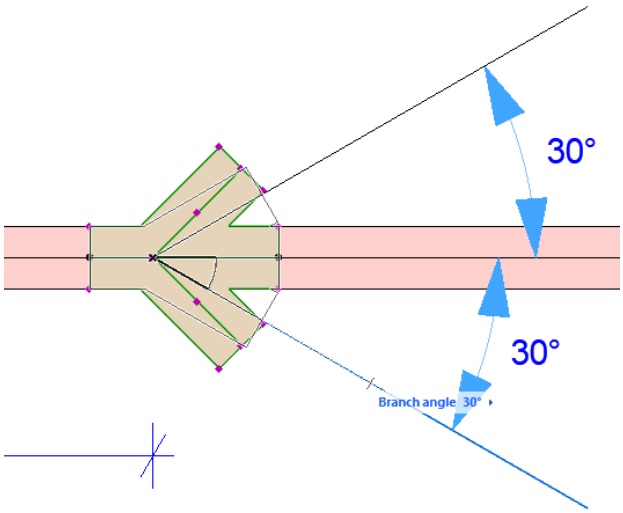
6. You can modify the length and the diameter of the Y Branch with the Hotspots, try these. Deselect the elements and select a "Double branch, 180° connection offset" type in the Settings Window:

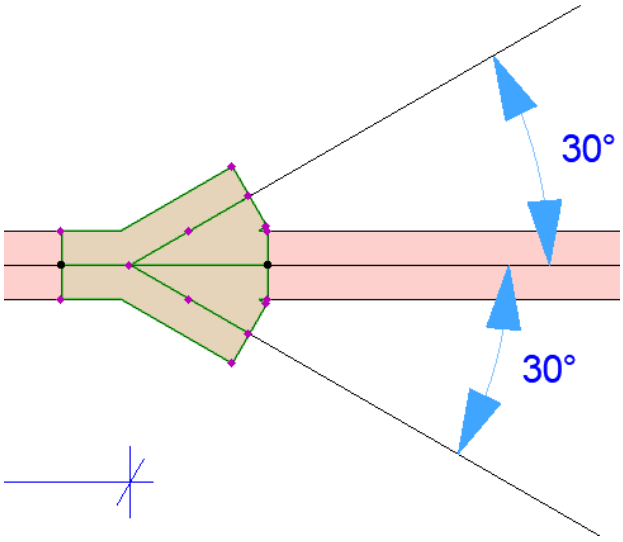


7. Place this Y Branch, by the intersecting point of the centerlines, to the right crossing point:

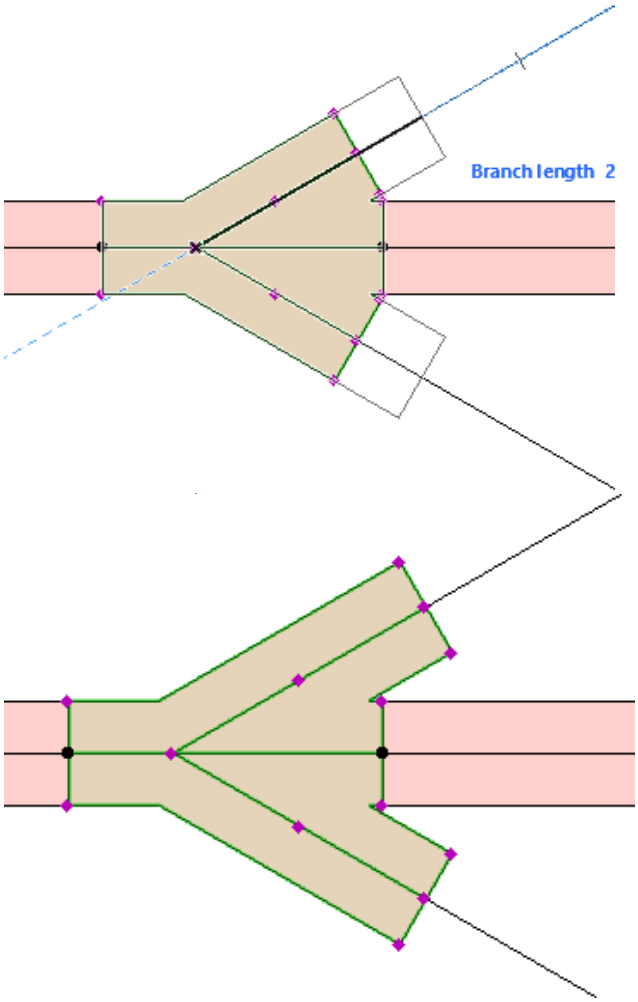


8. Select the element and modify the angle of the branches with the already known Hotspot and method (on any of the branches), and snap the branch to the line which represents it:



