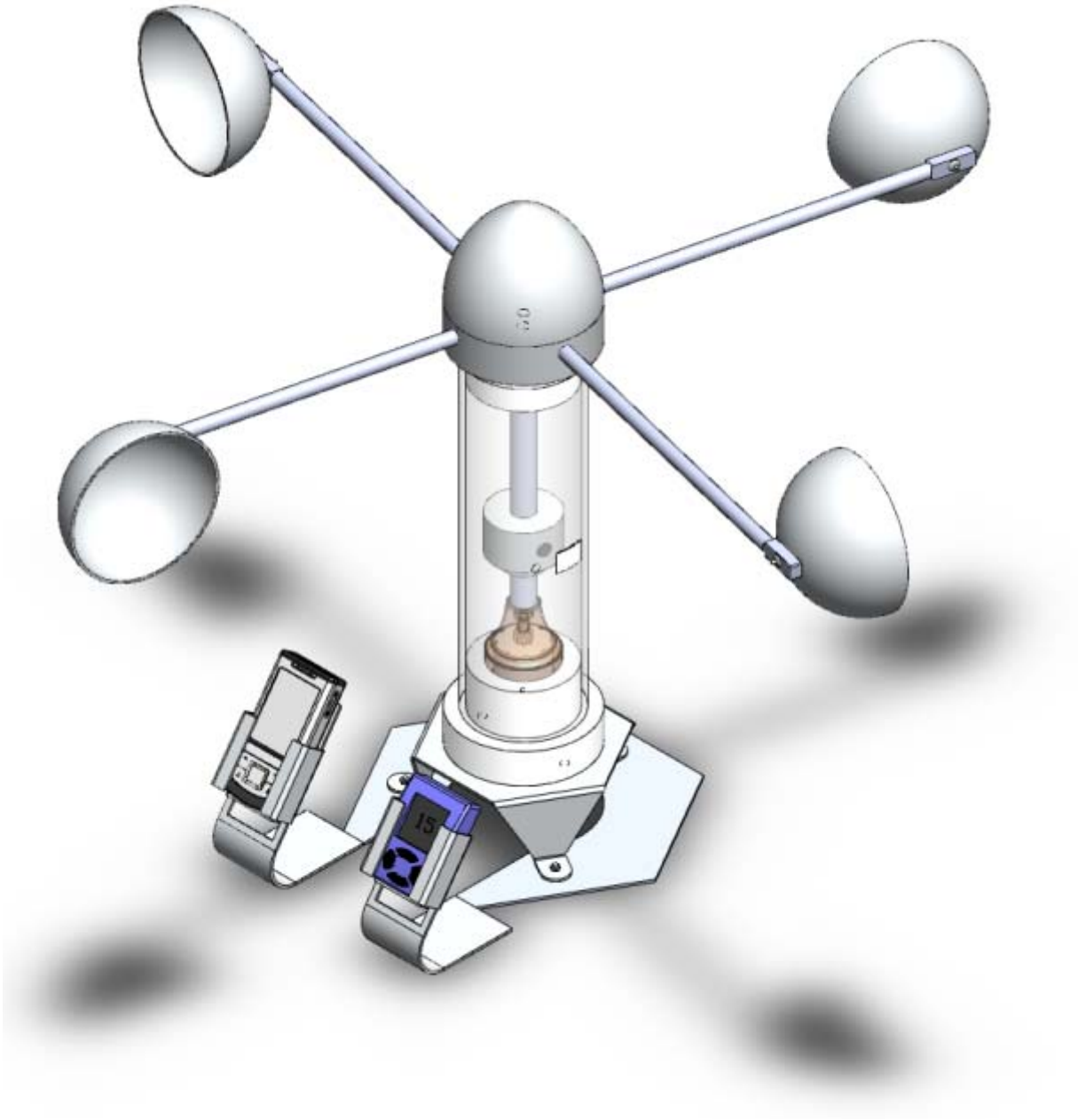
SolidWorks® tutorial 13-12
“Exciting”



Pre-vocational Secondary Education
and Senior Secondary Vocational Education

Stichting Consortium Beroepsonderwijs

SolidWorks

platform metaal & metalektro

For use with SolidWorks® Educational Release 2009-2010

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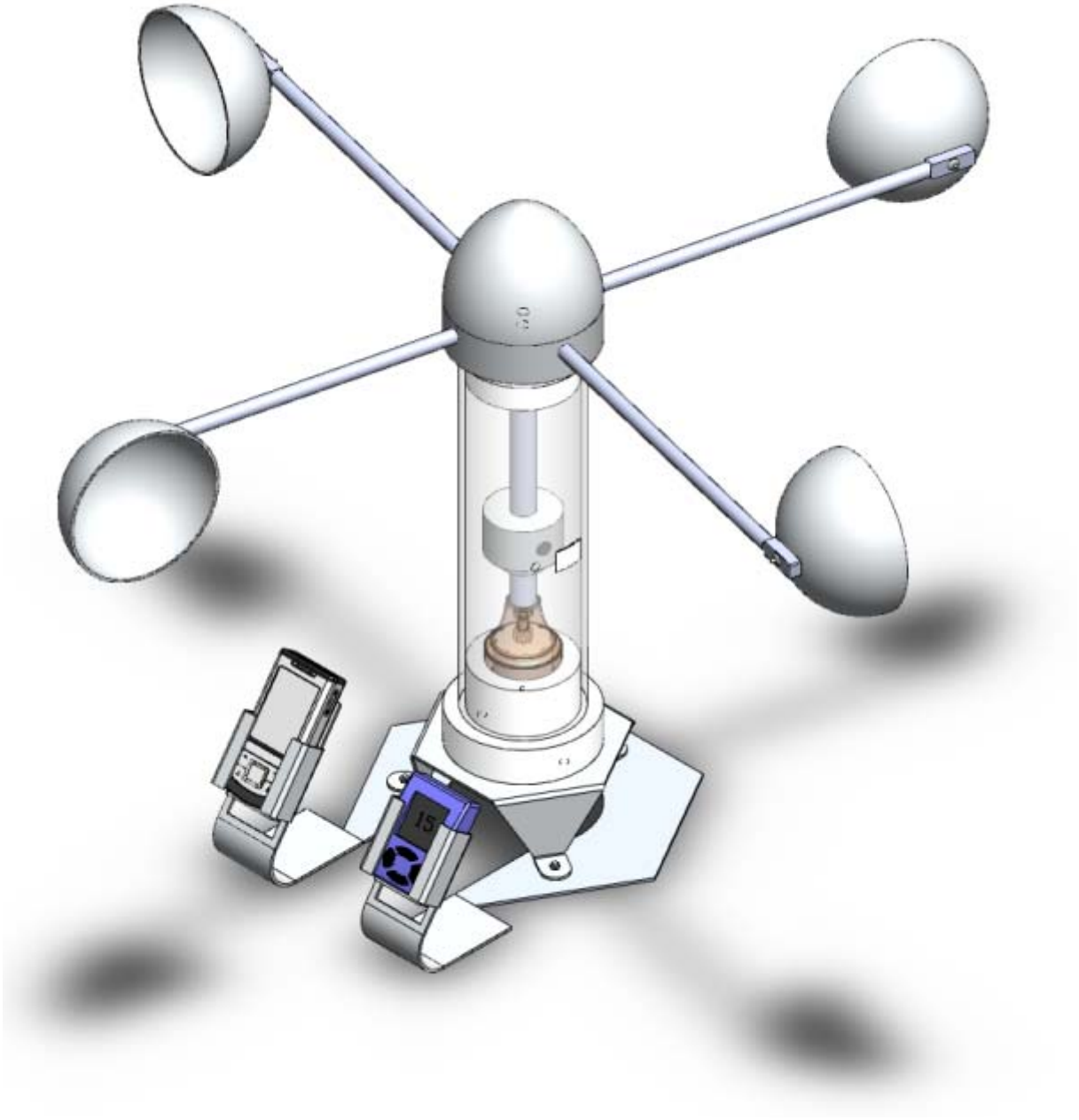
Adaptation to the educational level: Jack van den Broek (Technical school Dr. Knippenberg).
Completed by: Nenad Raskovic

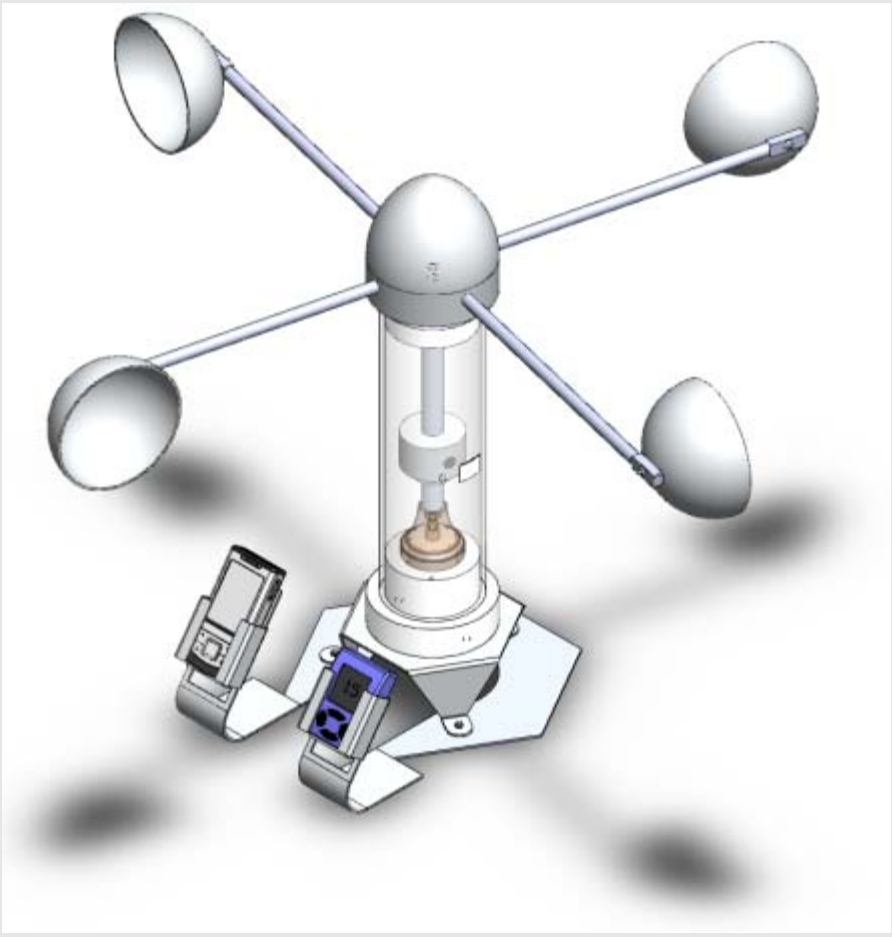
Tutorial 13-12
“Assembling a windmill”



Assembling a windmill

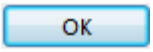
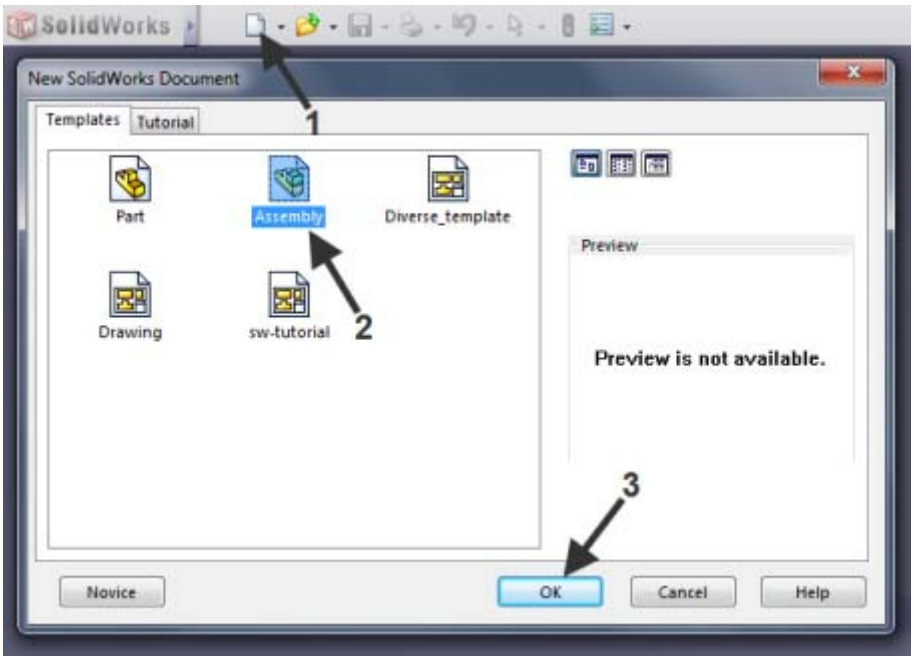
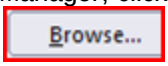
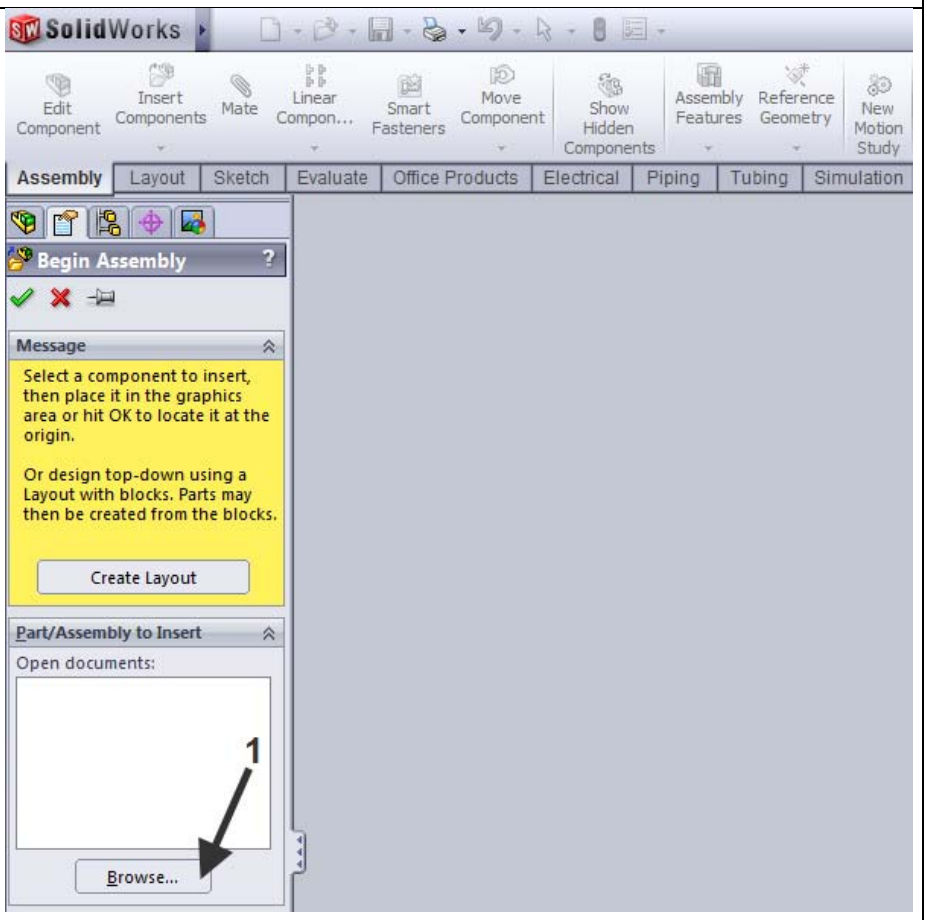
In this exercise, you will get acquainted with assembled products: Assemblies. Assemblies consist of all pieces you will have made in previous tutorials, together with a couple of pieces you will have to purchase. In this Tutorial, you will learn how to connect one piece to another,

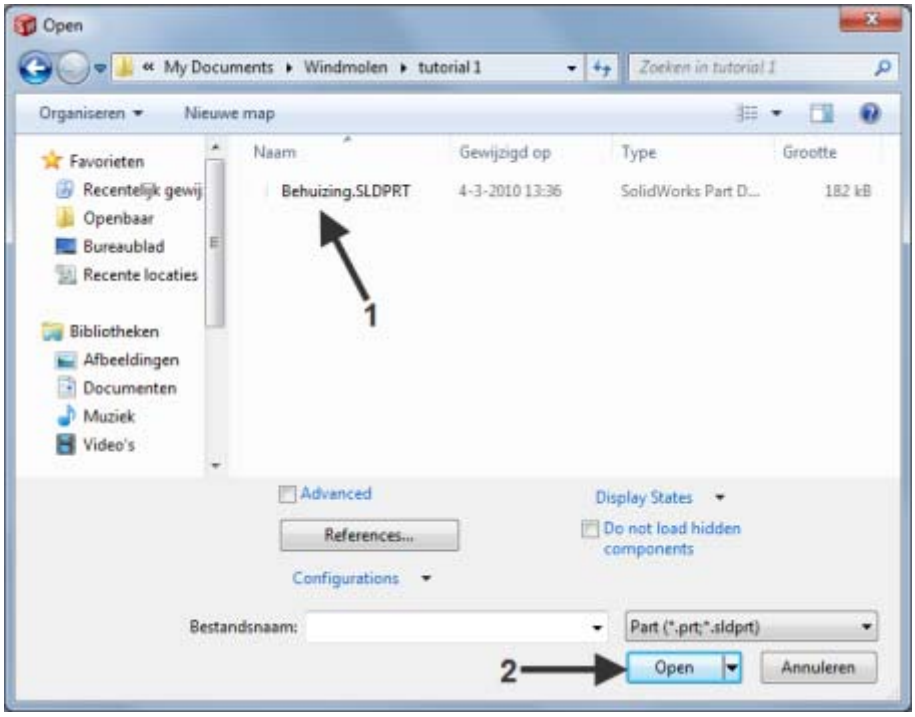
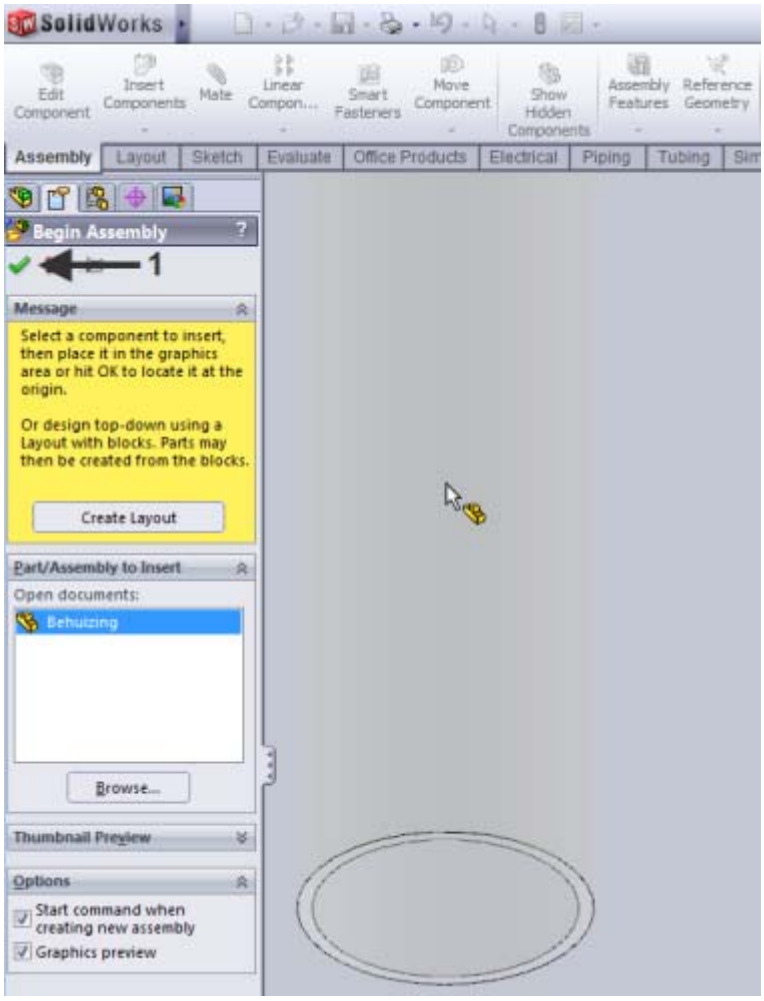
Work plan

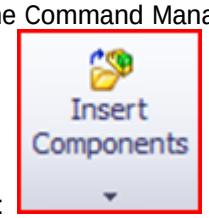
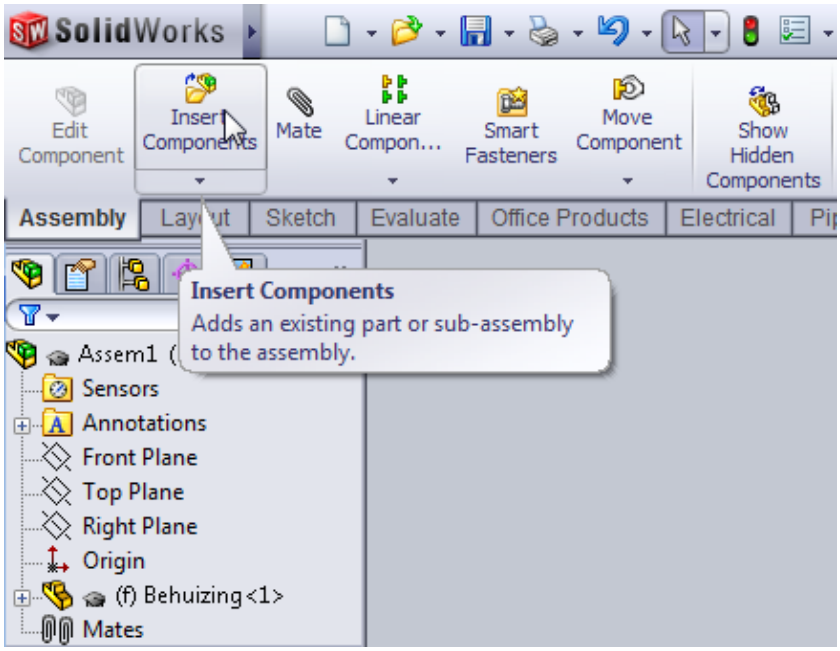
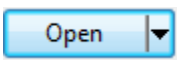
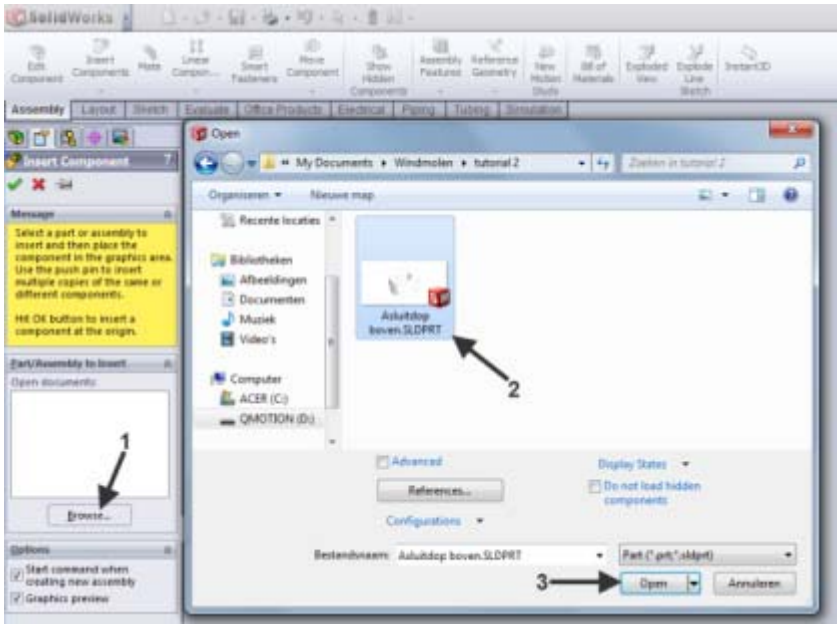


