Shark

Software for the simulation of refrigeration equipment and air conditioners

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Shark: application description and scope

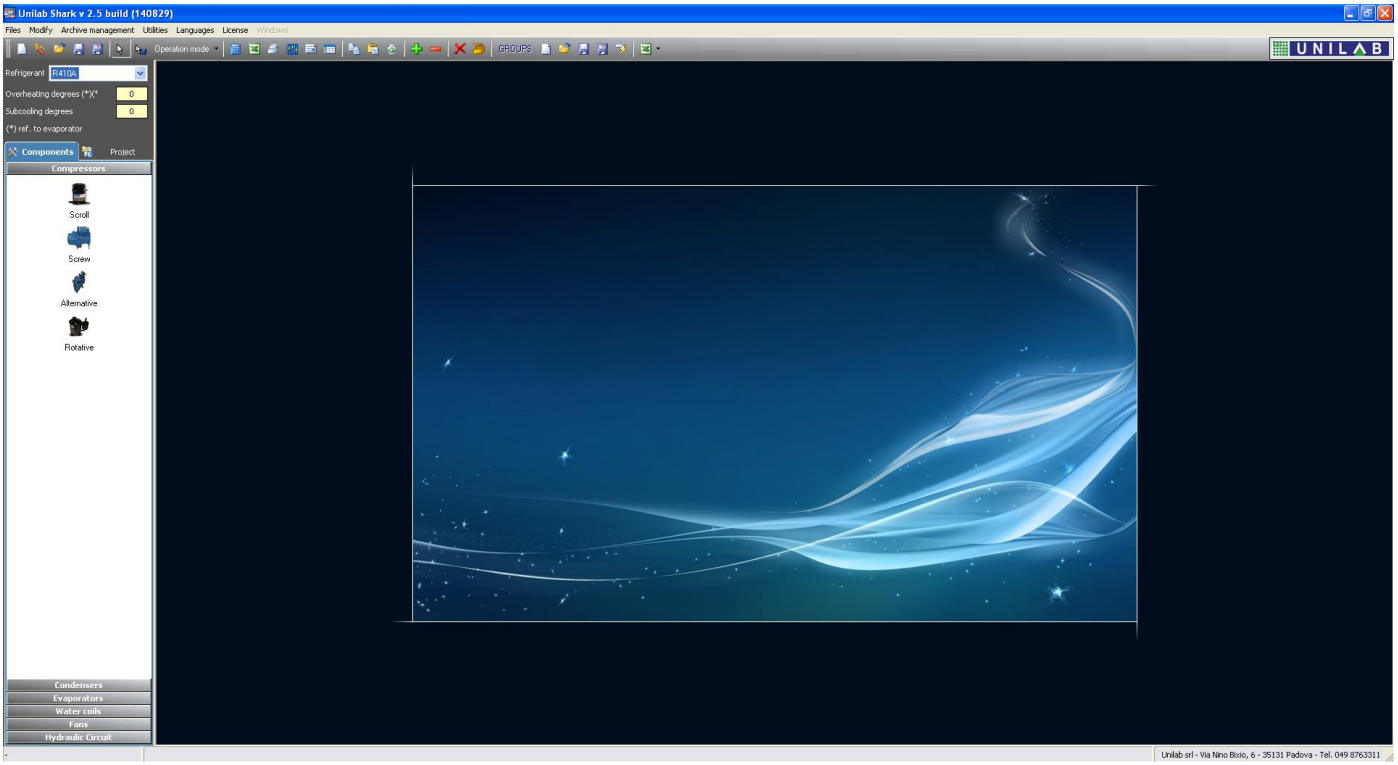
Shark is technical software developed by Unilab for the design and the development of liquid coolers, heat pumps and conditioners.

Shark is mainly a simulation program. Its aim is to allow the designer to specify the components of a unit, specify the working thermal conditions and perform a simulation of the unit's operating conditions. Once the simulation is done, it allows the user to create performances tables and datasheet, calculate the ESEER and IPLV of the unit, simulate its operation conditions at partialization and aggregate multiple units in a series. Within Shark the libraries of exchangers, compressors and of any other component are easily updatable: this guide will help the user in the data insertion and the calibration of them.