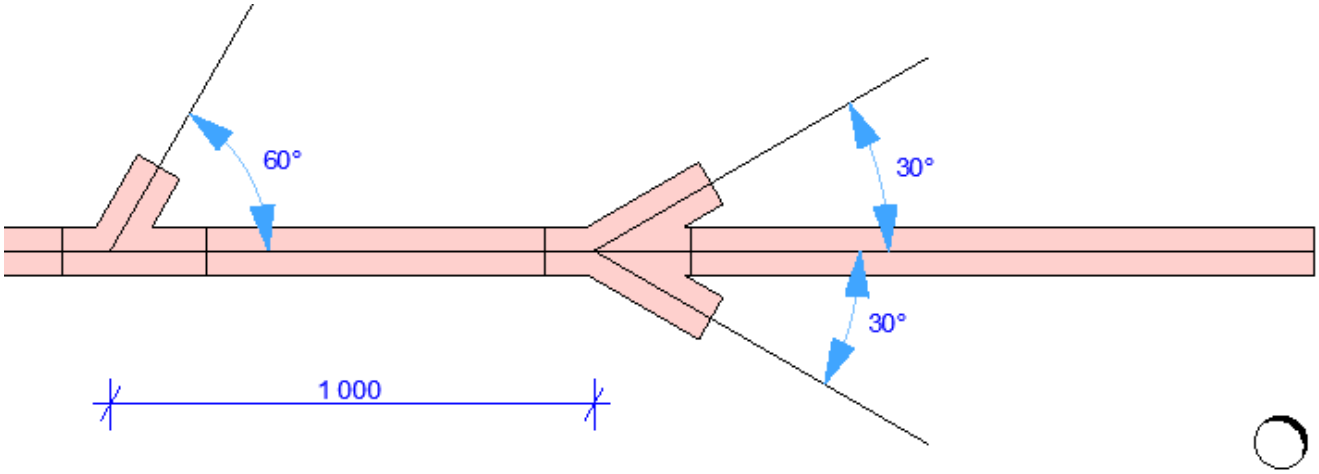


9. Slightly lengthen any of the branches, you can experience this way, that the branches operate the same way:

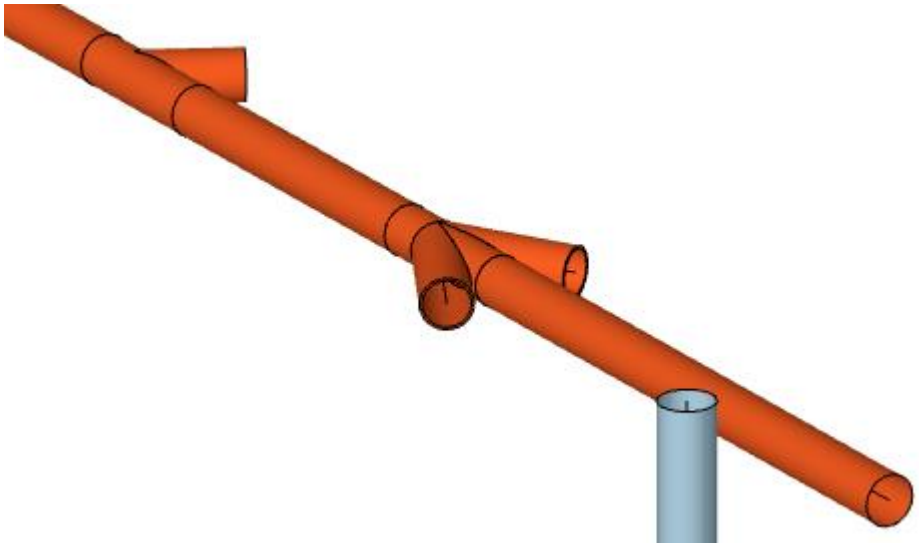


4.2 Quick exercise – Snapping & other operations