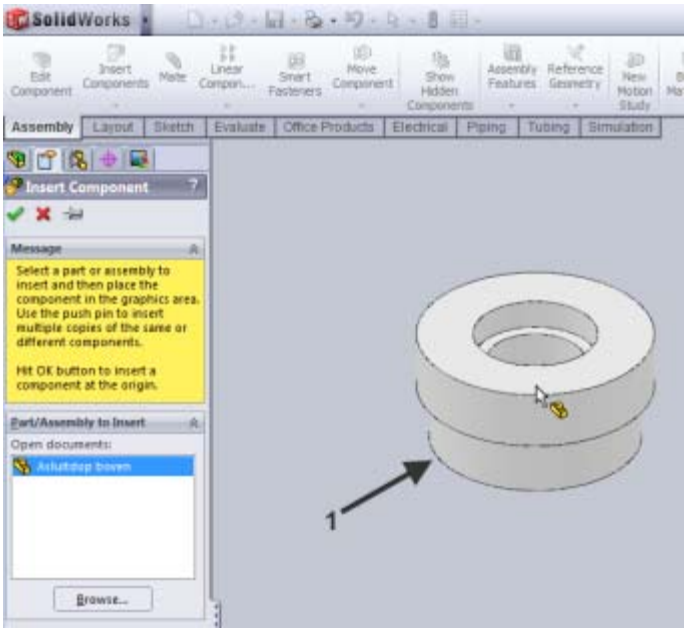
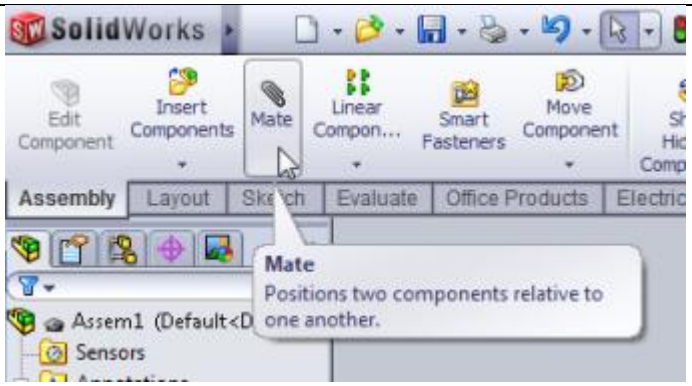
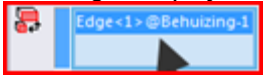
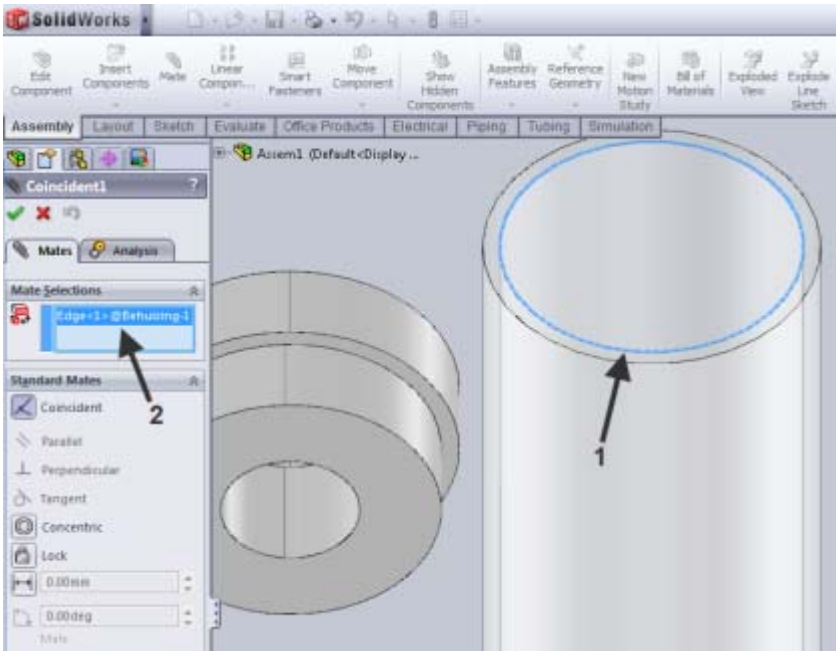
You will assemble a windmill. You will use pieces you have made yourself and pieces that have to be purchased.

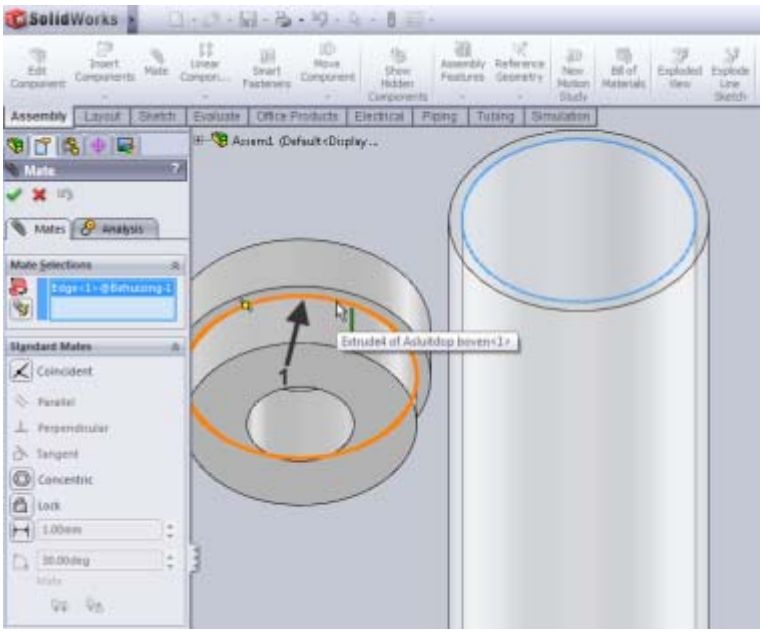
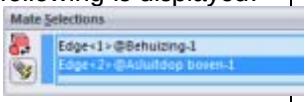
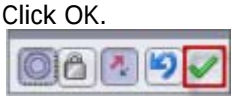
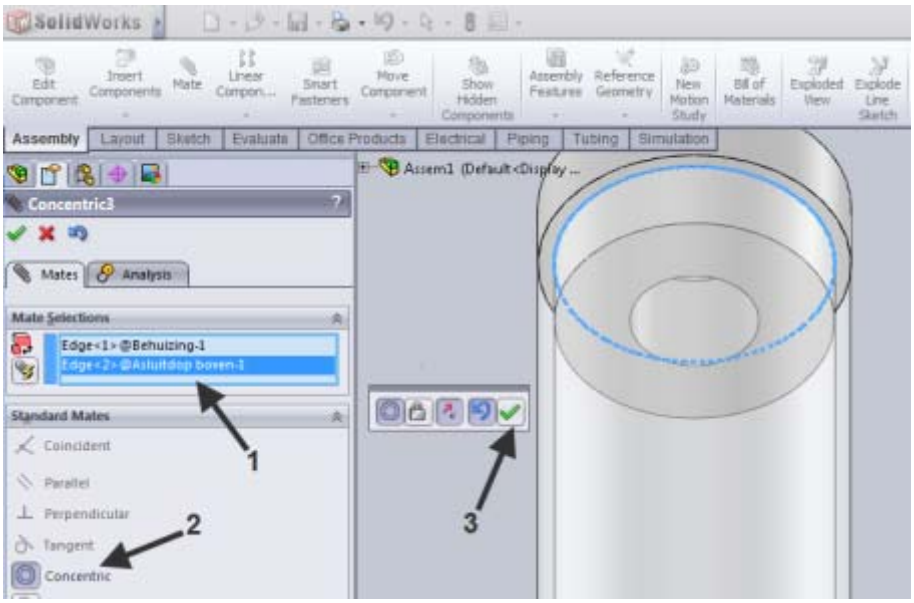
- First, you will learn how to bring pieces into the Assembly environment.
- Next, you will learn how to assemble the pieces (**mate**).
- You will learn how to use the **Toolbox**.

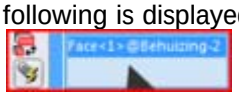
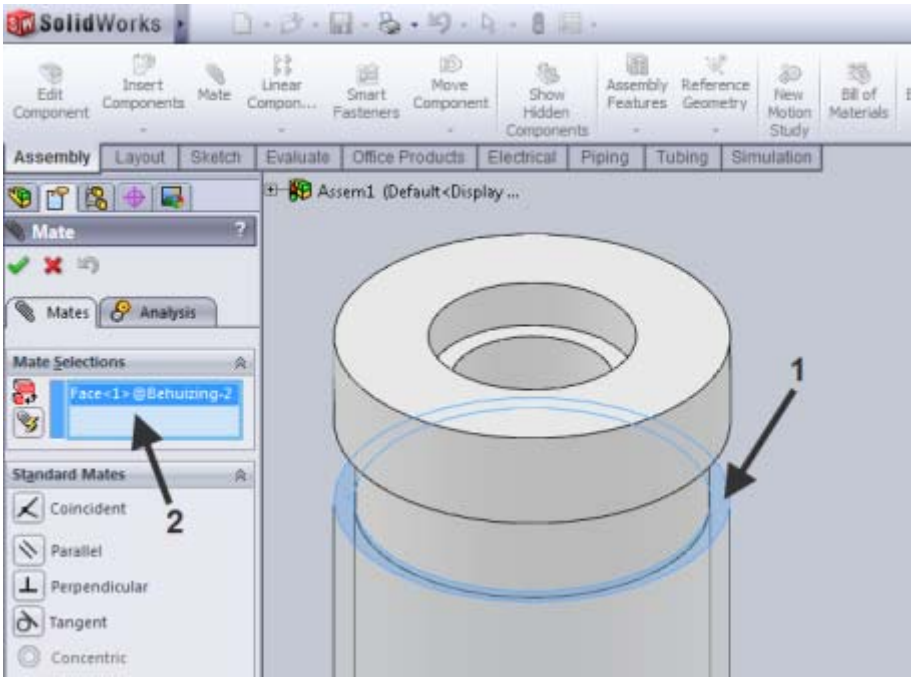
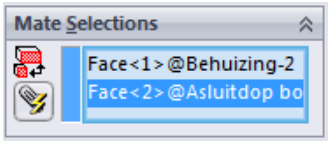
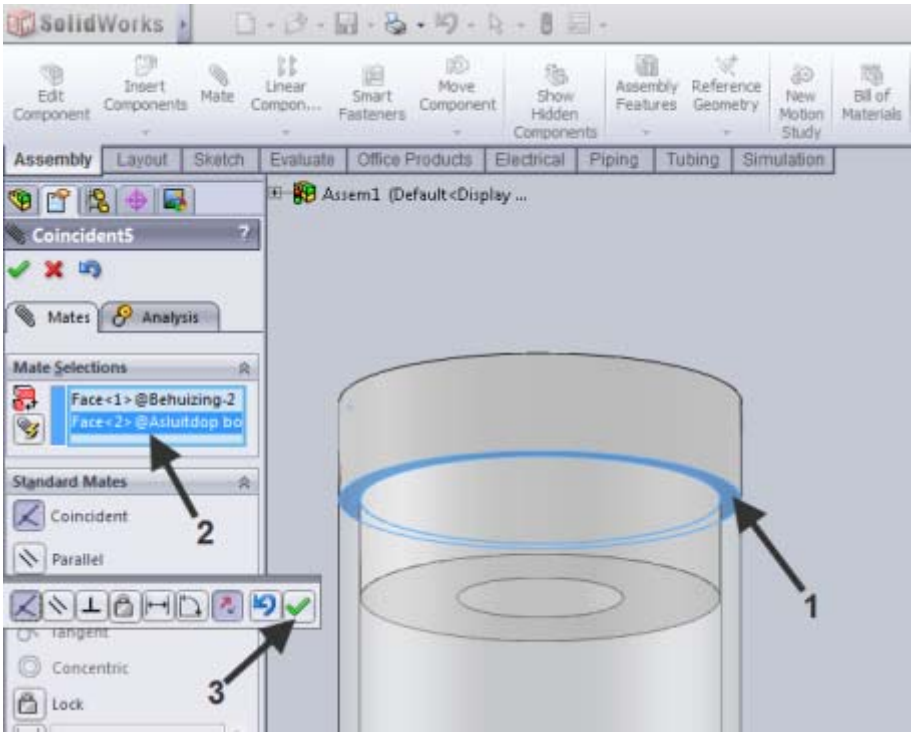
1	Launch SolidWorks.  **1.** In the menu bar, click New.  **2.** In the displayed menu, select: 'Assembly'.  **3.** Click OK.  	
2	A new menu appears. **1.** In the Property Manager, click:  Using this action button, search for the appropriate piece. We are looking for  The first piece we made. **Attention**: This step may work differently as described here. If so, read the instructions below.	

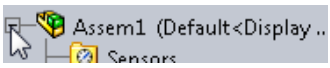
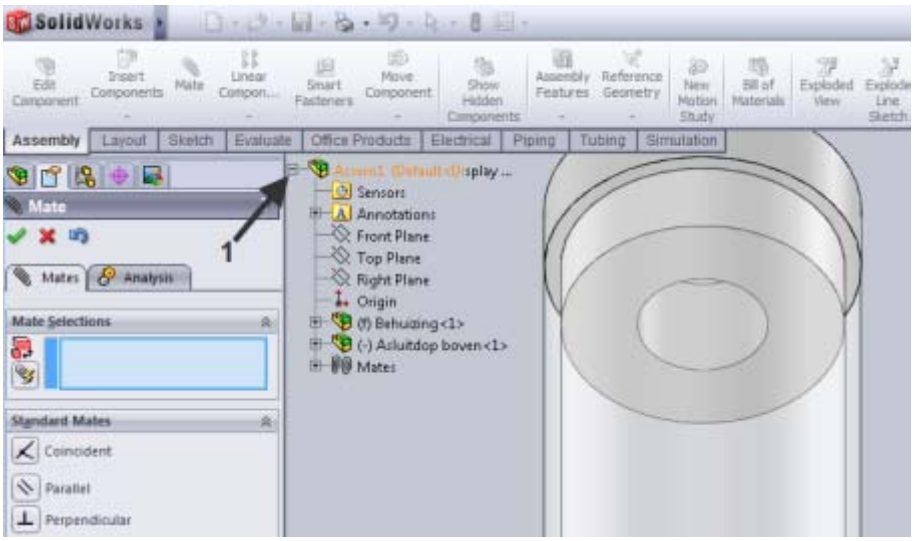
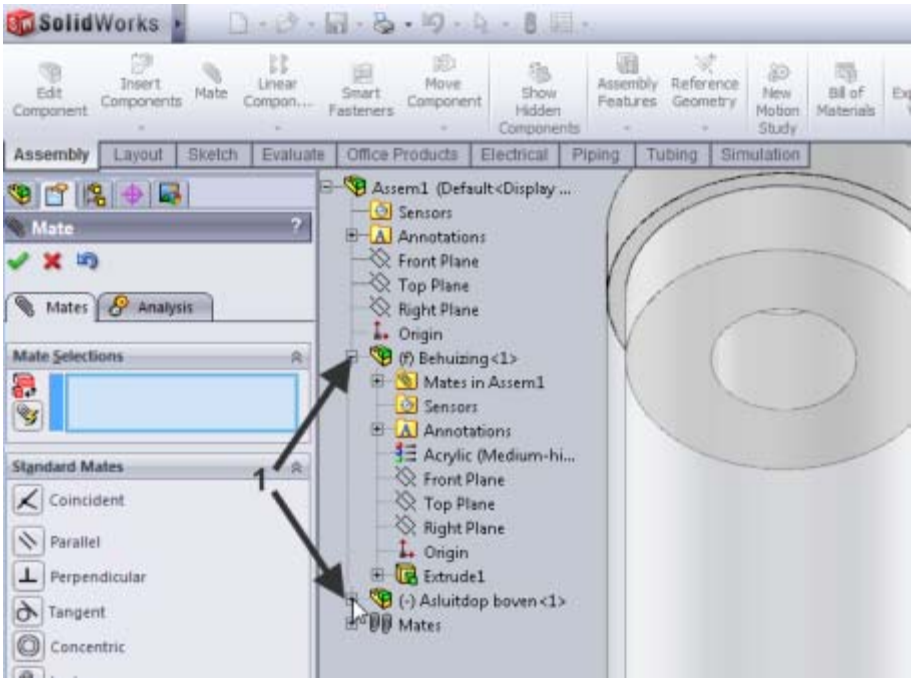
3	Go to the folder in which you saved your models. **1.** Select the model **Housing.SLDPRT**  **2.** Next, click Open 	
4	The piece is now hanging to the cursor.  **1.** Click OK:  to place the piece at the origin.  Placing the piece at the origin is very important for a correct assembly of the entire product.	

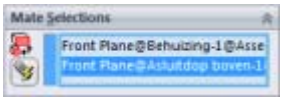
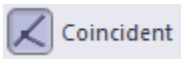
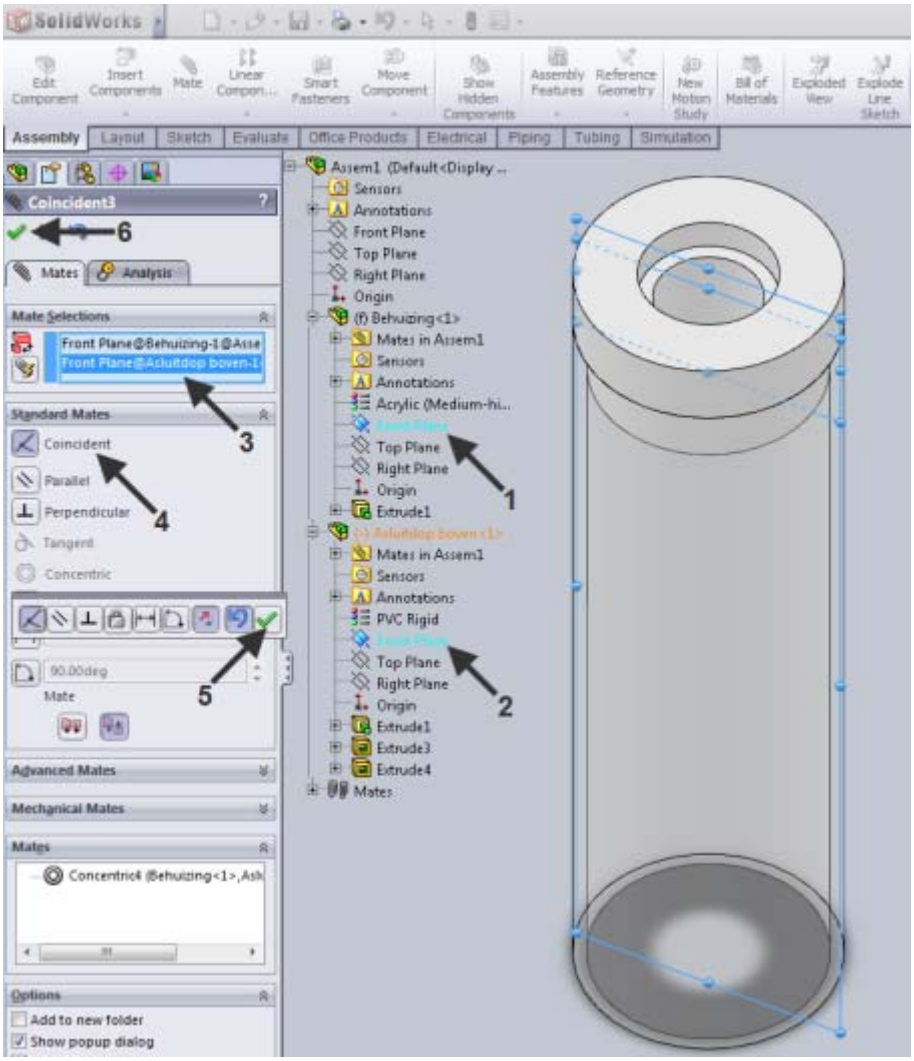
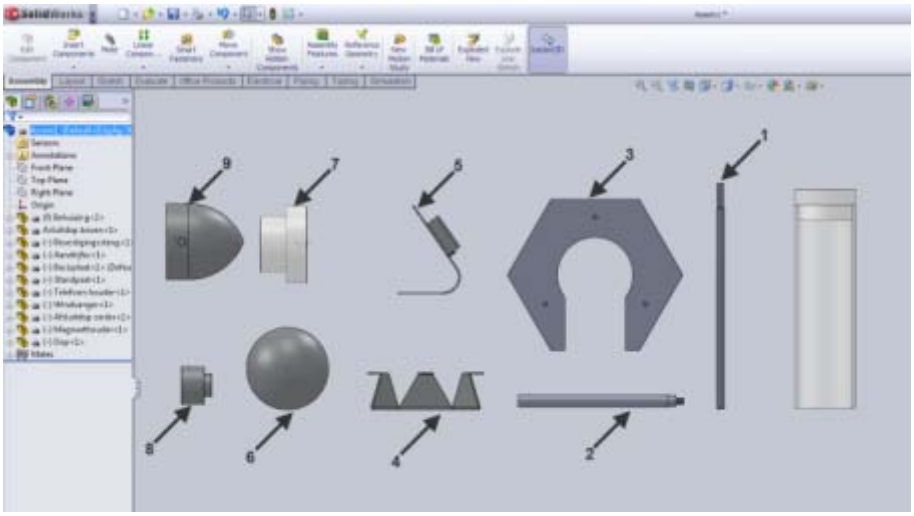
		In the next step, there will be a few things which might not work in the same way as described above. • If the left column is very different from the example above, the command 'Insert Components' did not start automatically. In that case, click 'Insert Components' in Command Manager. • If the pieces are on the list, you apparently had left it open. In that case too, click 'Browse' and start searching for the required document. (Housing), Next, you can simply put it in the assembly as we did above.
5	In the Command Manager, click:  to add the next piece to the Assembly.	
6	We will begin searching for the new piece in the file. **1.** Click:  **2.** Next, select the piece **Cap_Internal.SLDPRT**  **3.** Click Open 	