Starting Shark and program layout

First of all, we start the program by double clicking on its icon:

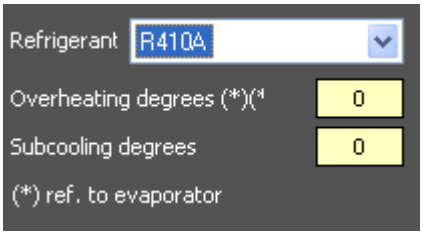
After the program has loaded, we see the main window of the program:



The main program's window is arranged in three different parts.

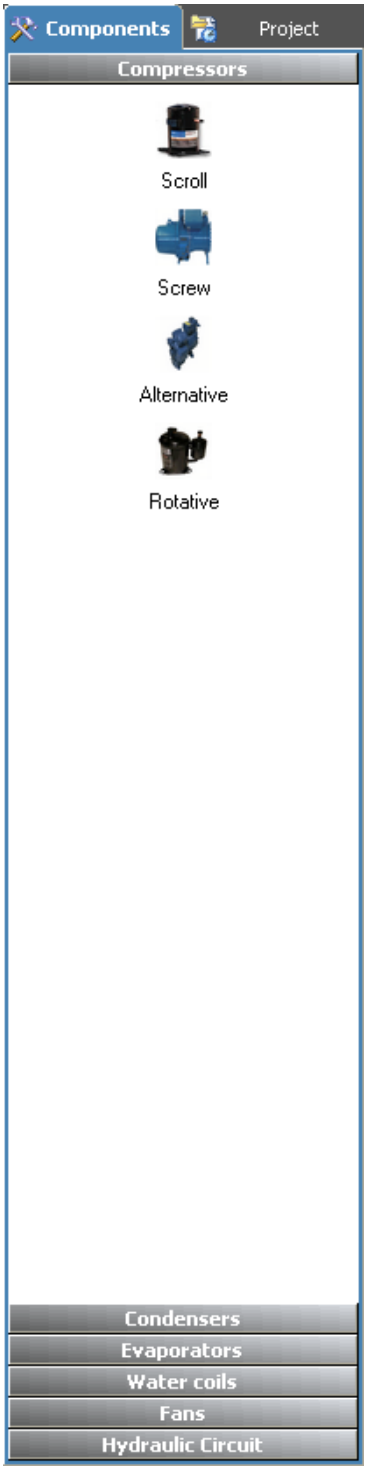
The top part contains the main tools:

Below this part, we see the most important parameters of the unit:



Overheating degrees in this mark is referred to the evaporator (if present). Condenser overheating will be requested during calculation.

Below, but on the left shoulder of the window, there's the components selection area (here on the right):