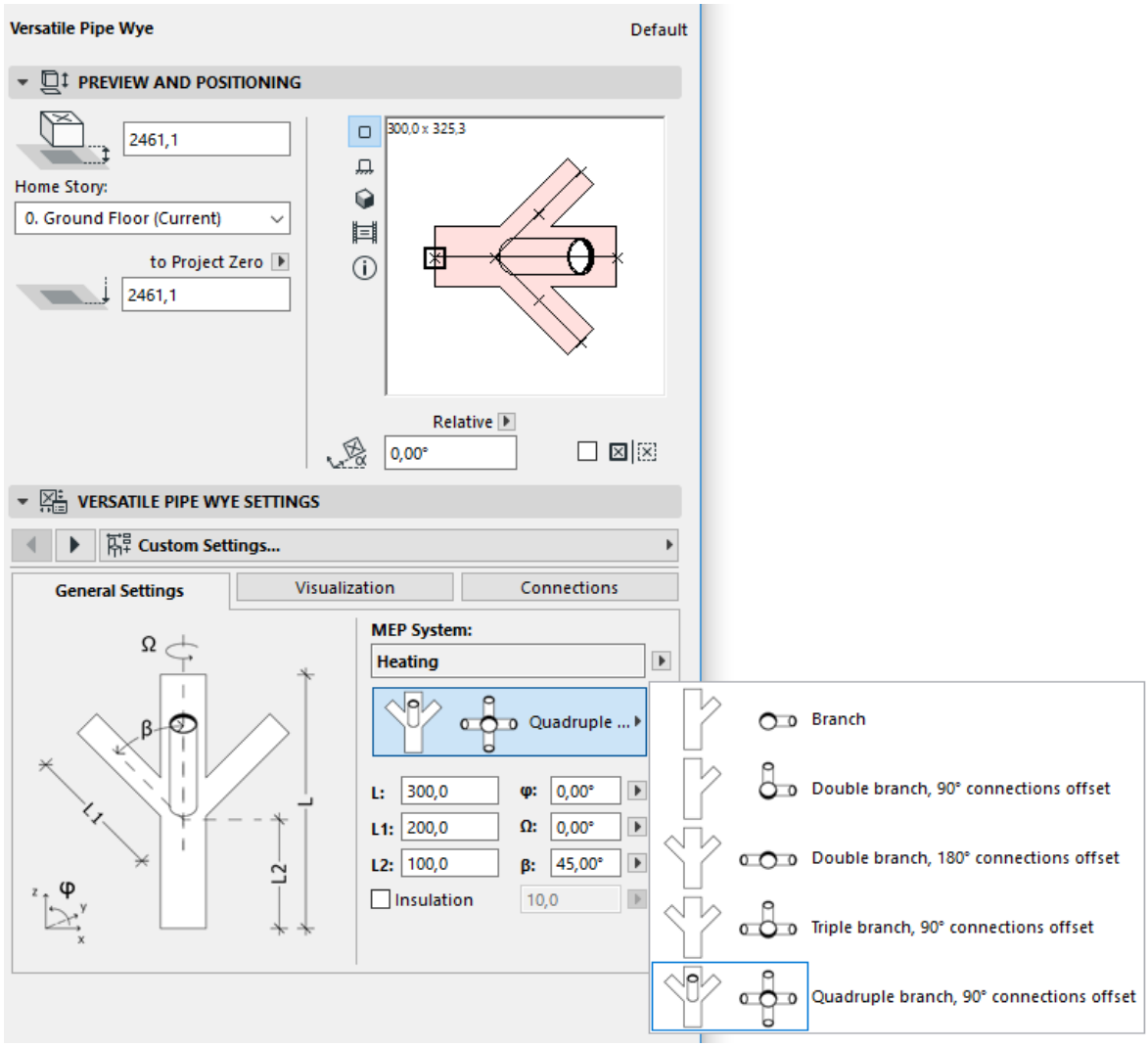
1. Place a vertical Pipe Straight into the Plan:



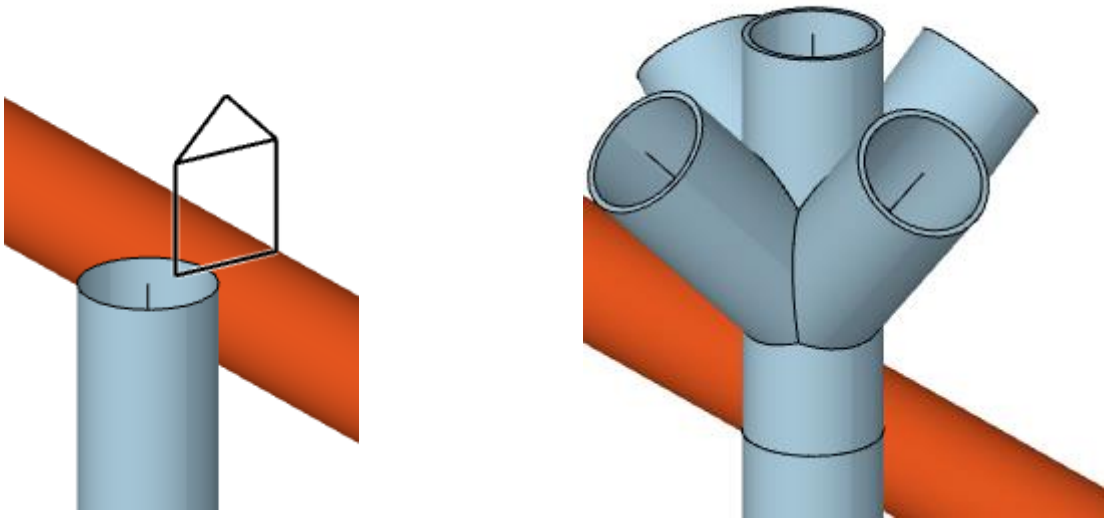
2. Select all elements that you can see here, and have a look at them in 3D:



3. Select the initial point of the Y Wye in its Settings Window and select the "Quadruple branch, 90° connections offset" type, this is a very rarely used shape anyway ☺

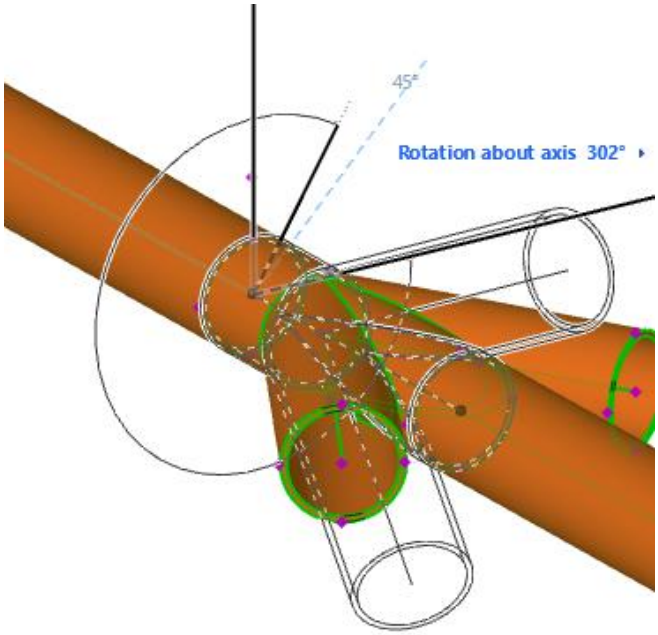


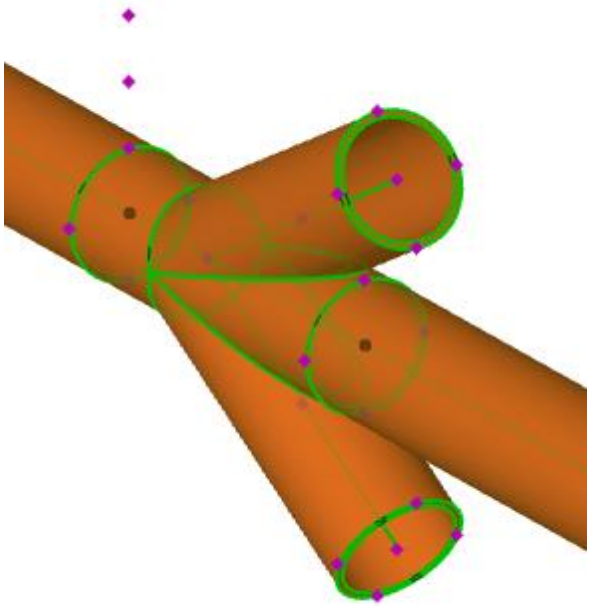
4. Place the element on top of the vertical pipe:



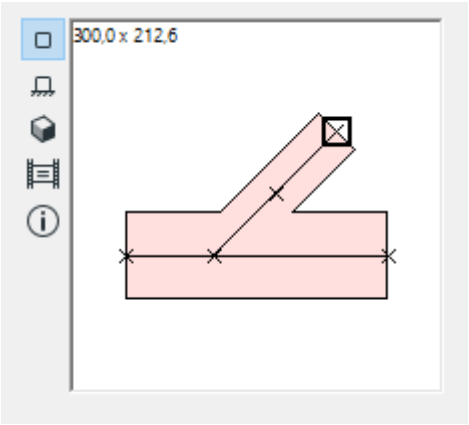
Select the element and try its Hotspots, practice how to use the element.