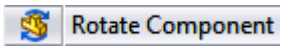
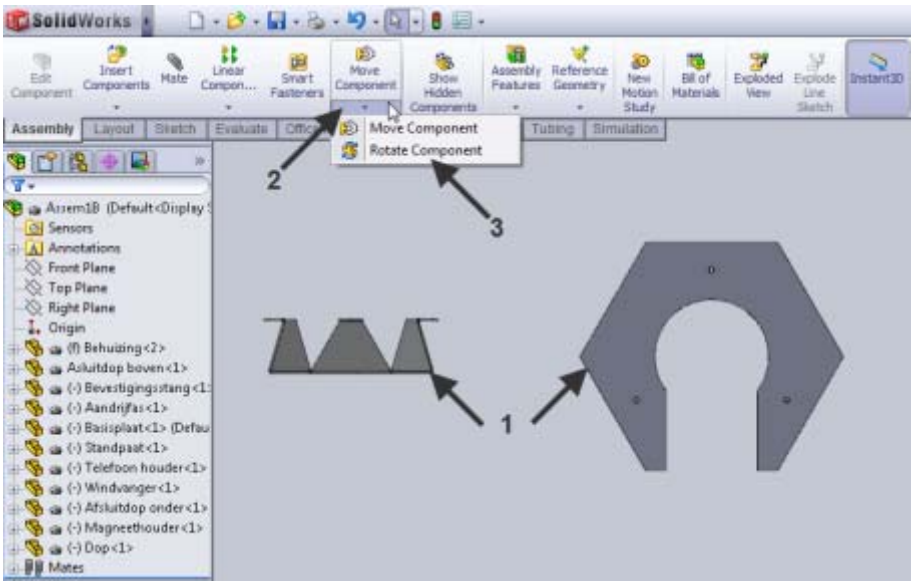
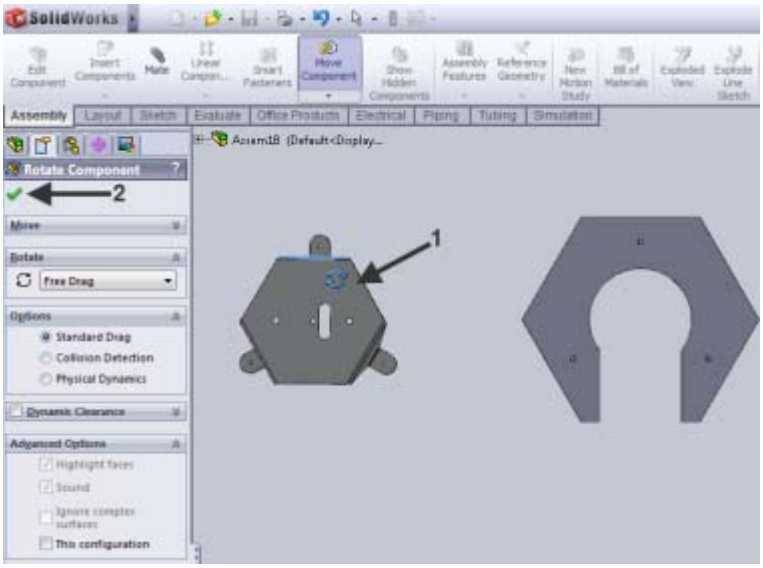
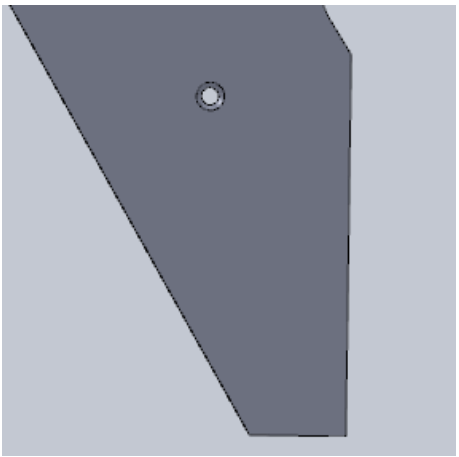
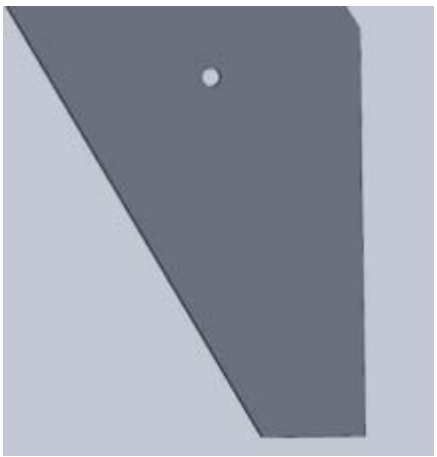
7	**1.** Click anywhere in the drawing area to add the piece.  The added piece is now positioned at an arbitrary location in the assembly.	
8	Now, we will connect both pieces: **together**. **1.** In the: Command Manager, click: 	
9	You must now select two elements between which a 'Mate' will be made. This needs to be done very carefully. Zoom in on the top section of the housing. **1.** Select the inner **edge** of the hole (an 'Edge' and not a 'Face' (Face = flat)). **2.** In the blue area of the Property Manager, the following is displayed: 	

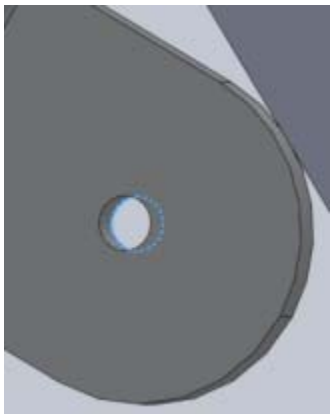
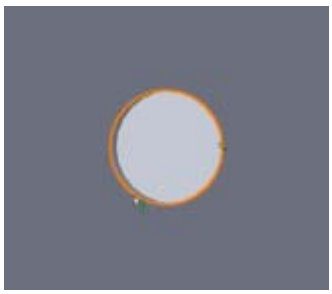
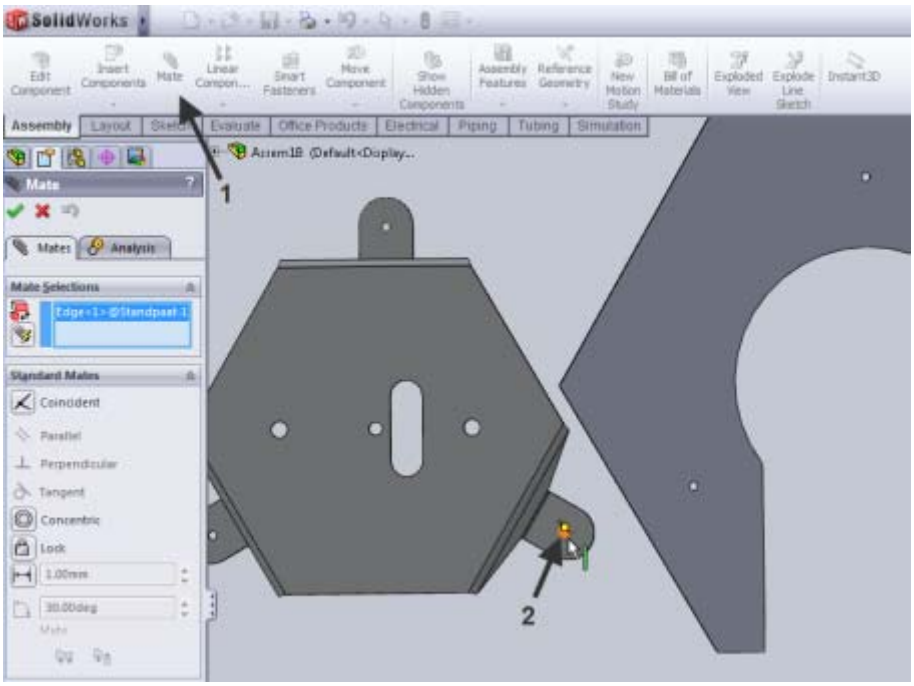
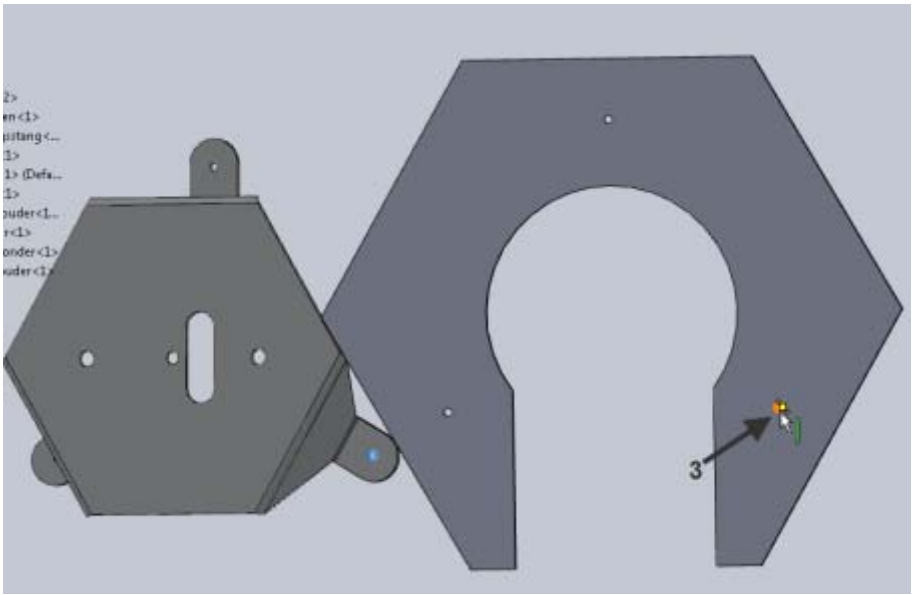
10	Rotate the model so the bottom of the **Upper cap** becomes visible. To achieve this, press the scroll wheel of the mouse or use the arrows on the keyboard. **1.** Select the edge of the **Upper cap**, as illustrated. Again, make sure you did not select a face.	
11	Both parts now move toward each other. **1.** In the blue area of the Property Manager, the following is displayed:  **2.** SolidWorks has already selected the appropriate 'Mate'.  **3.** Click OK. 	
		You may accidentally choose the wrong face or edge. In that case, do the following: With the right mouse button, click in the blue area Mate Selections  Then click Delete to remove the selected part (displayed in dark blue in the window). Click Clear Selection to remove everything.

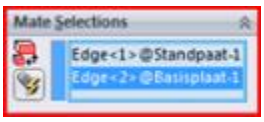
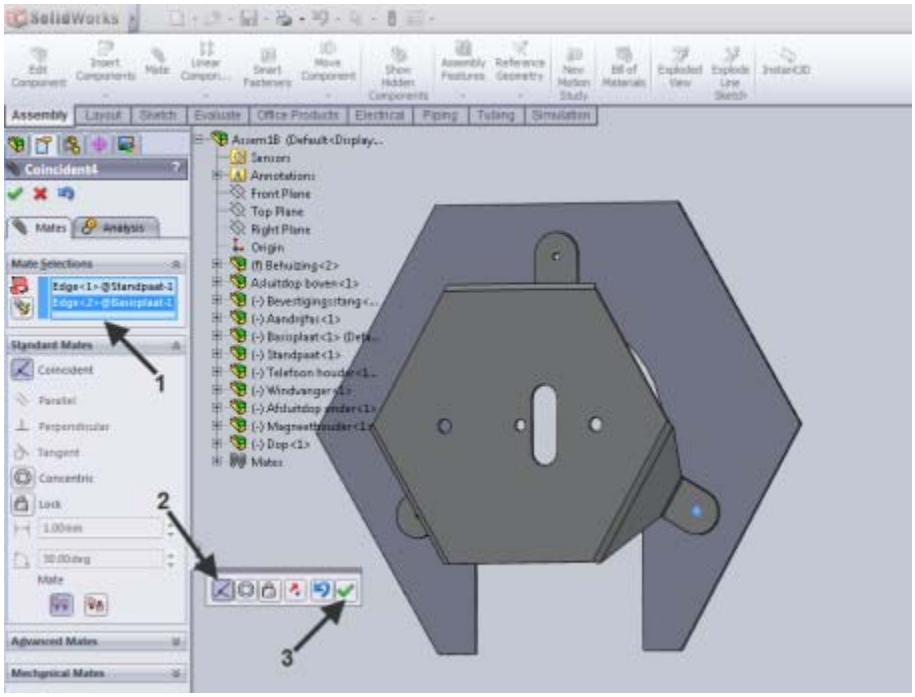
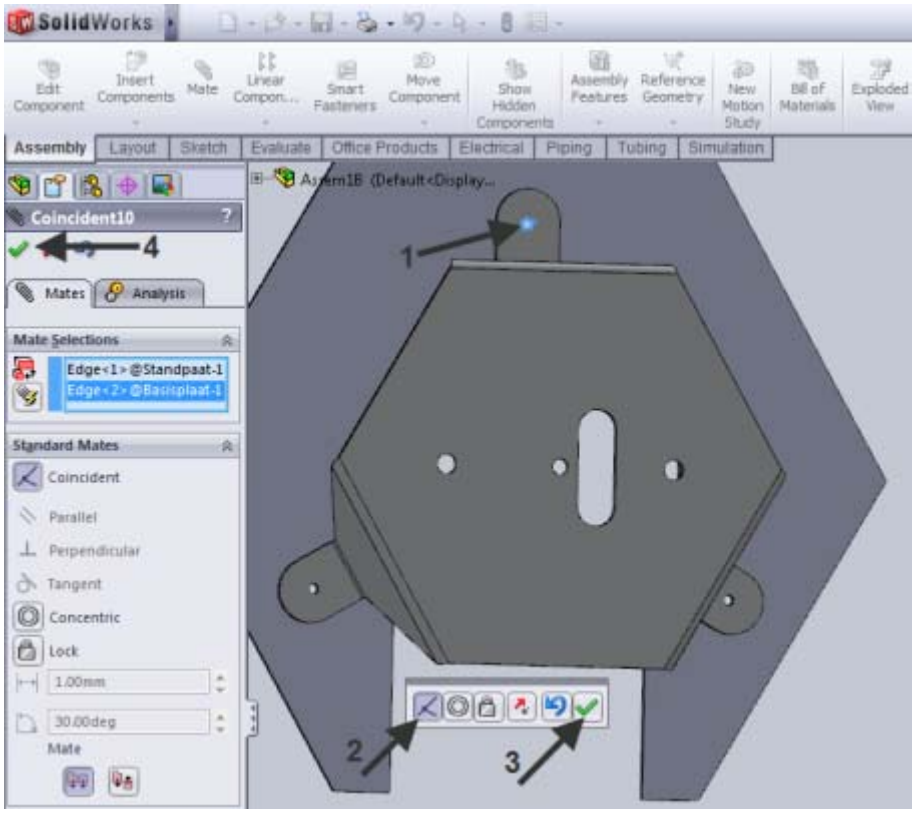
12	If necessary, move the upper cap as illustrated. **1.** Select the face of the hole (a 'Face' and not an 'Edge'). **2.** In the blue area of the Property Manager, the following is displayed: 	
13	Both parts now move to each other. **1.** In the blue area of the Property Manager, the following is displayed: Face<1>@Housing-1 Face<2>@Cap Internal-1  **2.** For 'Mate' , SolidWorks has selected  this time **3.** Click OK to confirm the 'Mate'. 	

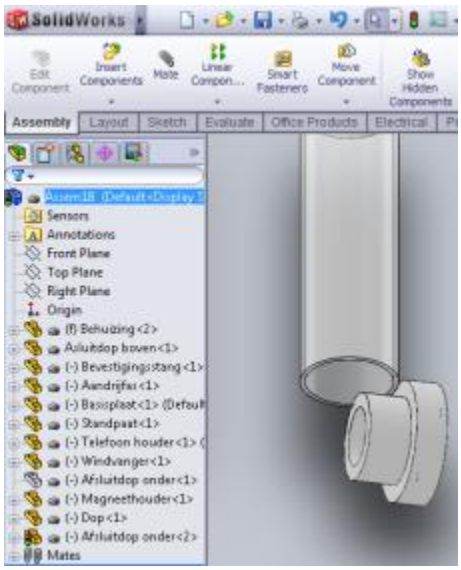
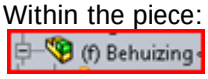
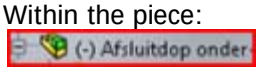
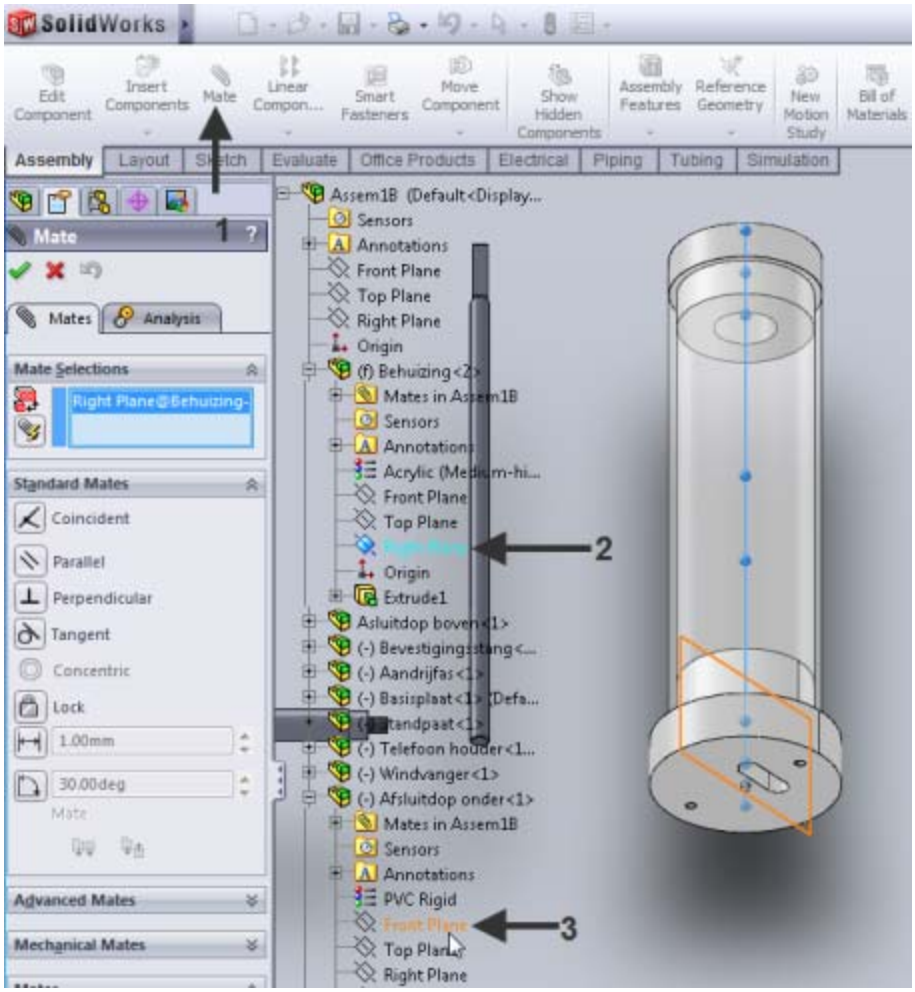
14	The selection area in the: Property Manager is emptied, so you can immediately enter the next mate. To fasten the cap, we use the Front Plane standard face. However, it cannot be selected in the model, but only in the Feature Manager. Since the Property Manager and not the Feature Manager is displayed, you have to use the Feature Manager displayed in the diagram area. **1.** Click the plus sign in front of the file name. 	
15	**1.** Click the plus signs for both pieces. **Attention!** After having clicked the first +, the list scrolls.	

16	**1.** Within the **housing element**, select the  **2.** Within **upper cap**, also select the  **3.** The selected pieces are displayed in the blue area of the Property Manager.  **4.** As 'Mate', SolidWorks has selected  **5.** Click OK to confirm the 'Mate'.  **6.** Click OK once more to close the Property Manager.	
17	Now, add the other required pieces. You can do that by repeating step 5 through 7. Be sure to do that in the following order. 1. Wing Arm 2. Shaft 3. Base Sheet 4. Housing Base 5. Phone Holder 6. Windblade 7. Cap Internal 8. Magnet Holder 9. Top End	

18	We will now continue the windmill assembly. **1.** Drag the **base sheet** and the **housing base** somewhat downward. **2.** Click the arrow below Move Component to open the scroll down menu.  **3.** Select 	
19	**1.** Rotate the **housing base** as in the adjoined figure. **2.** Click OK.	
20	Zoom in at the **base sheet** to see on which side the recessed holes are located. If visible, rotate the piece in such a manner that the recessed holes will be on the bottom side.	 Not like this!!  But like that!!

21	**1.** Click:  **2.** Zoom in on the **<u>housing base</u>** and select the **lower** edge of the hole.  **3.** For the **<u>base sheet</u>**, select the **upper** edge of the hole. 	 

22	Once you have clicked the upper edge of the hole, parts start moving toward each other. **1.** The selected pieces are displayed in the blue area of the Property Manager.  **2.** As 'Mate', SolidWorks has selected  . **3.** Click OK: 	
23	**1.** First, select the lower edge of the hole of the **housing base**. Then select the upper edge of the hole in de **base sheet**.  **2.** Coincident  is the appropriate mate, so we'll leave it like that. **3.** Click OK:  **4.** Click OK once more to exit the function.	

24	Drag the piece: **Cap Internal** toward the housing. See the example opposite.	
25	Mate! **the housing** and **the cap internal** as in steps 8 through 13. **1.** Click:  **2.** Within the piece:  now select the  **3.** Within the piece:  then select the   If necessary, click the plus sign to open the list of both pieces.	

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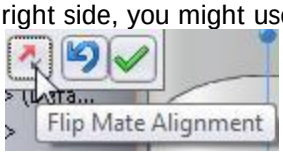
The Front Plane of the **bottom end** now turns towards the Right Plane of the **housing**.

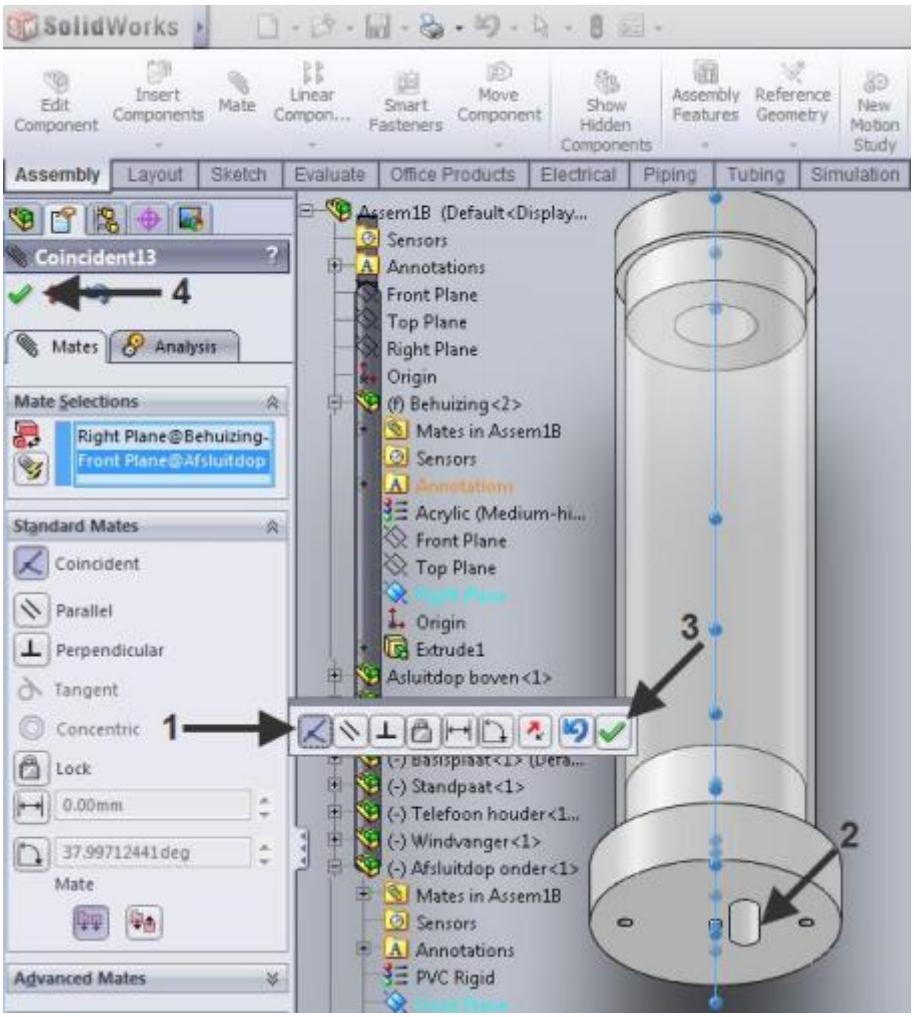
1. As 'Mate', SolidWorks has selected 

.
2. The keyway must be on the right side. If not, read the instructions below.
3. Click OK to attach the 'Mate'.