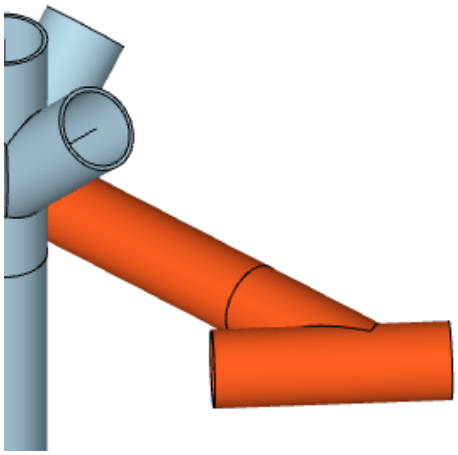
5. Now select the element on the horizontal pipe that has two branches, and rotate it with the Hotspot that you can find in the branch's plane to the value of 270°:



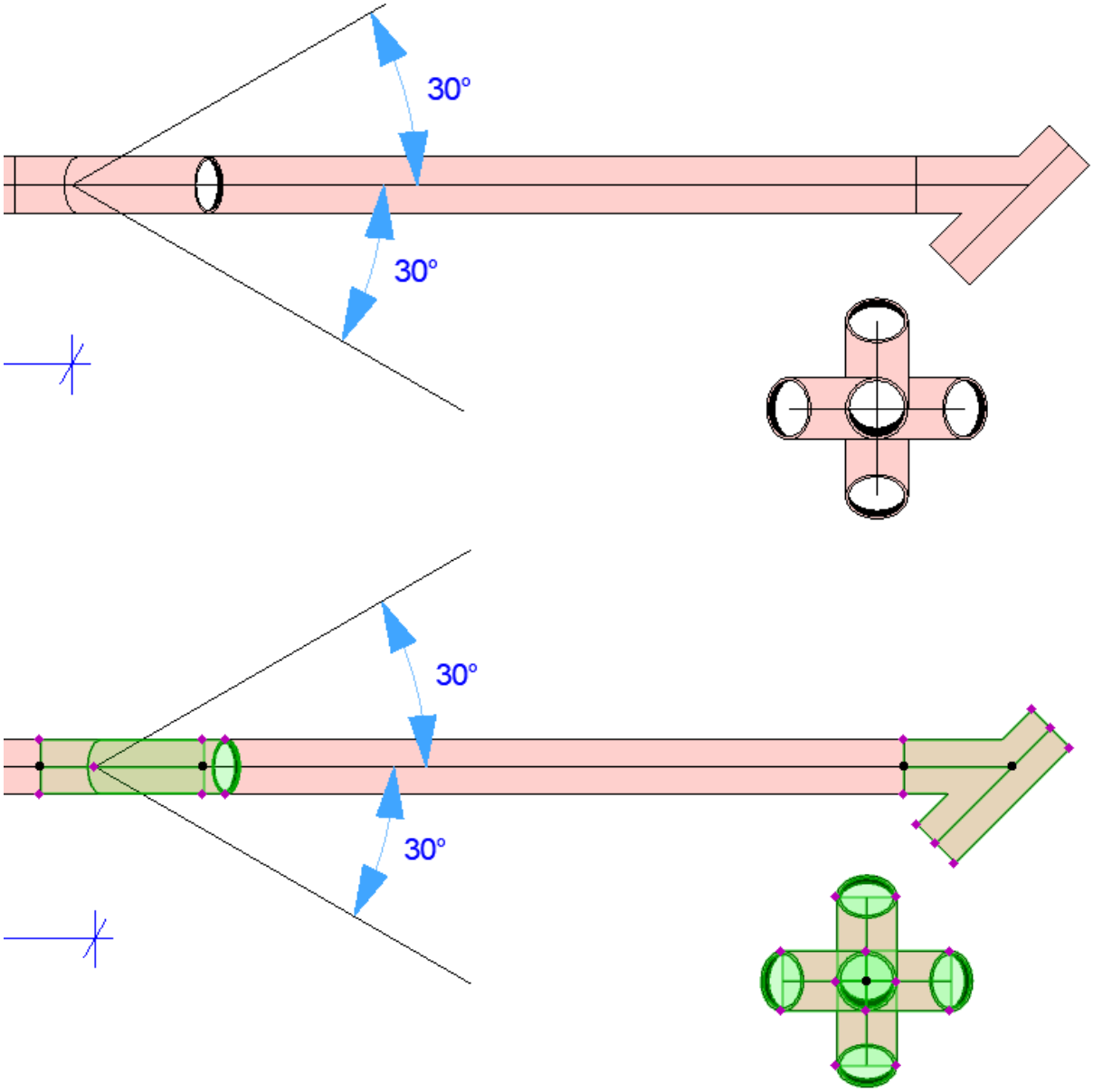


6. Snap a Y Wye, of which you have set the branch point active in the Settings Window – just to practice – to the end of the horizontal pipe:





7. Go back to the Floor Plan, select the 3 elements concerned, try their Hotspots, and get experience, how to use the vertical element in Floor Plan as well:



4.3 Use of the MEP Routing

We do not recommend this. Theoretically you can start from an existing pipe and arrive into it with Routing, but the angle of the connection is not transferred to the element, and this way unwanted parts can emerge and with the connection in wrong place. You can avoid all of this by setting the connection angle of the Y Wye in advance – if this is successful, then the Routing is successful as well. But this requires in every case many – easily forgettable – pre-settings.