4. Click OK once more to correctly close the Property Manager.

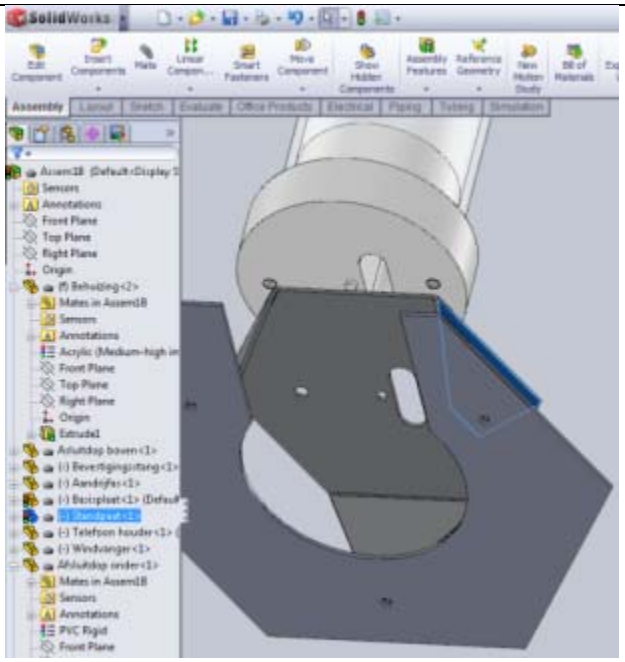
To get the keyway on the right side, you might use





27

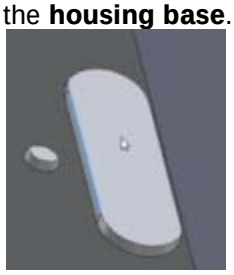
Zoom in, drag and/or rotate the bearing plate and the base sheet as illustrated.
Both are linked together, which is why they move together!



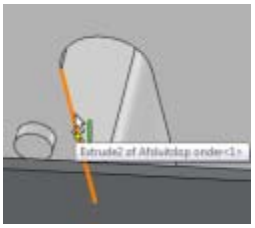
28

Now, first Mate both keyways together.

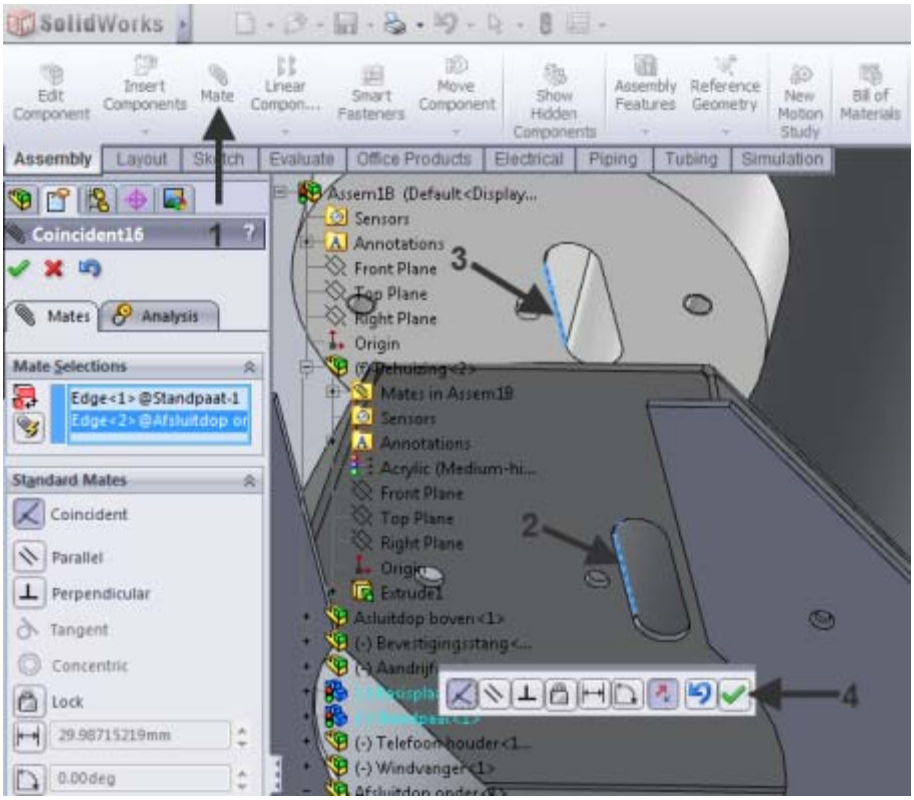
1. Click
2. Click the upper edge of the **housing base**.



3. Next, select the lower edge of the **bottom end**.



4. Confirm this by clicking OK.



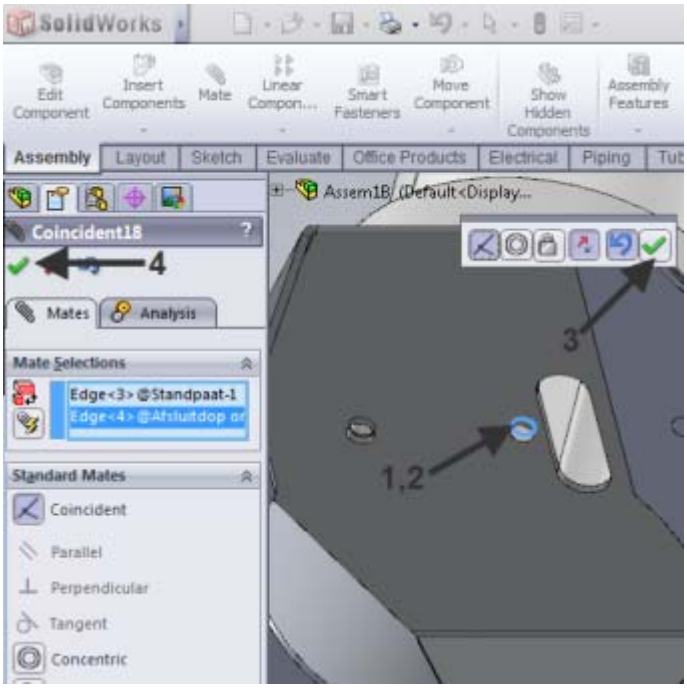
29

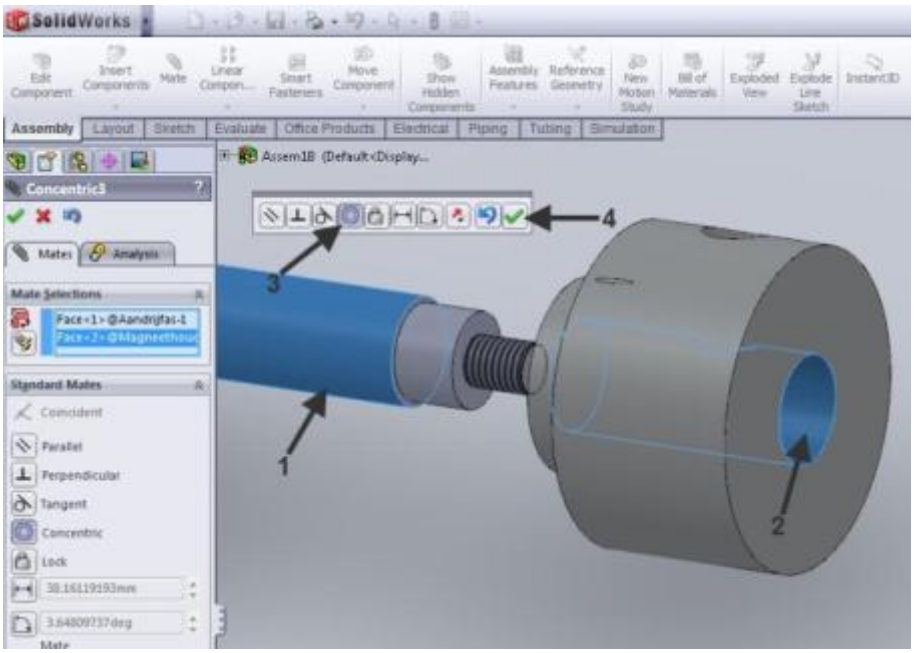
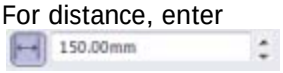
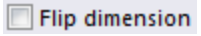
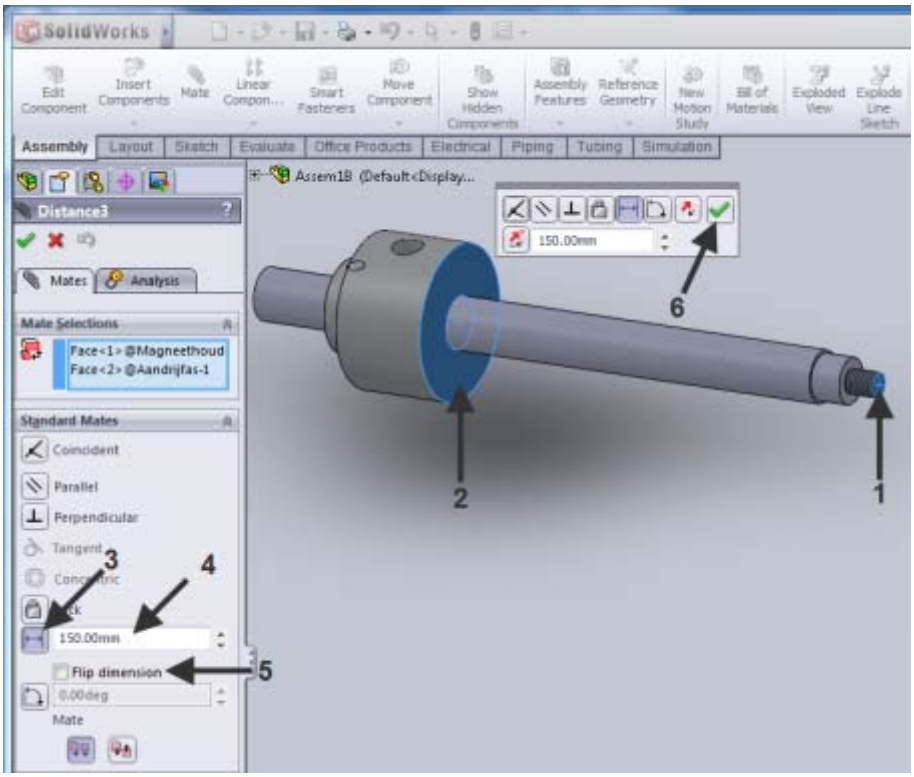
1. Select the upper edge of the hole of the **housing base**

.

2. Click the lower edge of the vent hole of the **bottom end**.

3. Click OK once.
4. Finally, click OK to close the command.



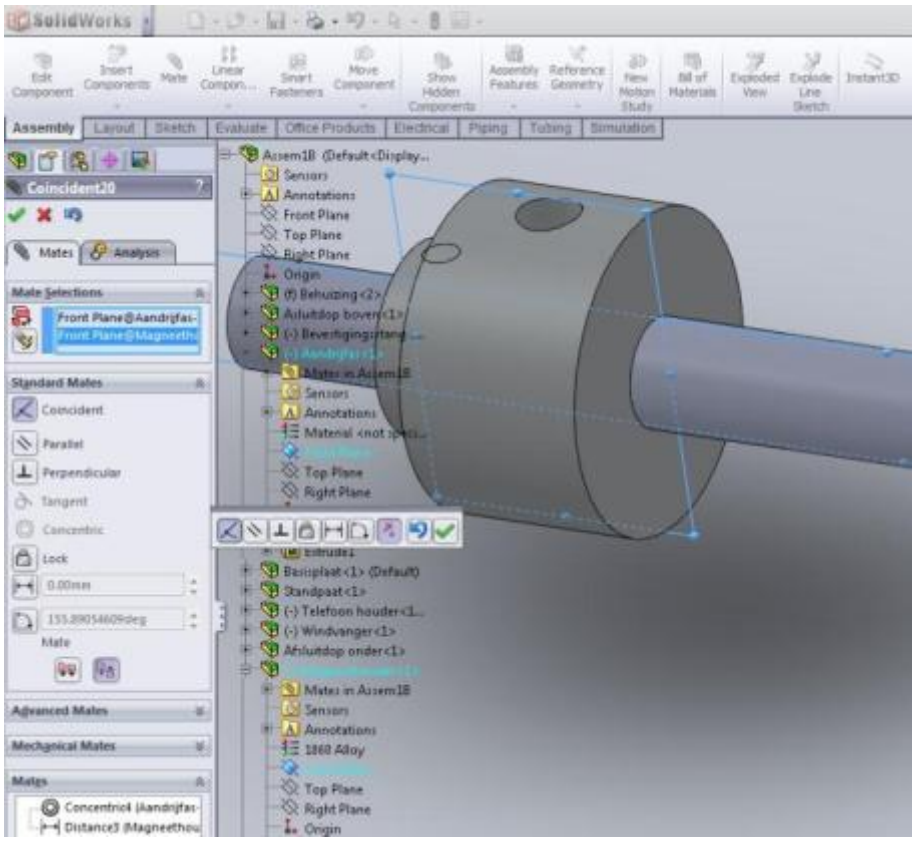
30	Zoom in, drag and/or rotate the **shaft** and the **magnet holder** as illustrated. Next click:  to link both pieces. **1.** Select the outer face of the **shaft.** **2.** Then choose the inner face of the hole. **3.** Using the function:  link both pieces together. **4.** Click OK: 	
31	**1.** Select the upper face of the **shaft.** **2.** Then choose the upper face of the **magnet holder.** **3.** For mate, select distance  . **4.** For distance, enter  **5.** Check or uncheck  to move the **magnet holder** to the right place. **6.** Click OK.	

32

now, the:

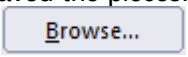
of the **shaft** and the **magnet holder.**

If you don't know how to do that, review steps 8 through 13 or 25 through 26.

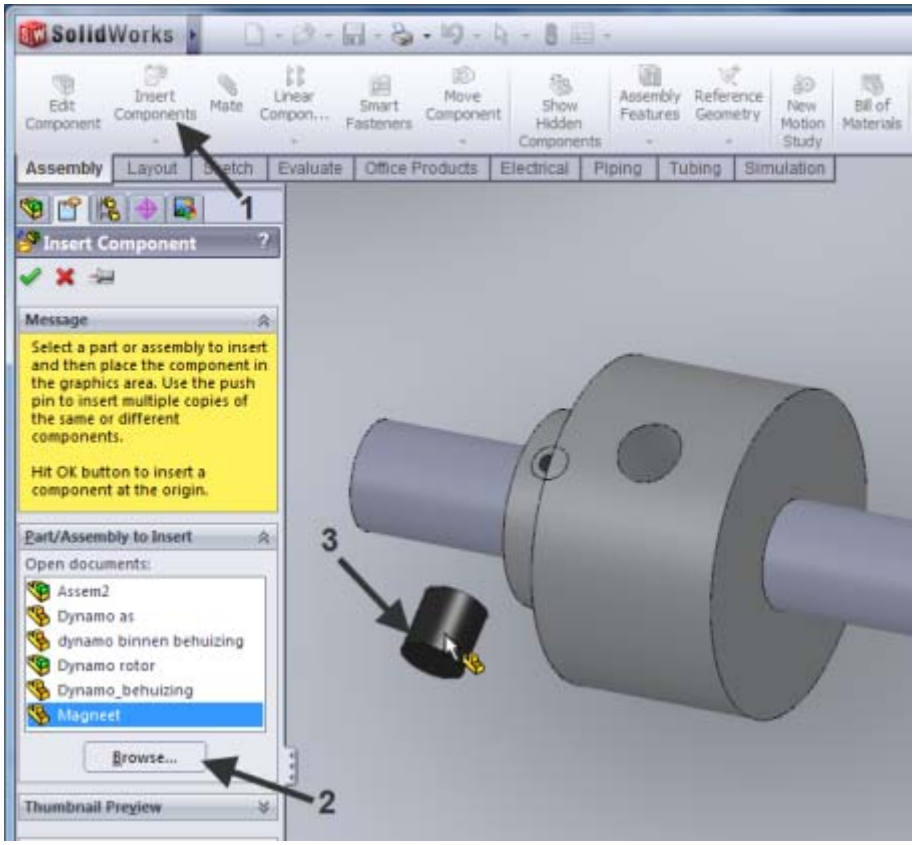


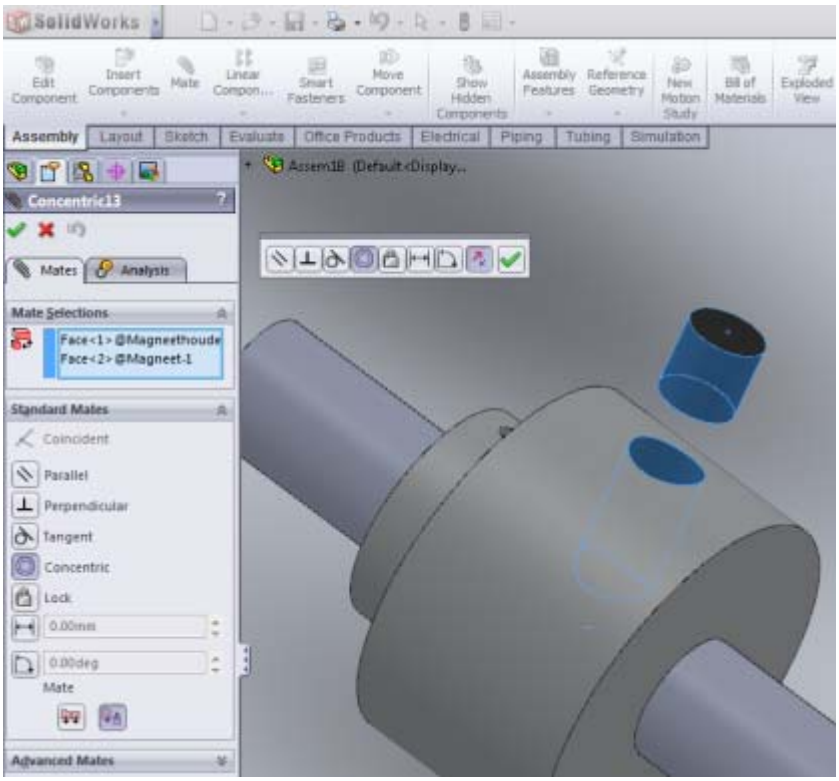
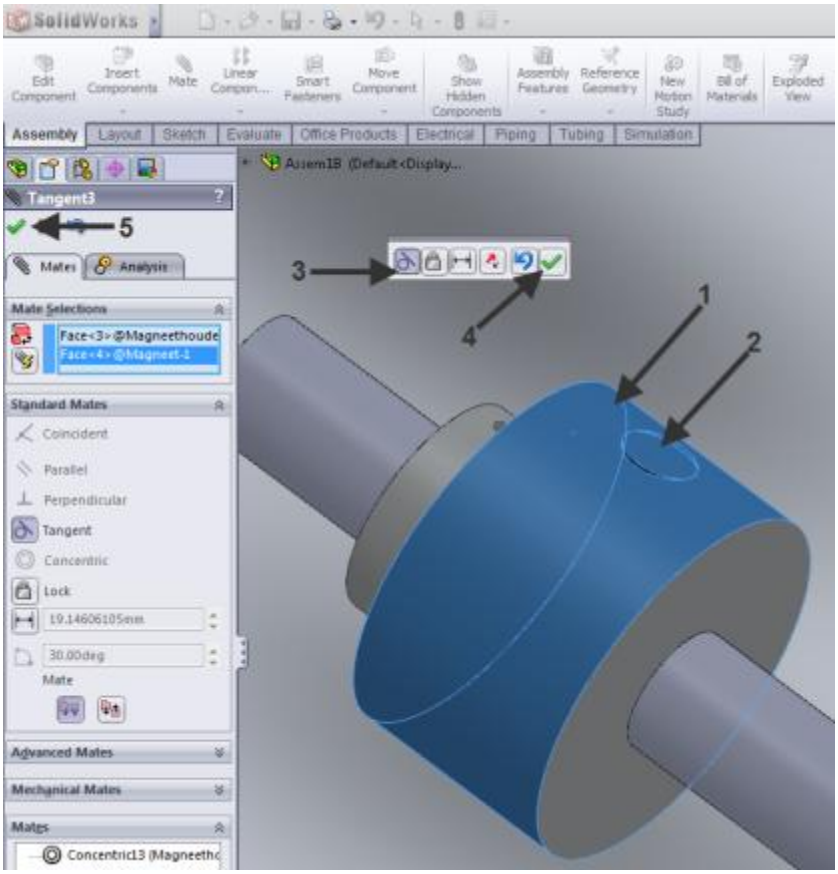
33

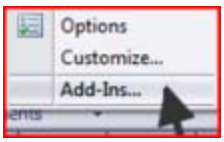
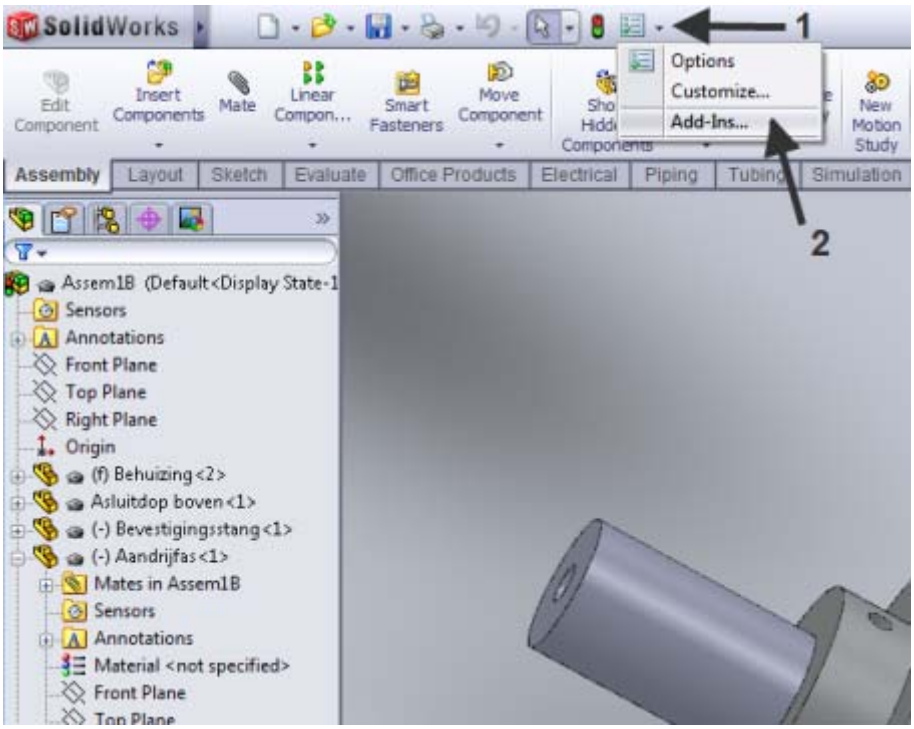
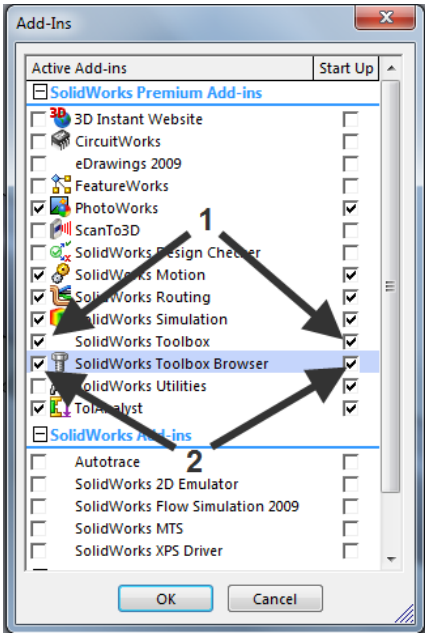
To finalize the piece, you must position two more pieces.
You need a **magnet** and an M6x8mm Allen head bolt.

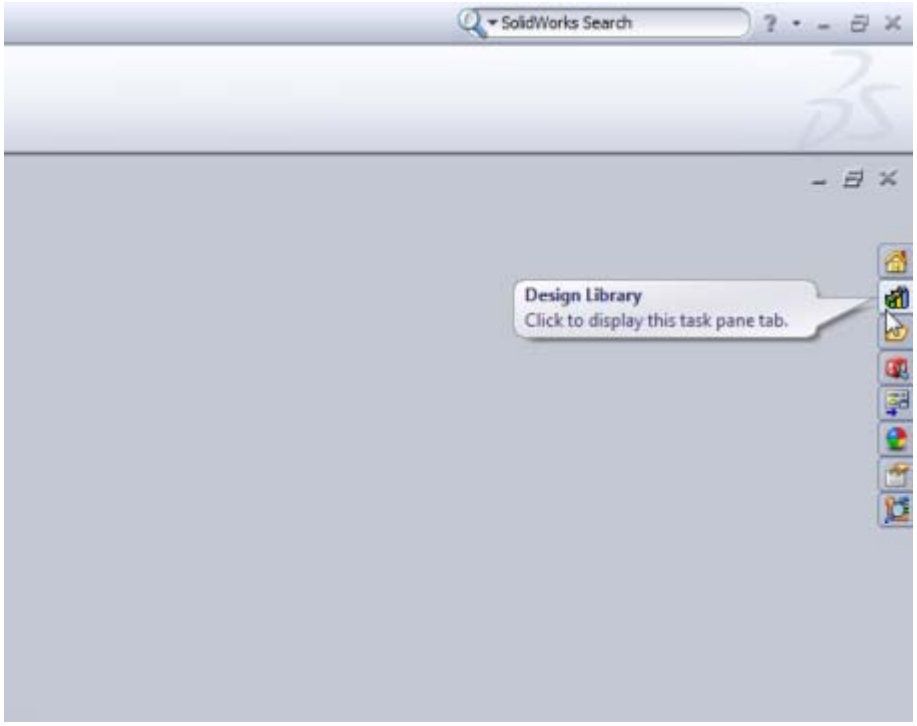
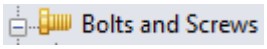
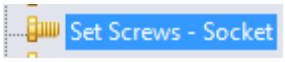
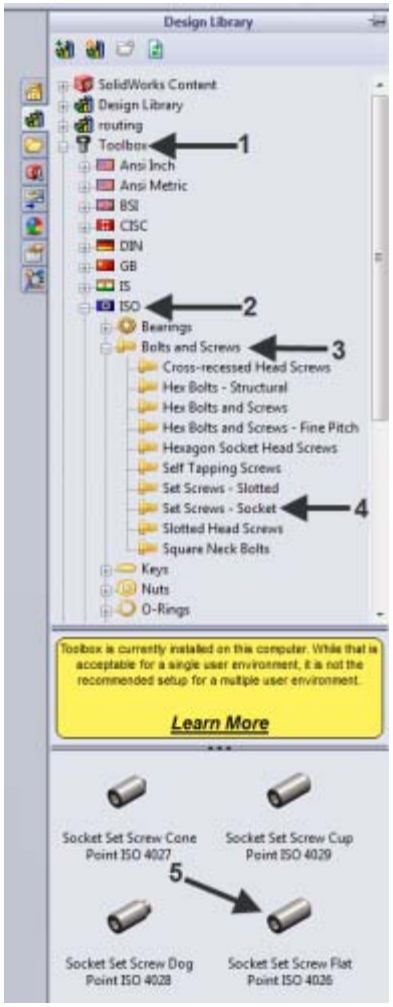
1. Click:
2. Go to the folder where you saved the pieces.
   Click: 

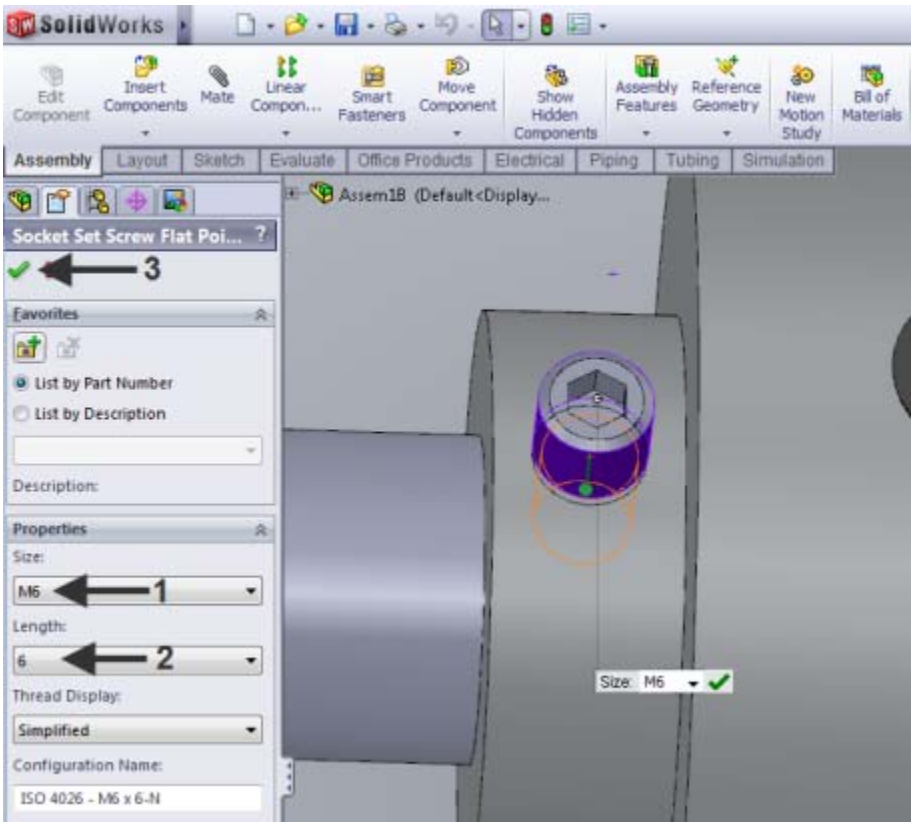
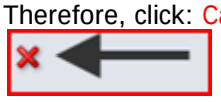
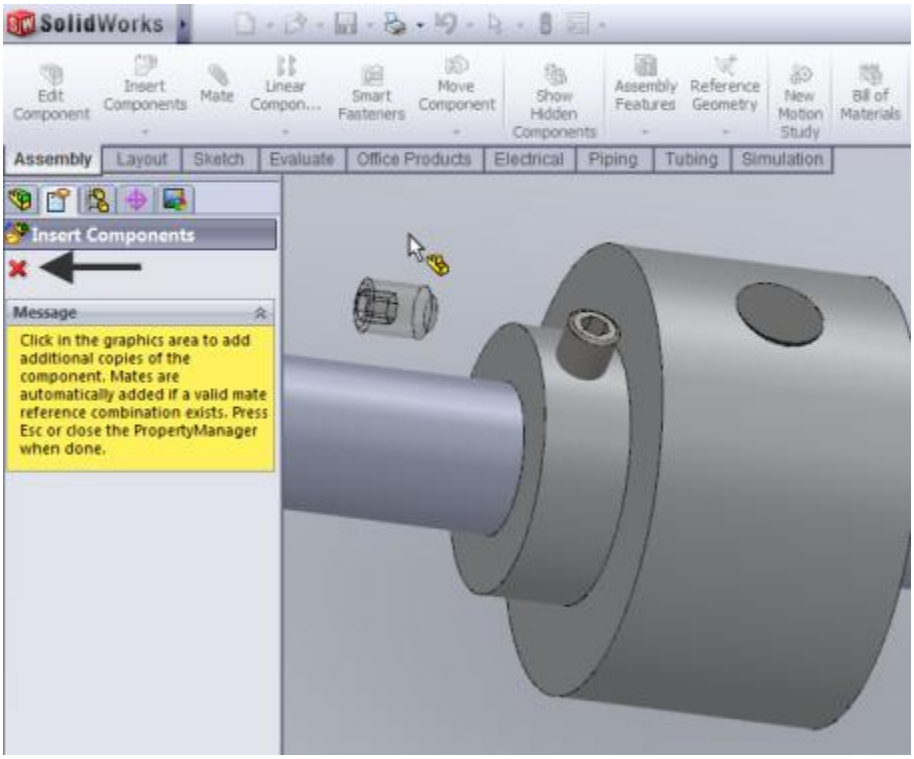
3. Add the **magnet**.

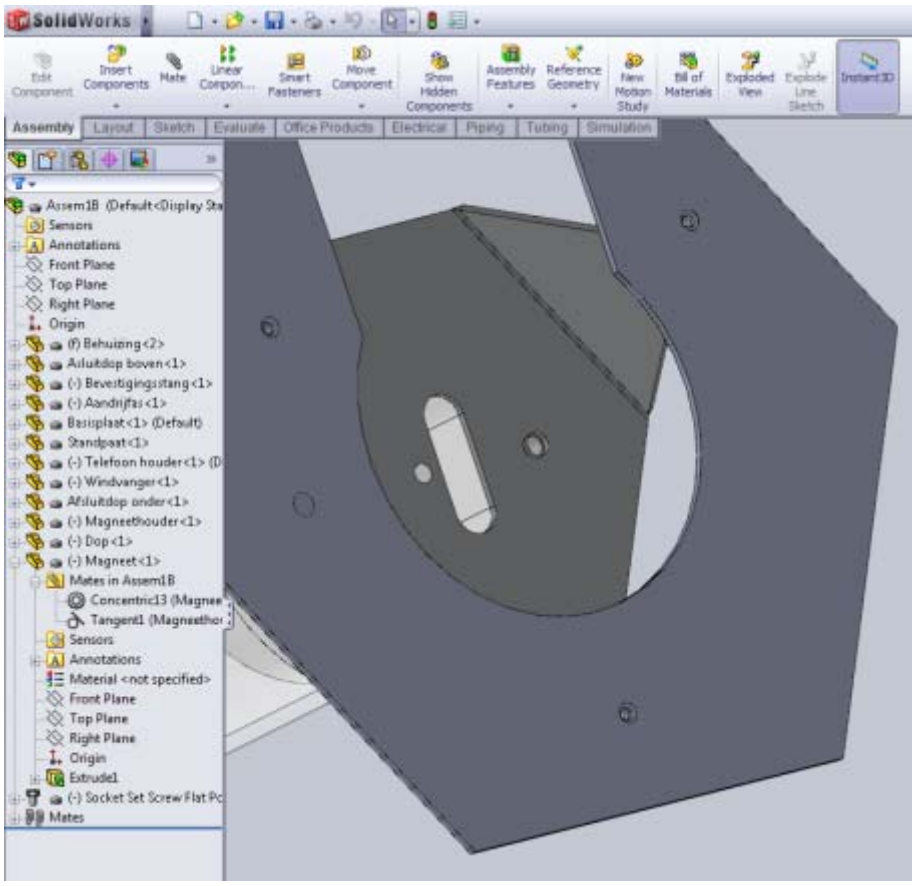


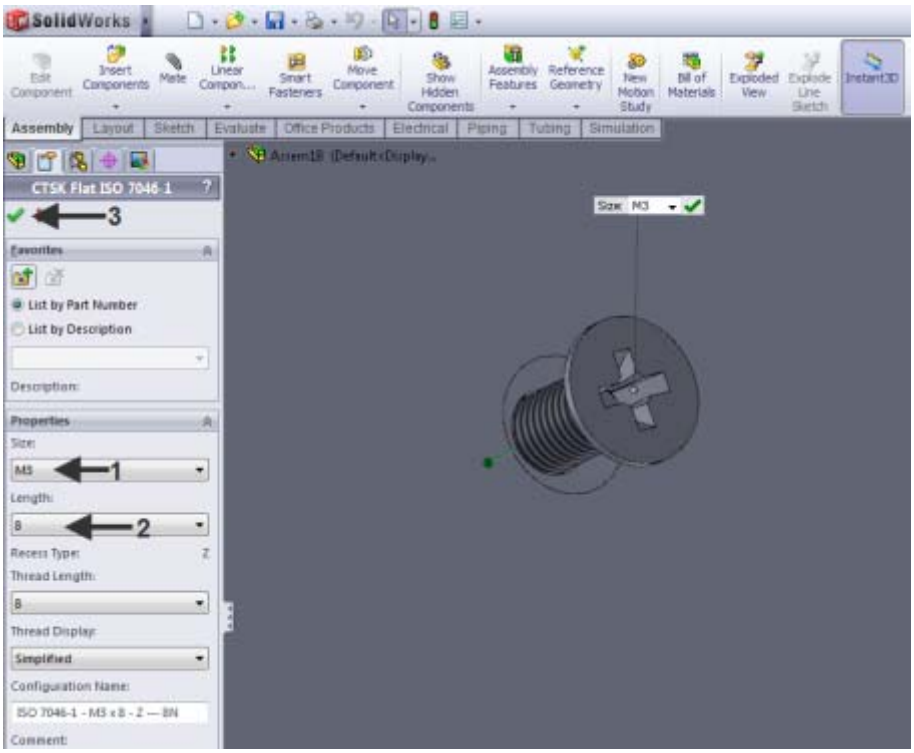
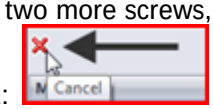
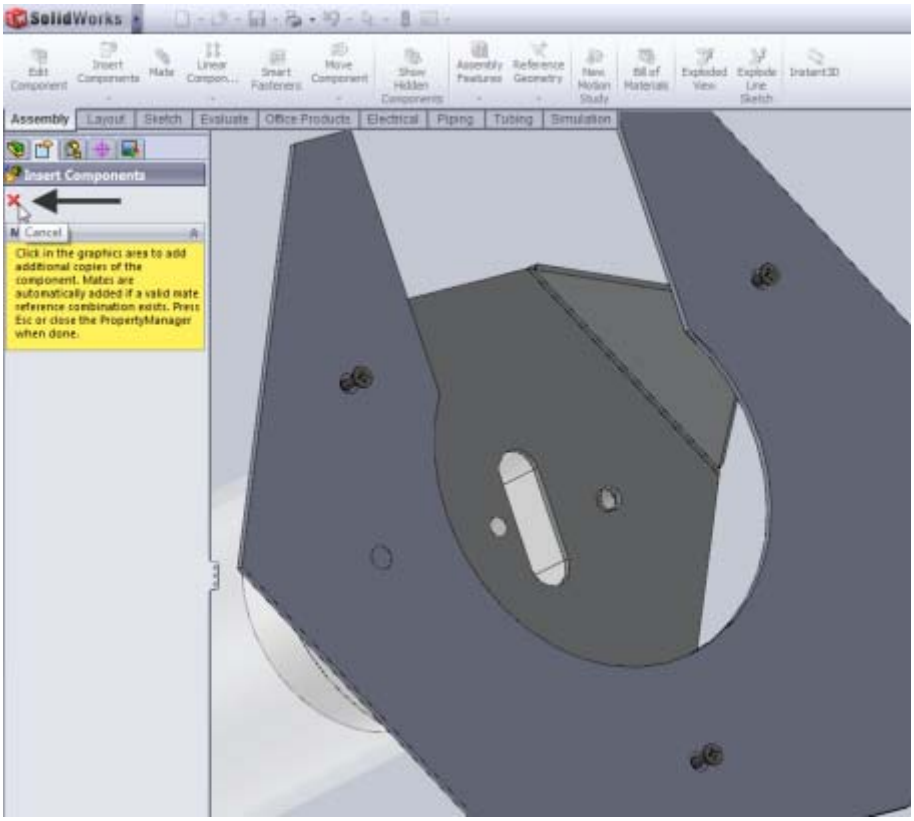
34	 now the outer face of the **magnet** with the inner side of the hole. Then click OK:	
35	**1.** First, select the outer face of the **magnet holder.** **2.** Then select the upper side of the **magnet.** **3.** In this case, SolidWorks has selected a:  mate. **4.** Click OK to confirm the mate.  **5.** Click OK once more.	

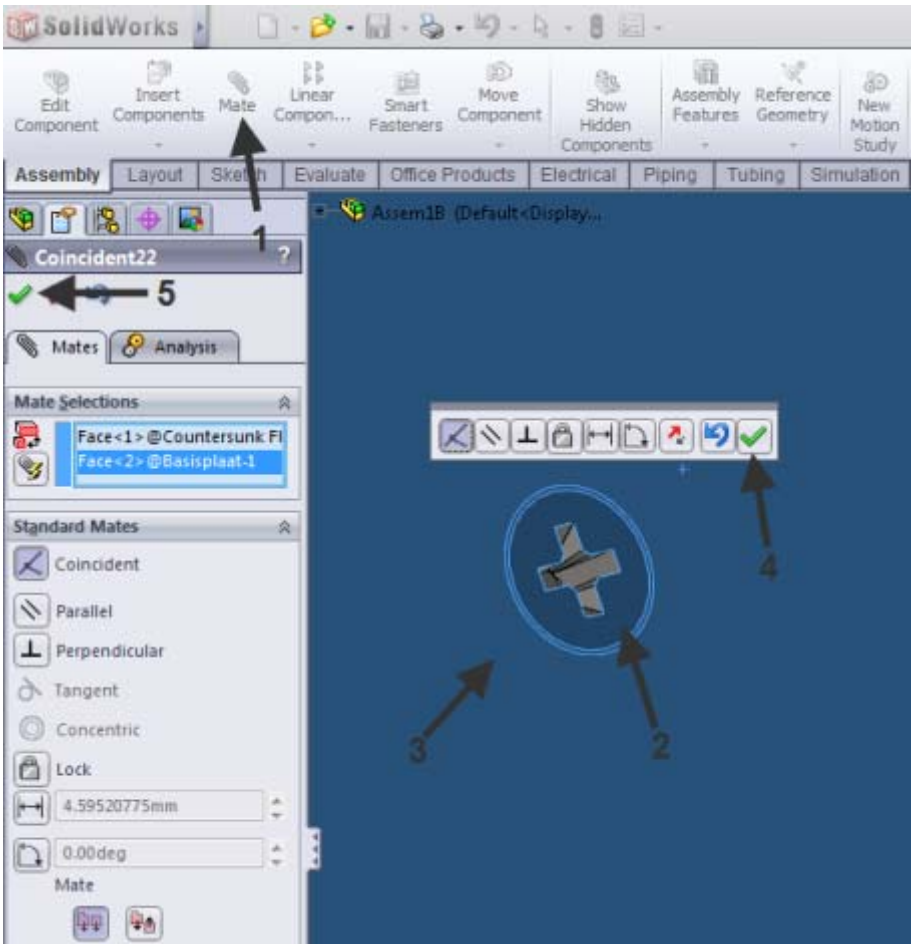
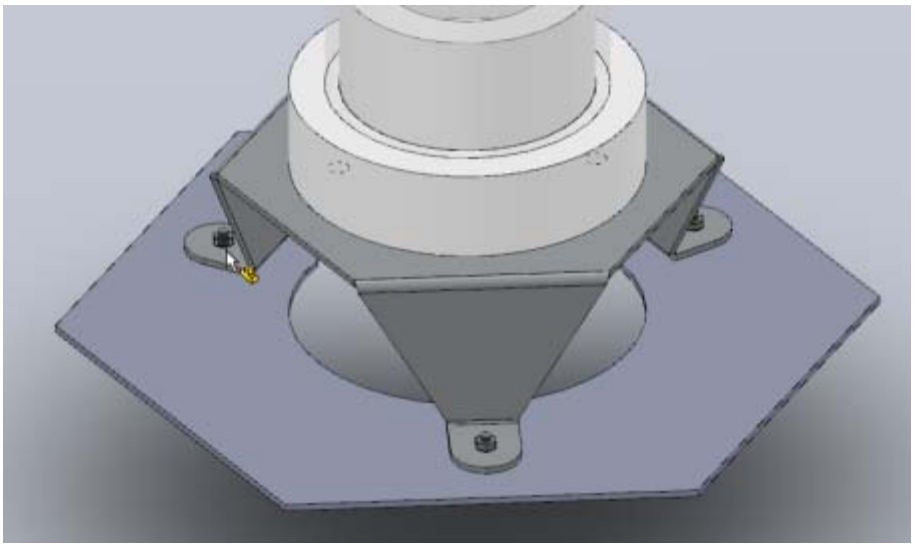
36	We will now add an M6x8mm Allen head bolt. We will do that using the SolidWorks Toolbox function. Before continuing, you must first make sure Toolbox has been installed and activated on your computer. **1.** In the Command Manager, click the arrow next to  **2.** Then choose: 	
37	Make sure the SolidWorks Toolbox and SolidWorks Toolbox Browser options are both checked in the menu. By adding a check mark to the right, **after** both options (SolidWorks Toolbox and SolidWorks Toolbox Browser), they will be, from now on, automatically loaded when SolidWorks is launched. So you don't have to activate the Toolbox each and every time. Read the following tip in case these options are unavailable.	
		It may be Toolbox is not available in your version of SolidWorks. In that case, you will not be able to finish the tutorial by following the steps below. If you still want to complete the model, you can also download the required attachments (bolts and washers) from www.solidworks.nl. You will not be using the Toolbox, but will add the bolts and washers to the assembly, as you would do with any other piece.