Instead, we recommend you to place the Y Wye in the correct position, set the connection angle and the branch length with the Hotspots, and continue editing the route.

4.4 Sloped position

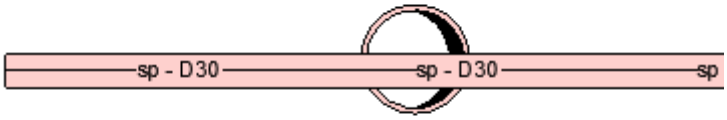
In many cases, it is necessary to use this element in sloped pipes. The element supports this, and is used for adjusting the projected length on Floor Plan with a Hotspot. Without presenting the practice – if you will probably need to model a sloped pipe system –, try the operation of the element in a sloped position. Often you have to snap the end of the profile to a point or a line on Floor Plan – projected stretching will be useful in these situations.

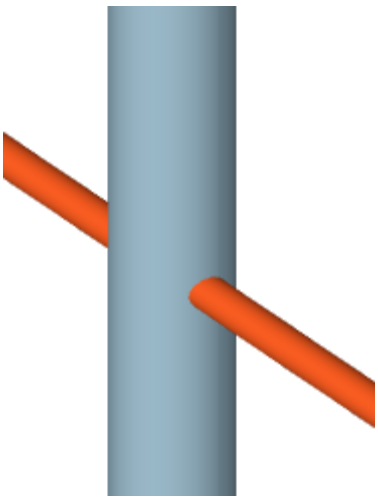
5. The “Versatile Bypass Pipe” element

With this element, pipe crossing can be solved easily. The basic function of this element is to solve problems, therefore in most cases it is placed into the model inside an existing pipe – but of course you can snap its cross-section to a pipe’s cross-section as well.

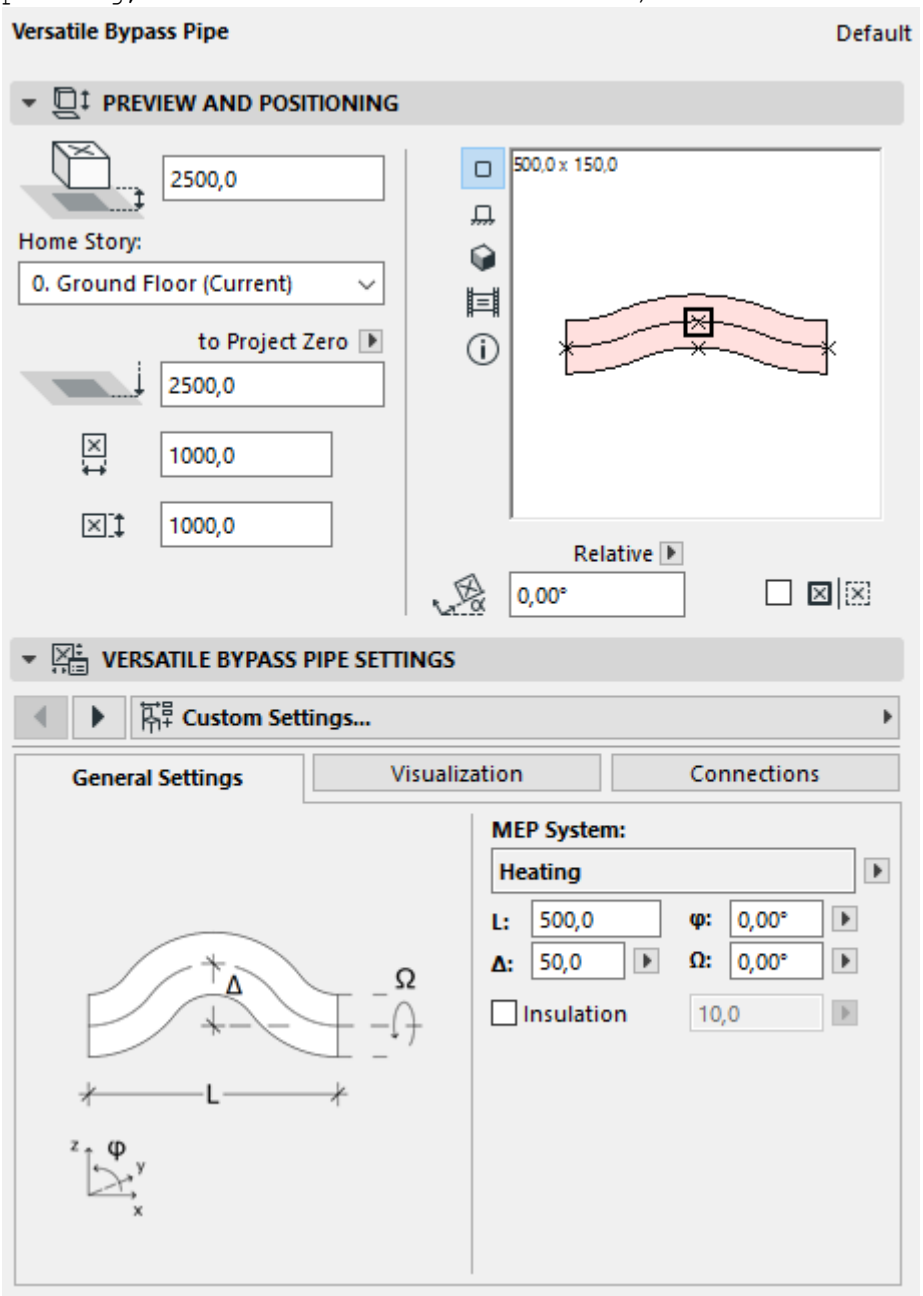
5.1 Quick exercise – Presenting the Bypass