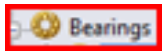
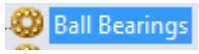
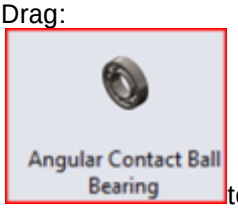
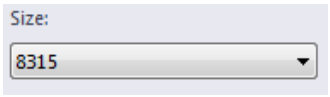
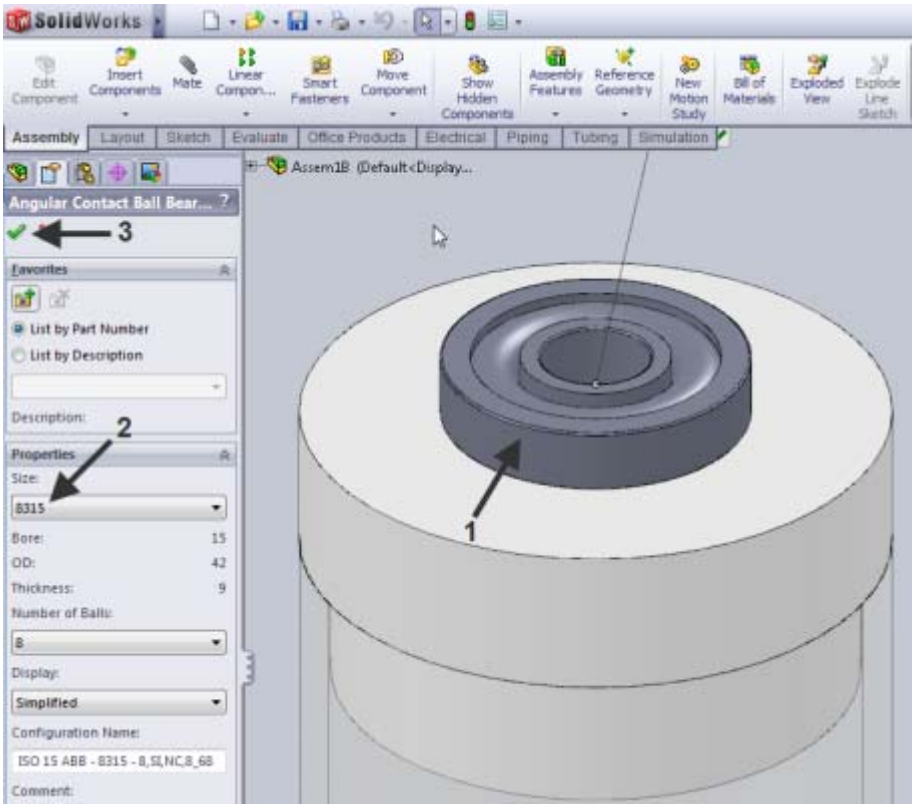
38	In the task pane Task Pane: (to the right on the screen), click the Design Library icon. 	
39	The Task Pane will open with the Toolbox. We will now insert an Allen head bolt into the threaded hole. Successively double-click **1.**  **2.**  **3.**  **4.**  The available screws will be displayed in the lower part of the Task Pane. **5.** Search for the screw with the following name: 	

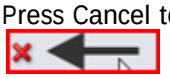
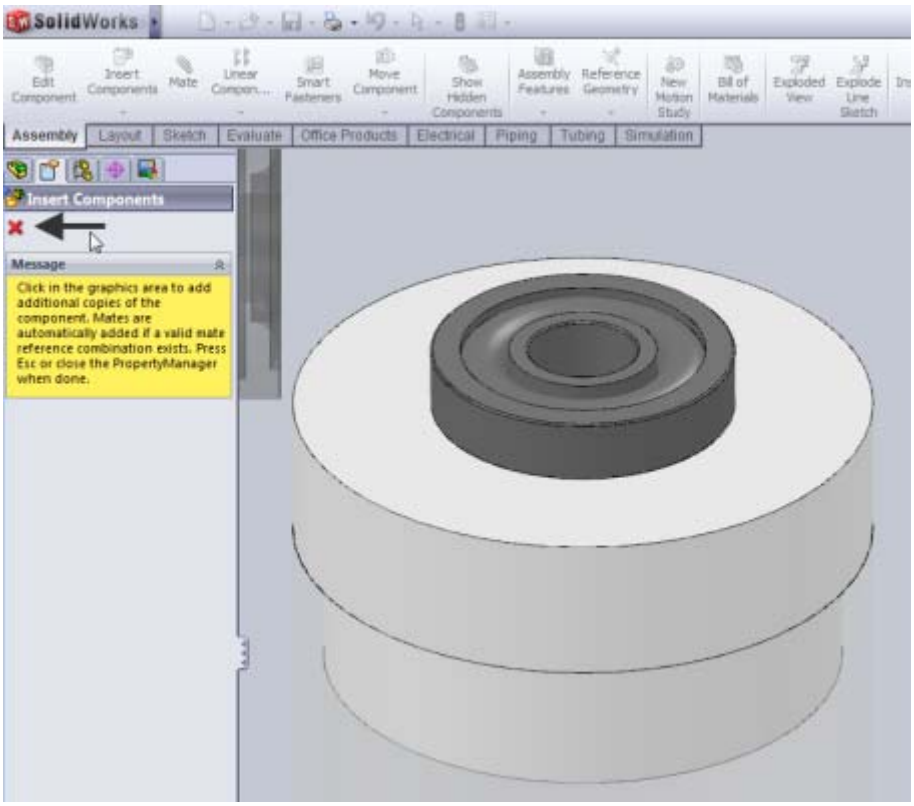
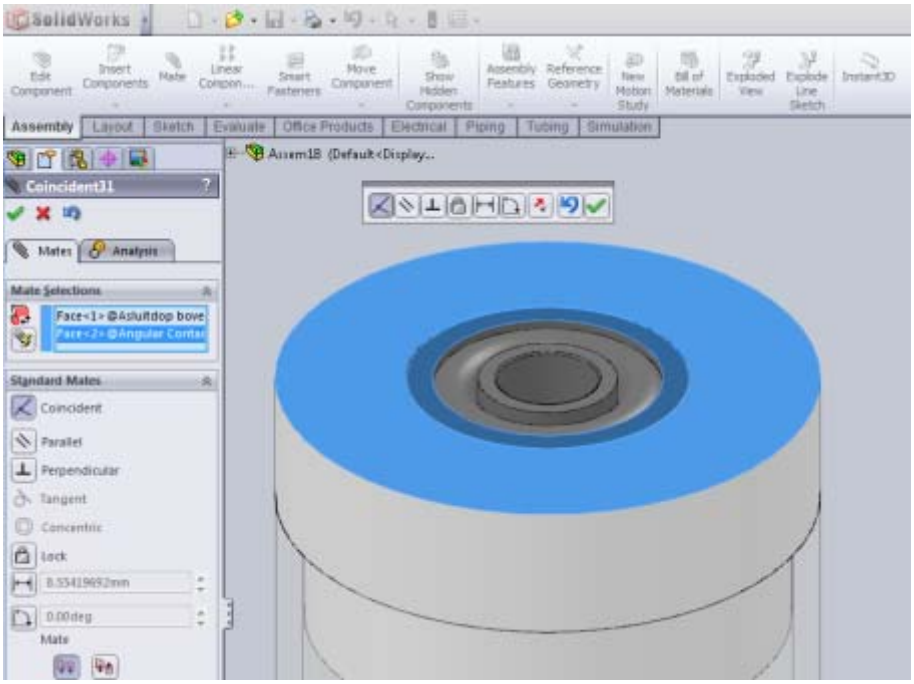
40	With the left mouse button, drag the screw from the Task Pane to your model. As soon as the mouse moves above the threaded hole, the screw jumps to the appropriate position. Release the mouse button. The screw may seem much too small or too large. That is not important at this point. In the: Property Manager change the size of the screw to M6x8, and click OK.	
41	The screw is now locked to the mouse and you could insert it into other threaded holes. But because we don't have any other holes, we no longer need the screw. Therefore, click: Cancel 	

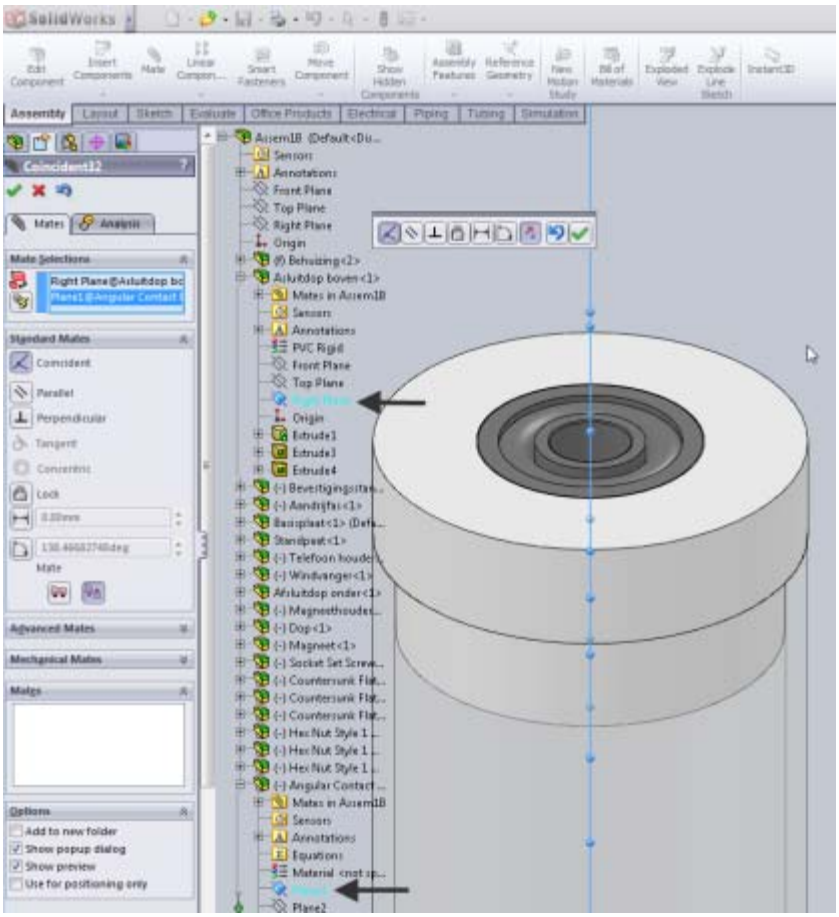
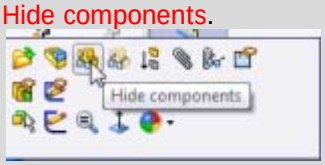
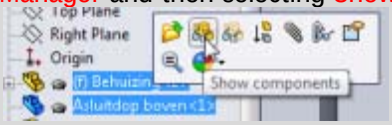
42	Zoom in, drag and/or rotate the **<u>housing base</u>** and the **<u>base sheet</u>** as illustrated.	
43	Add the following piece in the same way as above. Successively double-click **1.** Toolbox **2.** ISO **3.** Bolts and Screws **4.** Cross-recessed Head Screws The available screws will be displayed in the lower part of the Task Pane. **5.** Search for the screw with the following name: 	

44	Drag this screw to the hole. In: Property Manager,, change the size of the screw to M3x8, and click OK.	
45	The screw is locked to the cursor so you can insert it into other holes as well. Add two more screws, then click: 	

46	It may be the screws are protruding. Solve that problem as follows.  **1.** Click: **2.** Select the upper face of the screw. **3.** Then select the face of the base sheet. **4.** Click OK: **5.** Click OK once more: Repeat this for both other screws.	
47	Add the following piece to the bolt ends in the same manner. (M3 Bolt)  	

48	We will add a **bearing**. You will use the toolbox once more. Double-click the following pieces. **1.**  **2.**  **3.**  **4.** Choose  **5.** Drag:  to the hole of the **cap internal.**	
49	**1.** Insert the **bearing** into the hole. **2.** Locate the appropriate bearing  **3.** Click OK:	

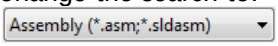
50	Press Cancel to close. 	
51	Mate the **bearing** as illustrated.	

52	Then mate: Plane1 of **the bearing** and the Right Plane of the **cap internal**. This is required to fasten the bearing.	
		Sometimes a piece is in the way during the assembly. For instance, it may not be possible to select a piece correctly. This can be solved in two ways. You can hide the piece that is in the way by clicking it and then selecting Hide components.  You can bring it back again by clicking the hidden piece in the Feature Manager and then selecting Show components.  Or, you can make the piece transparent. Again, click the piece and then select Change Transparency.  If you want the piece to be displayed normally again, click it once more and then click again Change Transparency.

53

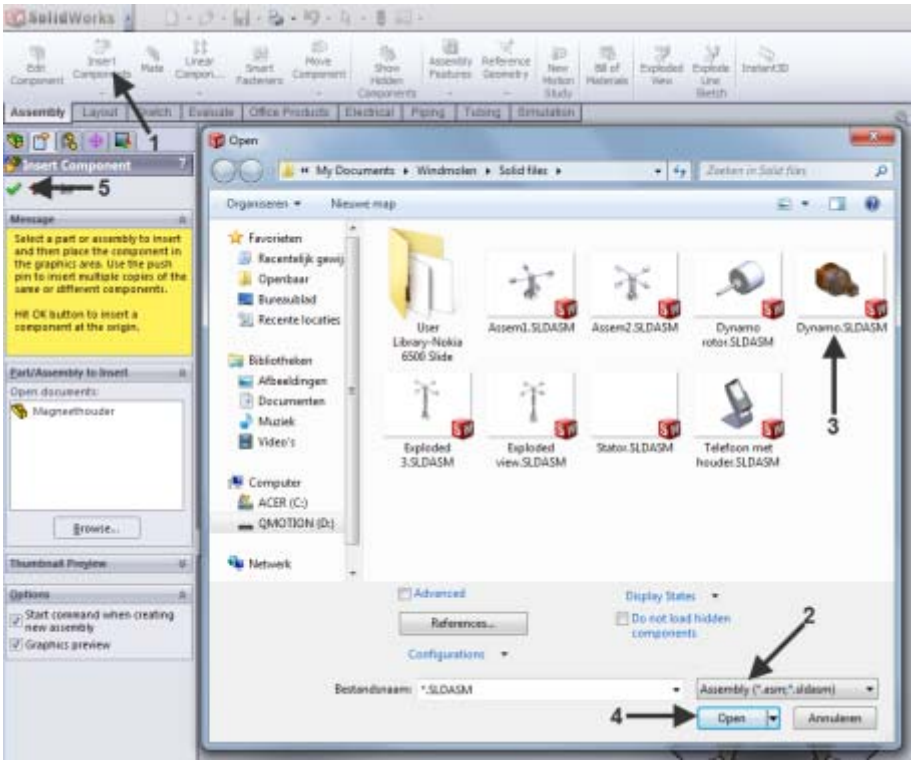
Add the **Dynamo** to the assembly.

1. Click: 

2. Change the search to: 

3. Then choose the file: 

4. Click: 



54

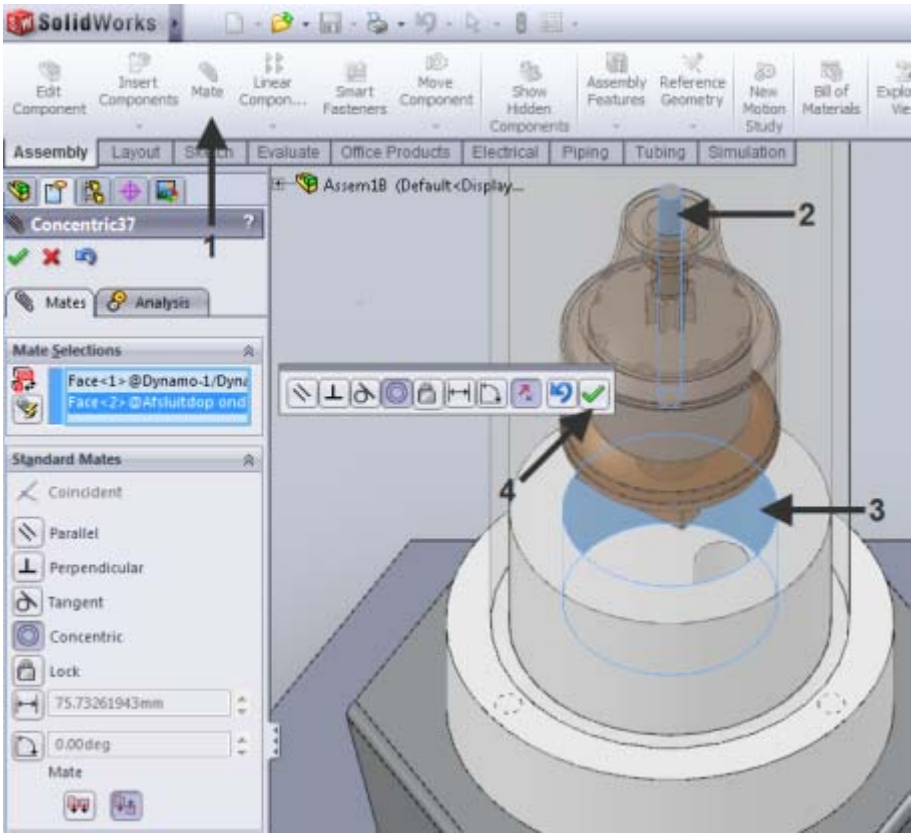
1. Click: 

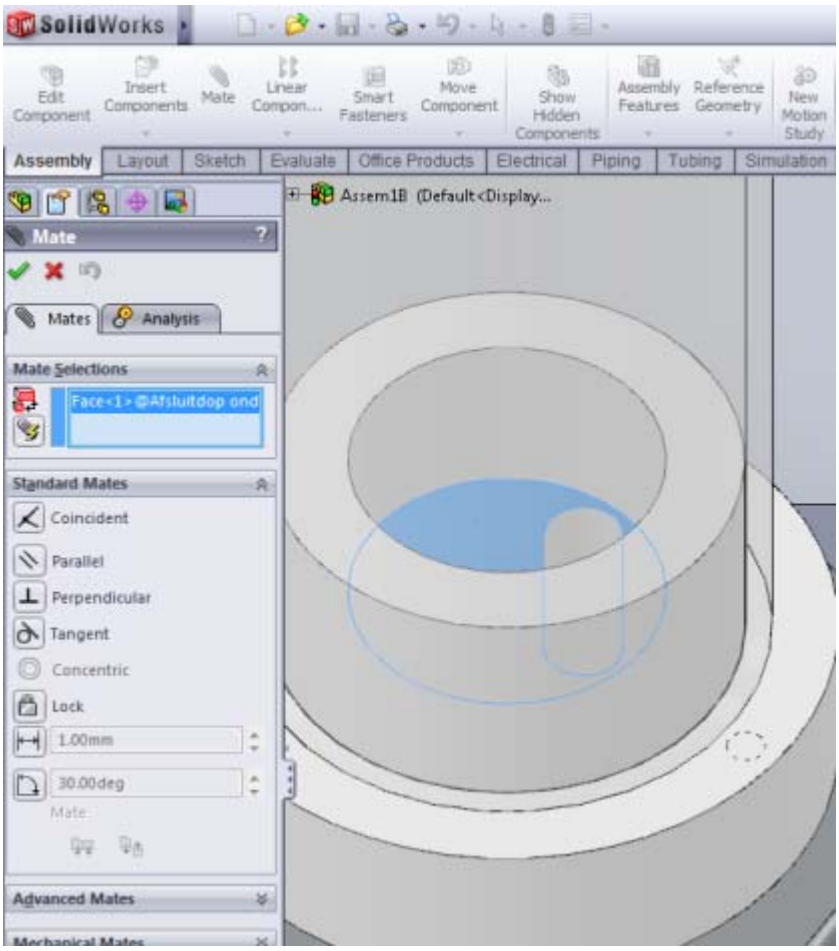
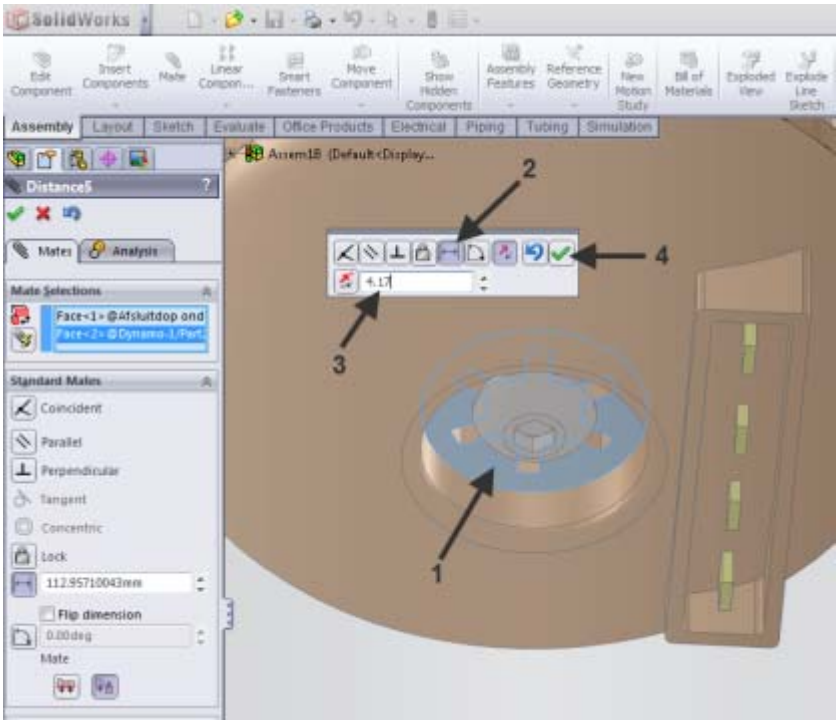
2. Choose the outer edge of the shaft.

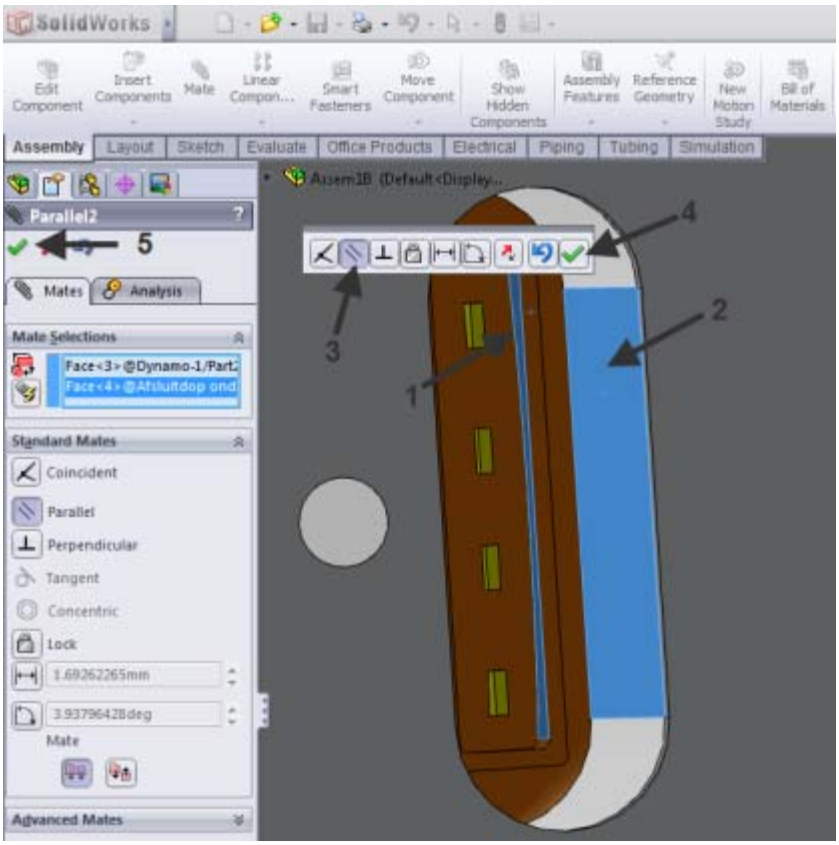
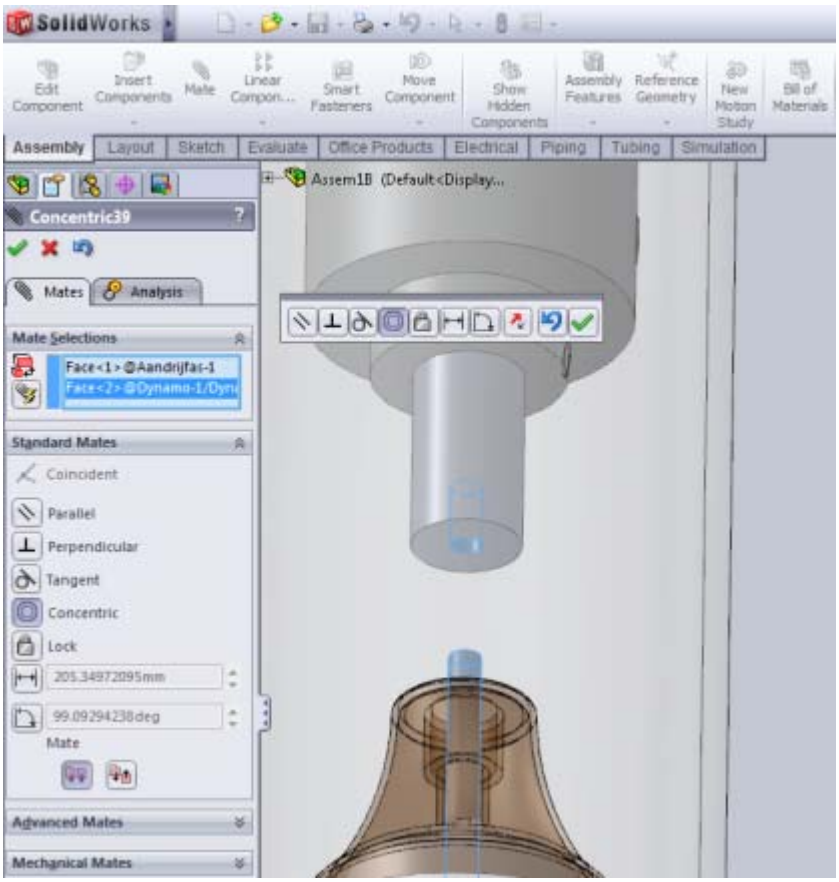
3. Then choose the interior of the **bottom end.**

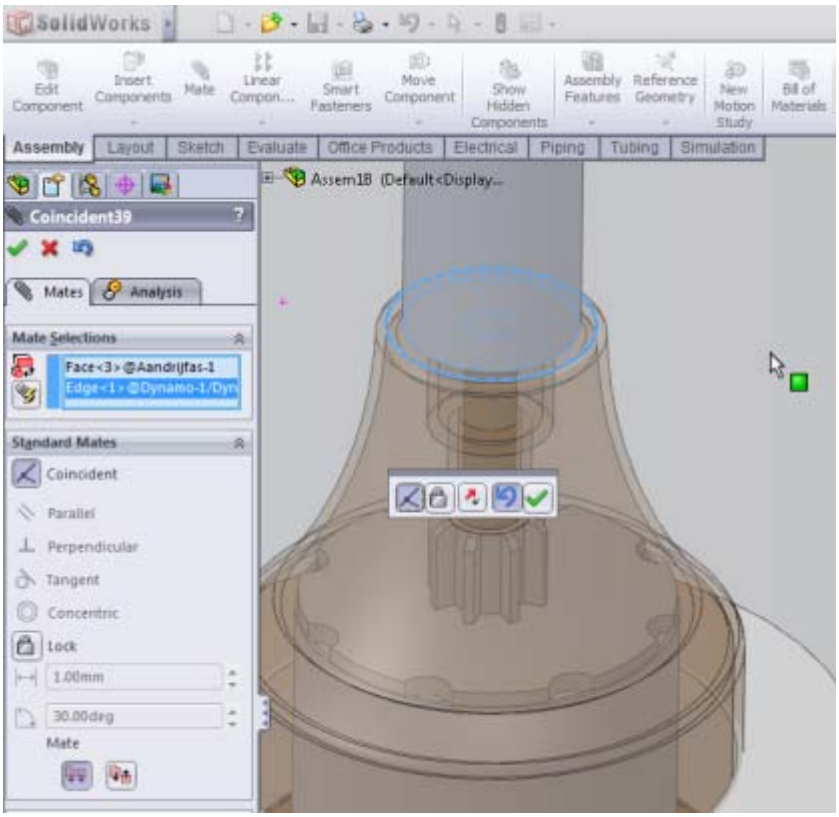
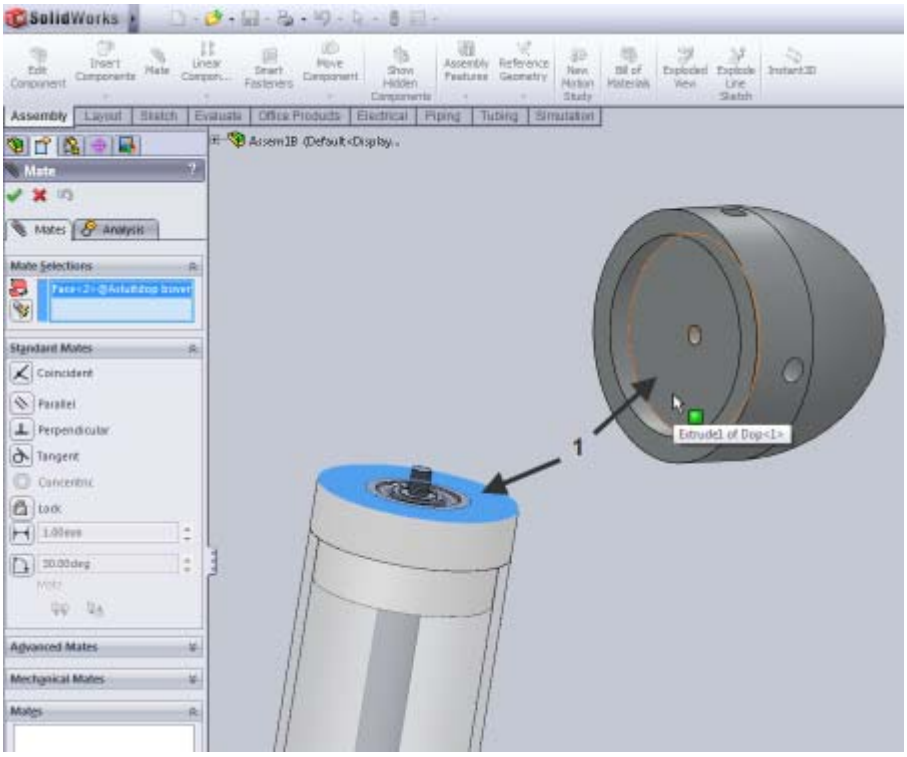
4. Click OK: 

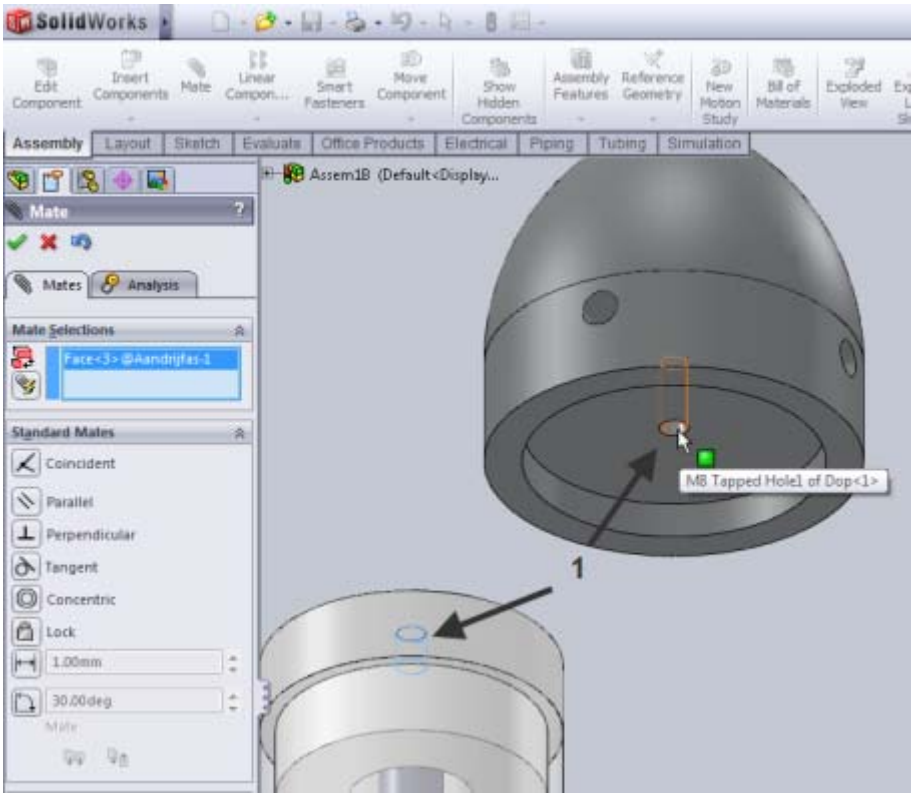
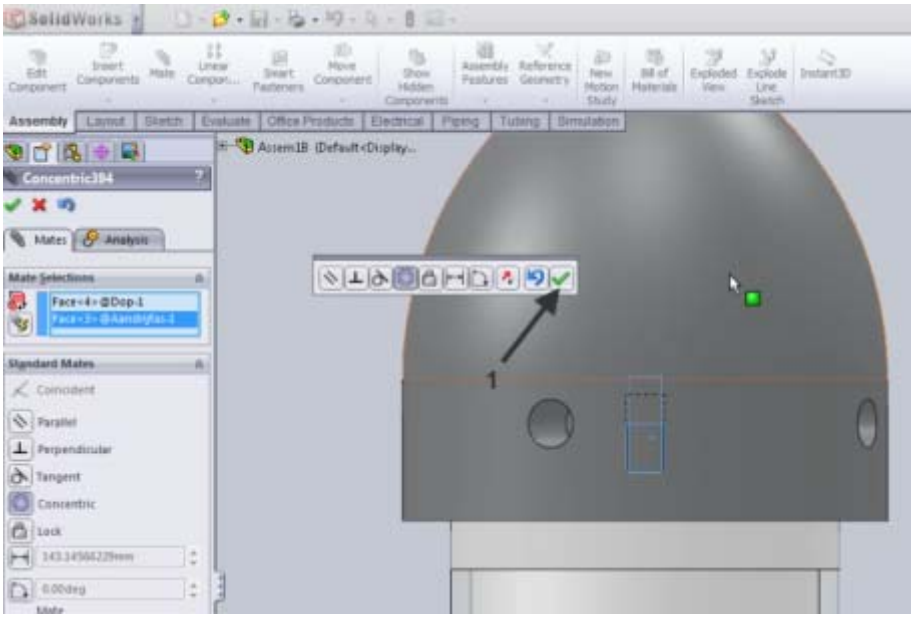
5. Click OK once more:

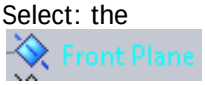
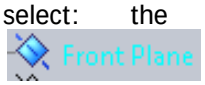
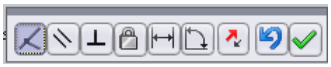
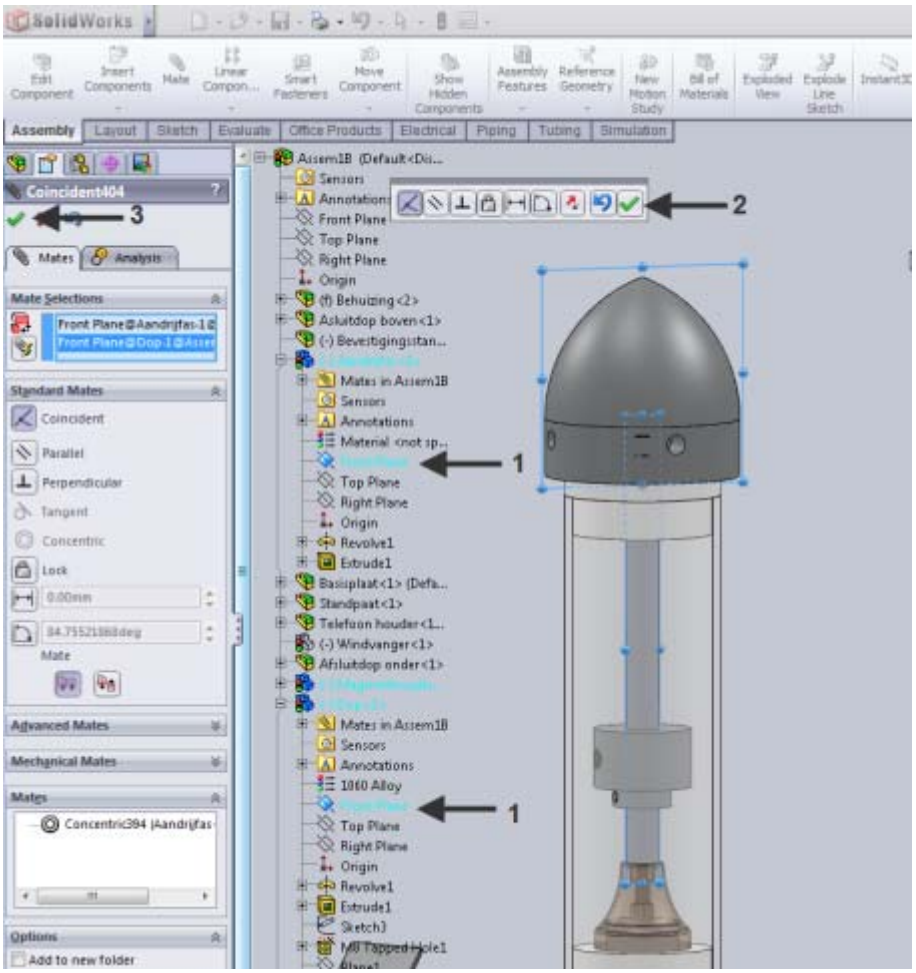
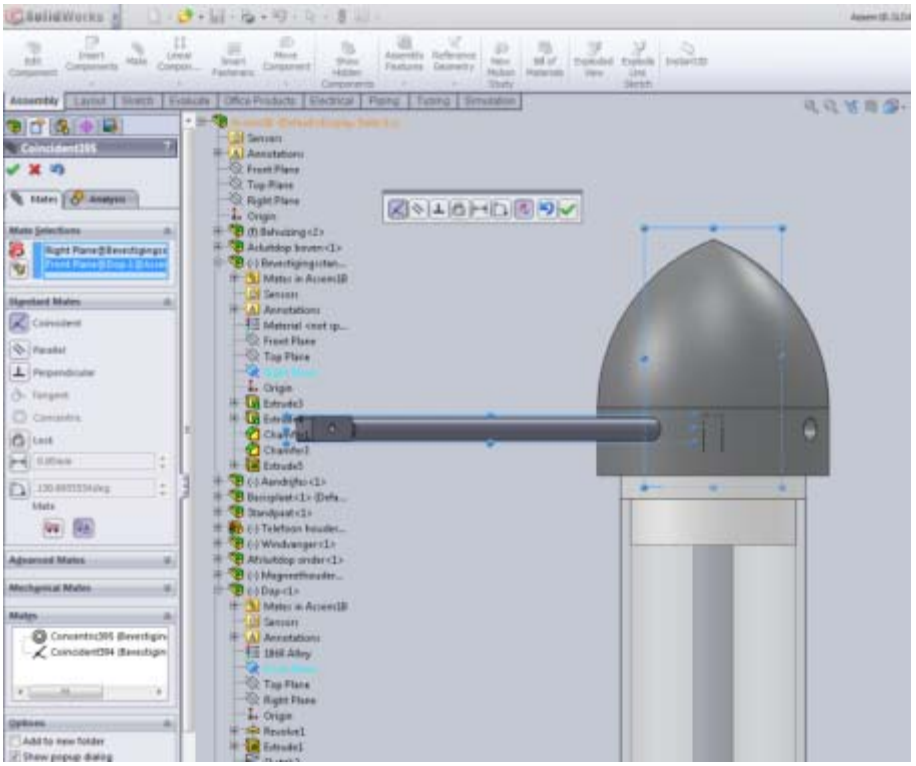


55	Select the bottom of the hole of the: **bottom end.**	
56	**1.** Select the bottom of the hole of the dynamo. **2.** Then select the mate:  **3.** Enter 4.17mm:  **4.** Click OK: 	

57	**1.2**. Select the faces as in the figure: **3.** For mate enter:  **4.** Click OK:  **5.** Click OK once more:	
58	Now mate the shaft of the dynamo to the hole of the shaft. See the figure!	

59	Complete the mate by linking the bottom of the shaft and the top of the dynamo.	
60	Now is the time to put the **cap** to place. **1.** Click mate and select the upper face of: **cap internal** and the inner face of **top end.** Mate these two pieces together.	

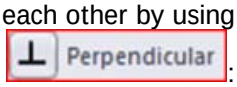
61	**1.** Select the threading of the shaft and the threaded screw hole M8 of the cap.	
62	Click OK once.	

63	**1.** Select: the  of the **<u>shaft,</u>** Then select: the  of the **<u>top end.</u>** **2.** Click OK.  **3.** Click OK once more:	
64	Mount the wing arm to the top end. Use the following mates to do that. Concentric for the shaft/hole assembly. Coincident for the end shaft / end hole mount. Finally, use Planes to straighten the wing arm. See figure.	

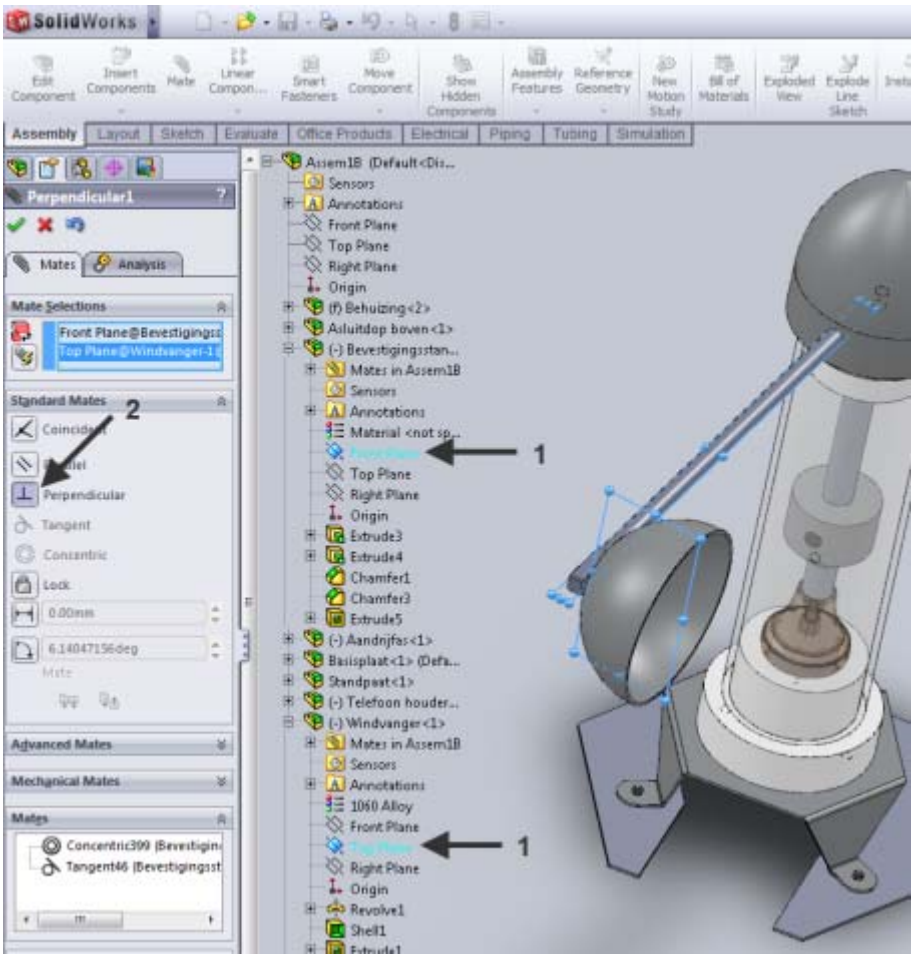
65

Now you can mount the windblade.

First, make a connection between the holes (Concentric). Next, link the outside of the windblade to the wing arm.

1. Finally, choose the Front Plane of the wing arm and the Top plane of the windblade.
2. Put them straight to each other by using 

:

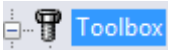


66

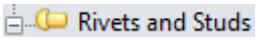
Get the piece:

from the Toolbox.

Double-click the following pieces

1. 

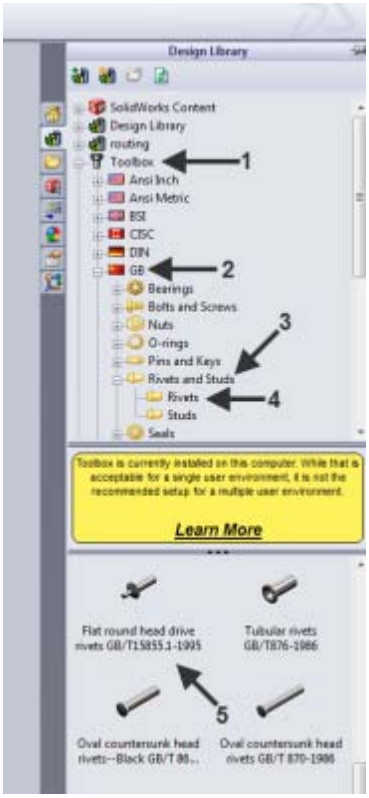
2. 

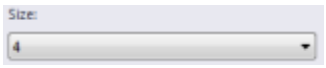
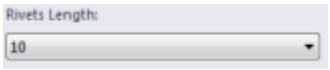
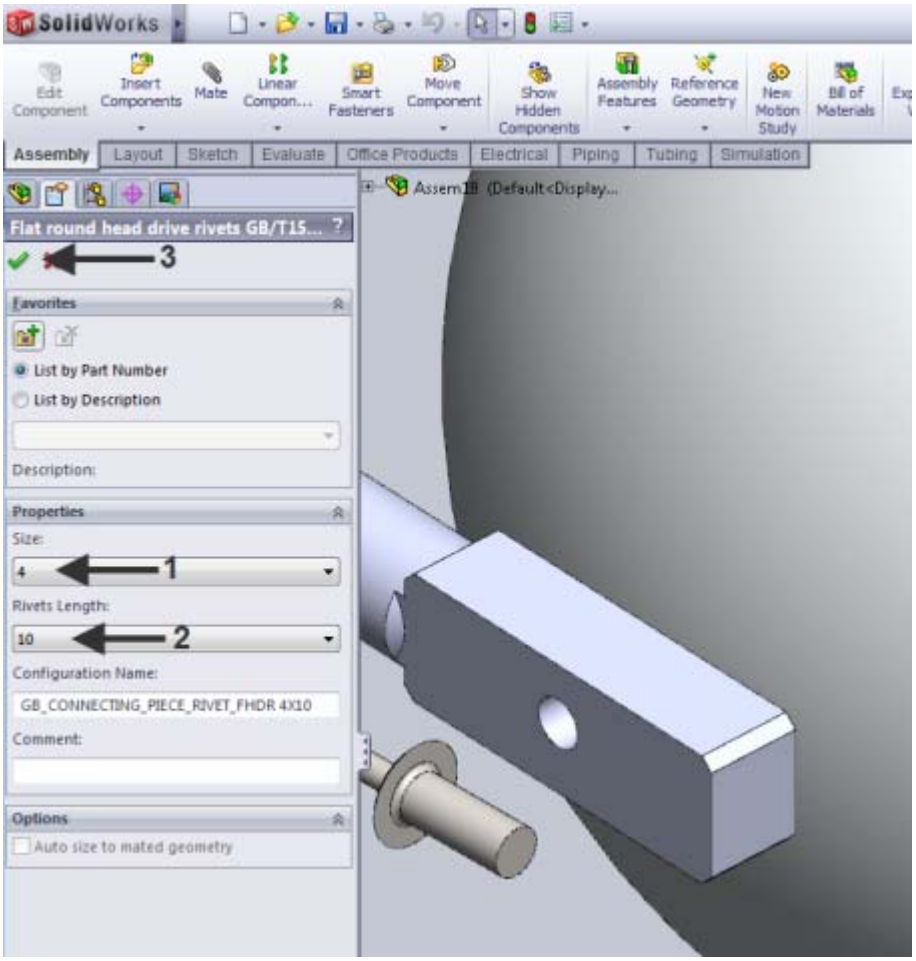
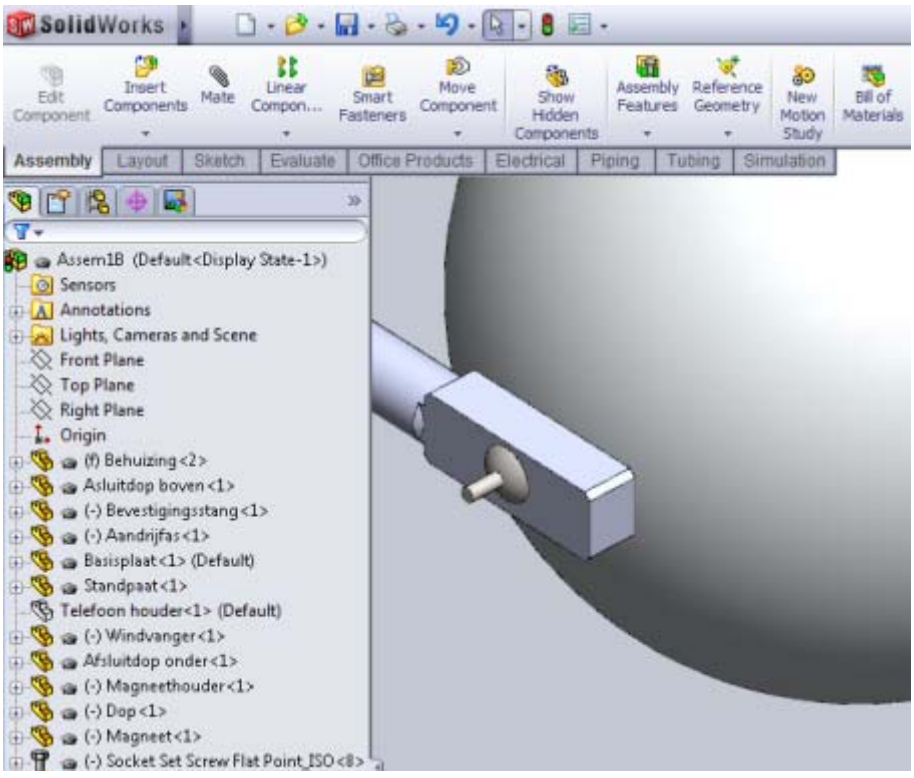
3. 