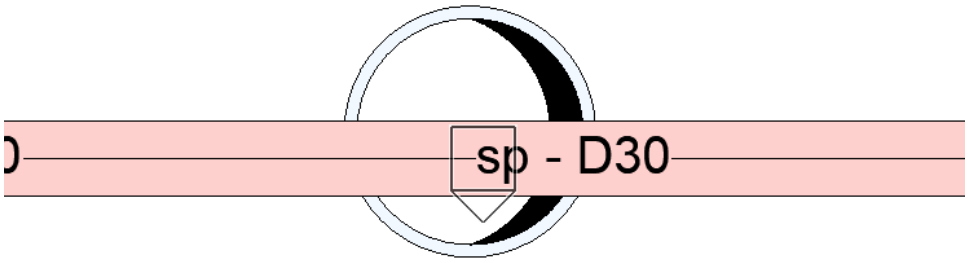
1. Create the following problem (the vertical pipe is 110, the horizontal 30):



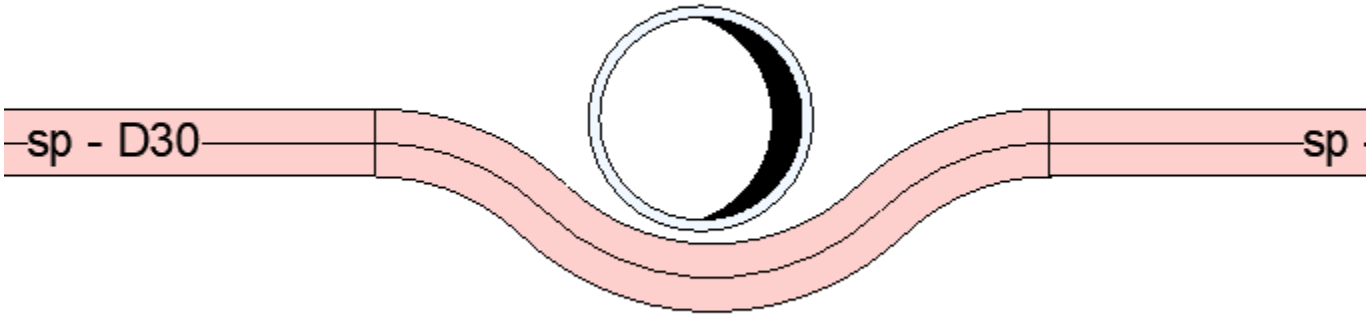


2. Choose the "Versatile Bypass Pipe" element's centerline point in the Settings Window (this is on the centerline), and on the Floor Plan place it into the horizontal pipe, approximately at the pipe-crossing (during placing, choose the "down" direction):



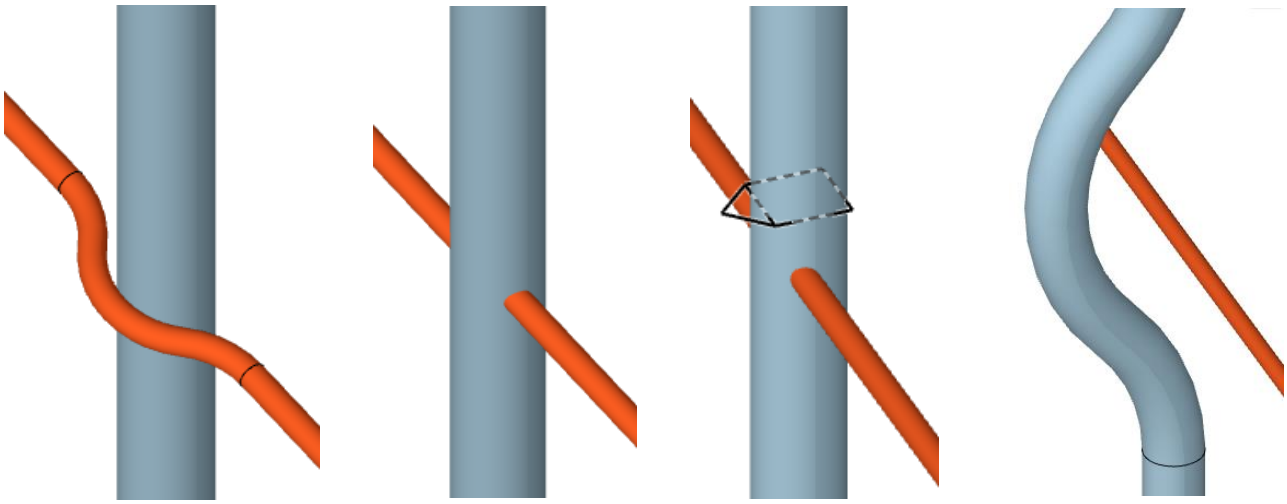


The created Bypass looks like this:

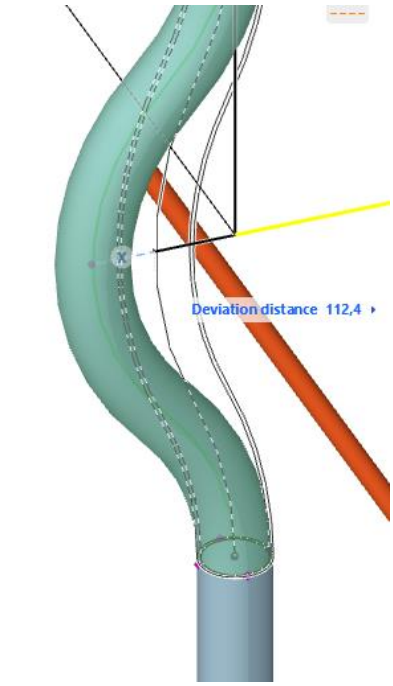


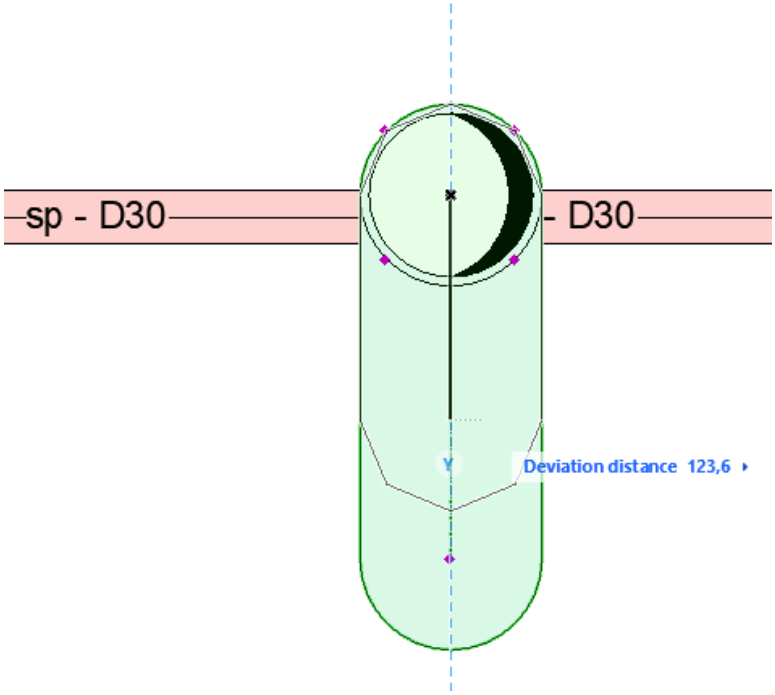
Observe the parameter values of the element in the Settings Window: the Deviation distance and length of the Bypass derives from the diameter of the pipe. By selecting the element, you can adjust the Deviation distance with a Hotspot.

3. After having a look at the Bypass in 3D, Undo placing the element into a pipe, remain in 3D, and now place the Bypass element into the vertical pipe approximately at the crossing:



You can have a look again at the Deviation distance in the Settings Window – which you can adjust in 3D and on Floor Plan as well:





The element supports the use in sloped position, you can adjust the projected length in such case – although there are only a few cases when the Bypass element is a free – not connected – cross-section.