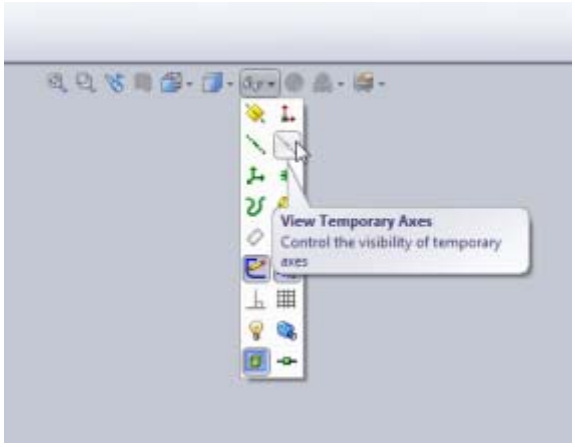
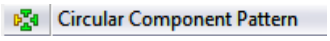
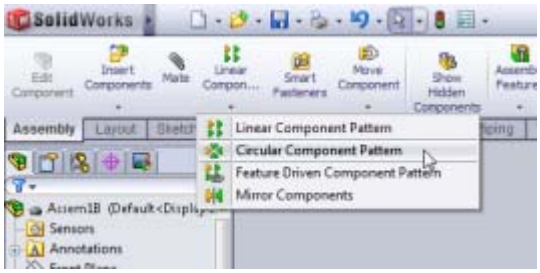
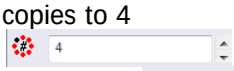
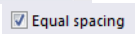
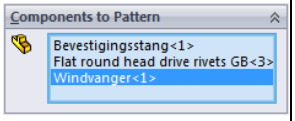
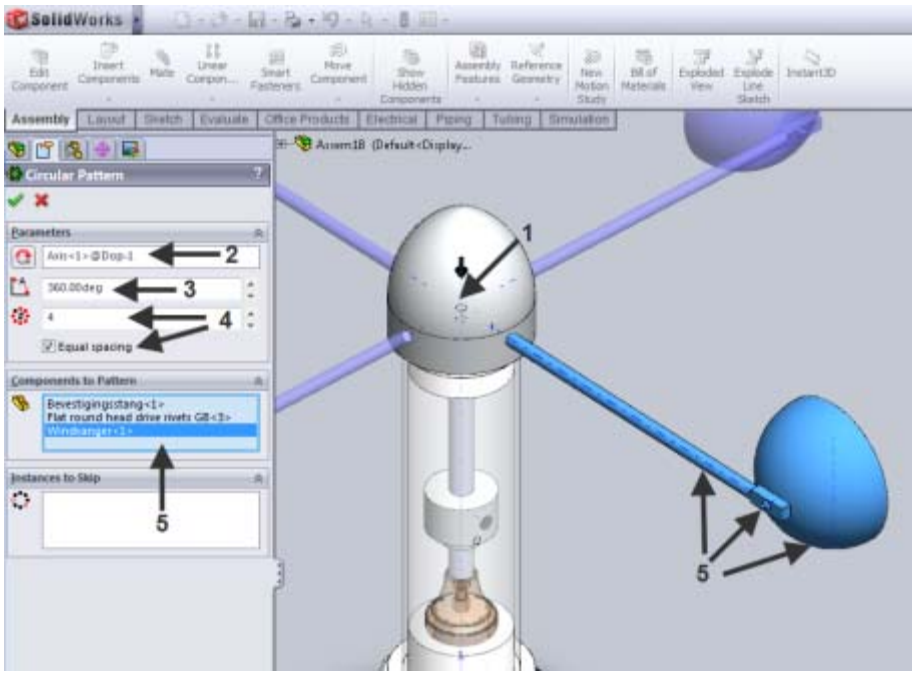
4. Choose 

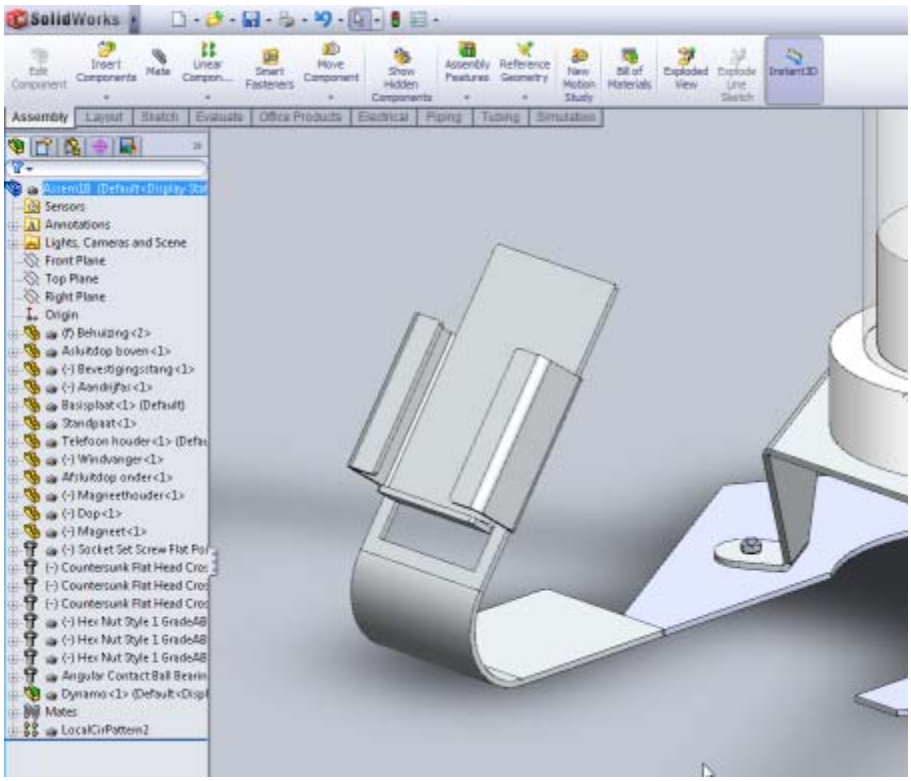
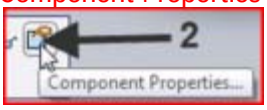
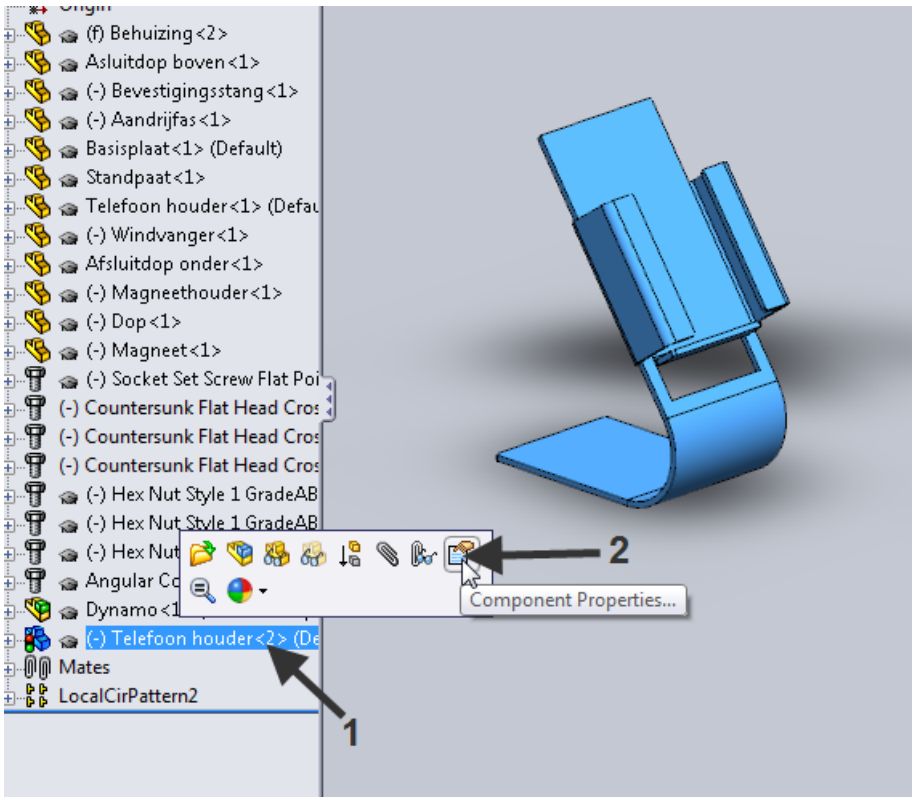
5. Drag 

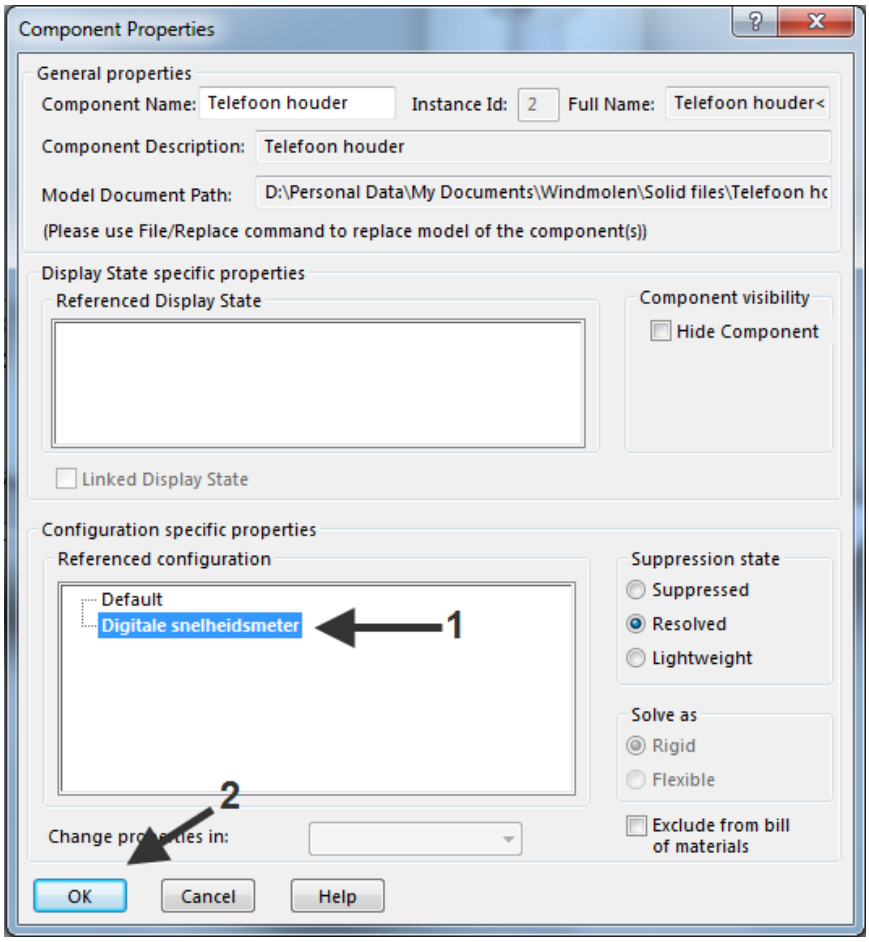
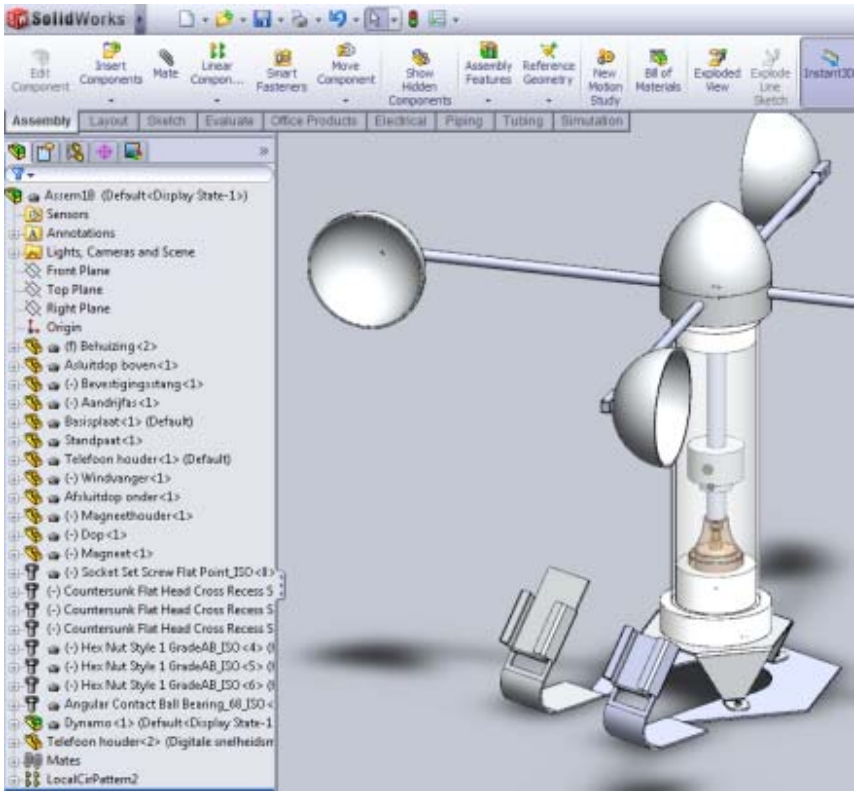
to the hole of the **top end.**

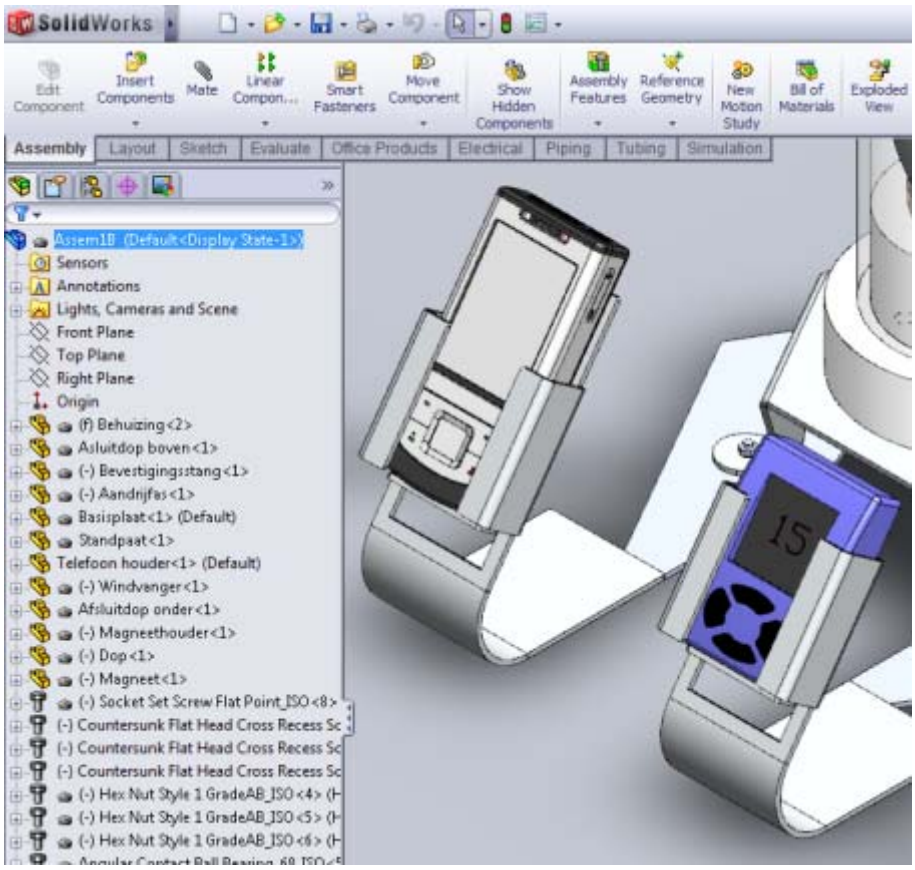
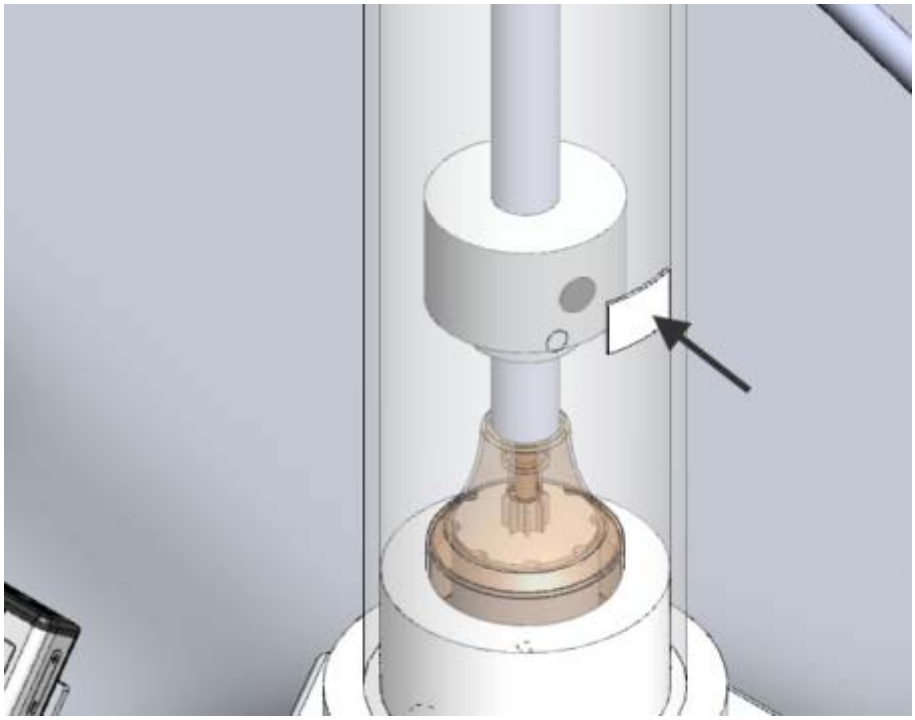


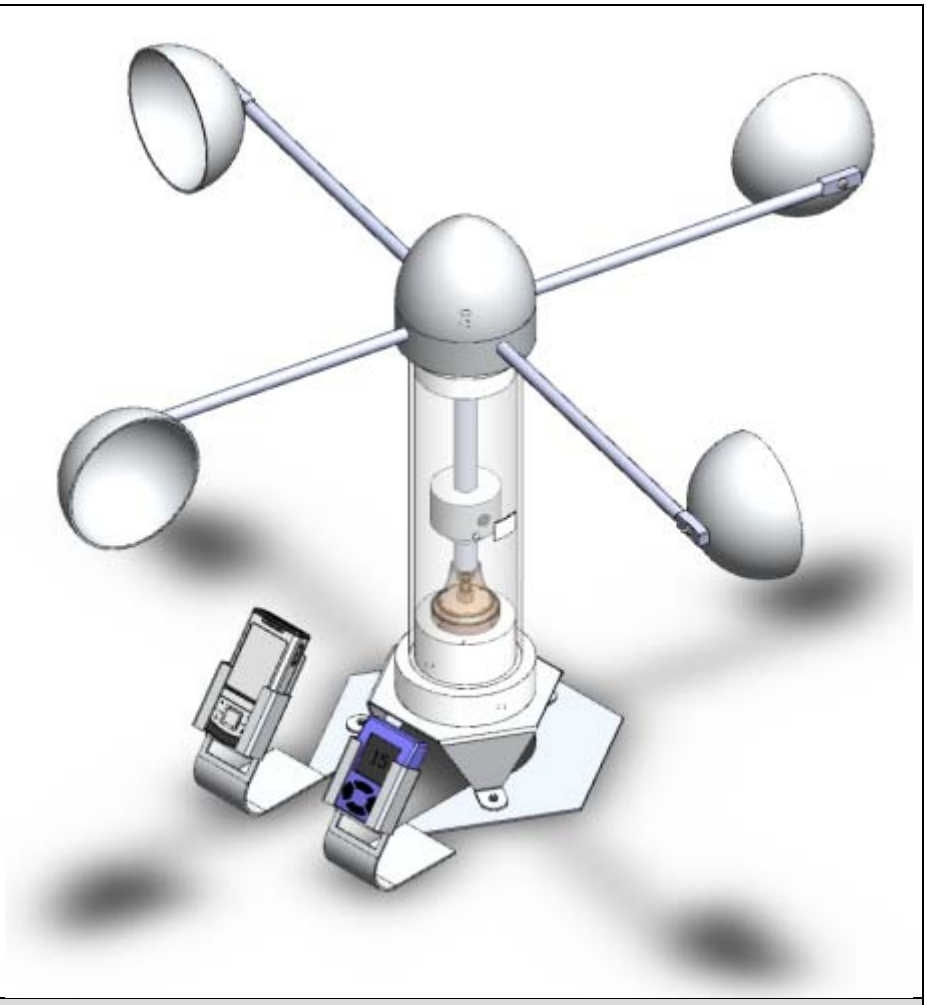
67	Choose the following: **1.** Rivet size:  **2.** Rivet length:  **3.** Click OK. In the next screen, click Cancel.	
68	Mate the rivet and the wing arm.	

69	For the following features, we need a guideline running through the middle of the model. This axis already exists in the model, but is invisible (in the standard settings). **1.** Click Hide/Show Items  **2.** Make sure the button View Temporary Axes is activated. 	
70	Choose the function: 	
71	**1.** Choose the axis of the cap  **2.** The window displays which axis you have selected.  **3.** Enter 360° degrees  **4.** In Property Manager, change the number of copies to 4  and check:  **5.** Select the windblade, the wing arm and the rivet.  **6.** Click OK.	

72	Mate the phone holder as in the figure.	
73	Add the phone holder piece once more. **1.** In: Feature Manager, click the  **2.** Click: Component Properties 	

74	A new menu is displayed. **1.** Choose: Digitale snelheidsmeter **2.** Then choose: OK	
75	Mate it in the same way as the phone holder. See the figure.	

76	Insert the phone and the speed indicator. Next, connect the phone and the speed indicator to the phone holders.	
77	Finally, add the magnet detector to the assembly. Then, mate the magnet detector, the housing and the bottom end.	

78	When the assembly is ready, save the file as **Windmill.sldasm**	
79		List the most important things you have learned during this tutorial.