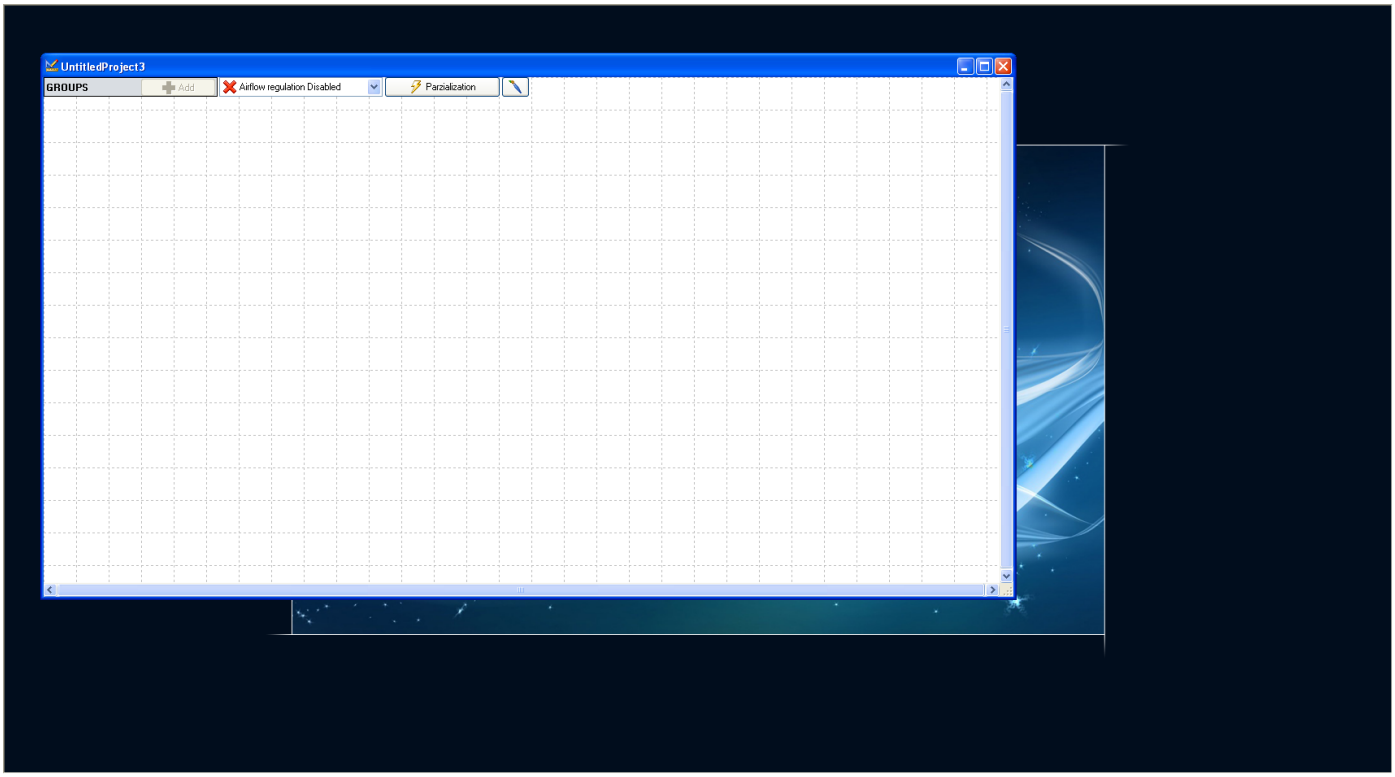


By clicking one of these icons, the corresponding component will be added to the project.

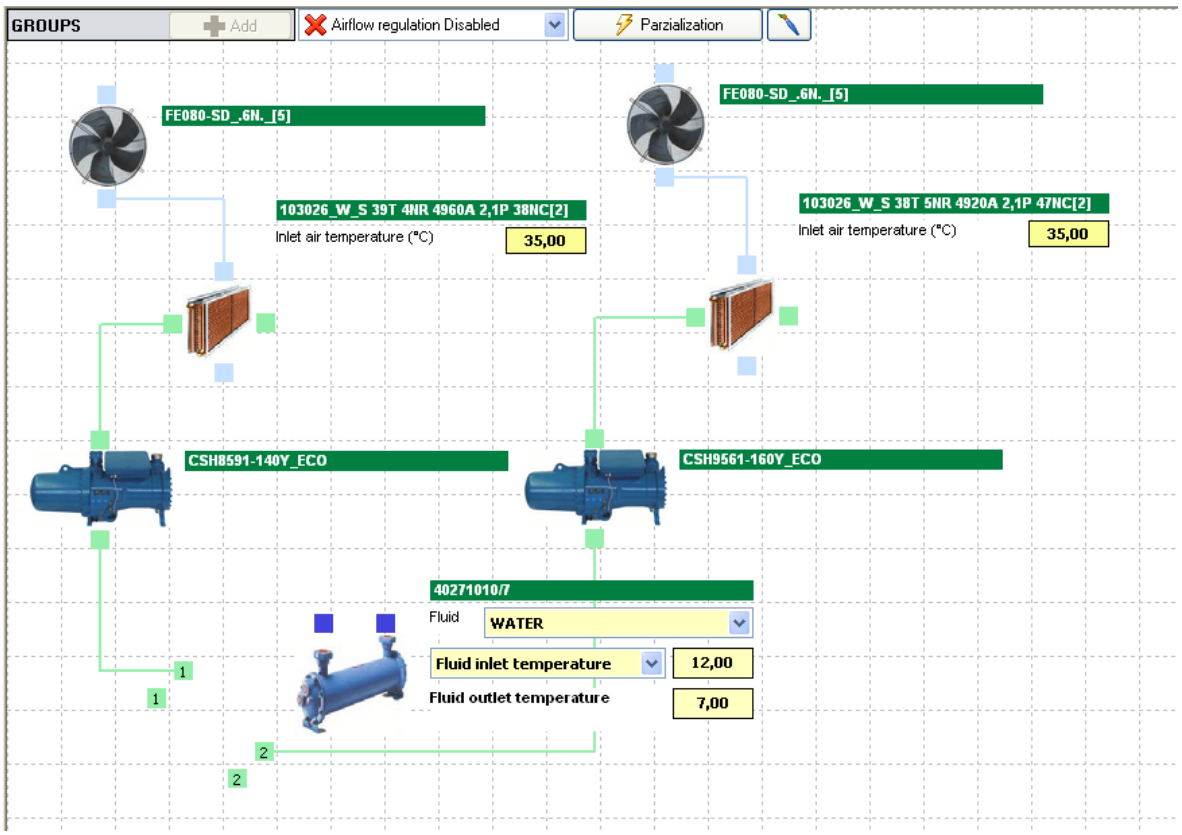
PLEASE NOTE:

Each icon represents a GROUP of components of the same type, not a sole component.

The central part of the window represent the design area, where multiple projects can be loaded:



Usually a unit in the design area looks like this:



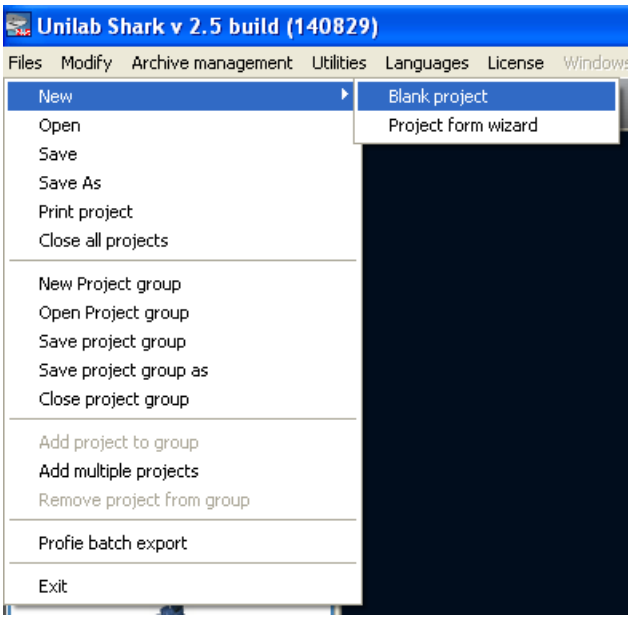
Performing the simulation

Air water chiller

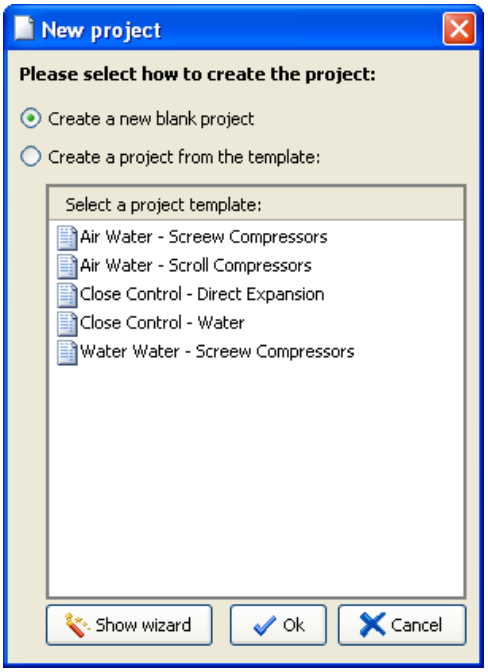
For a better understanding of the main functionalities of the software Shark, let's start with creating an Air Water chiller project.

Creating a new project

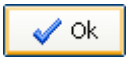
Now we can create a blank project:



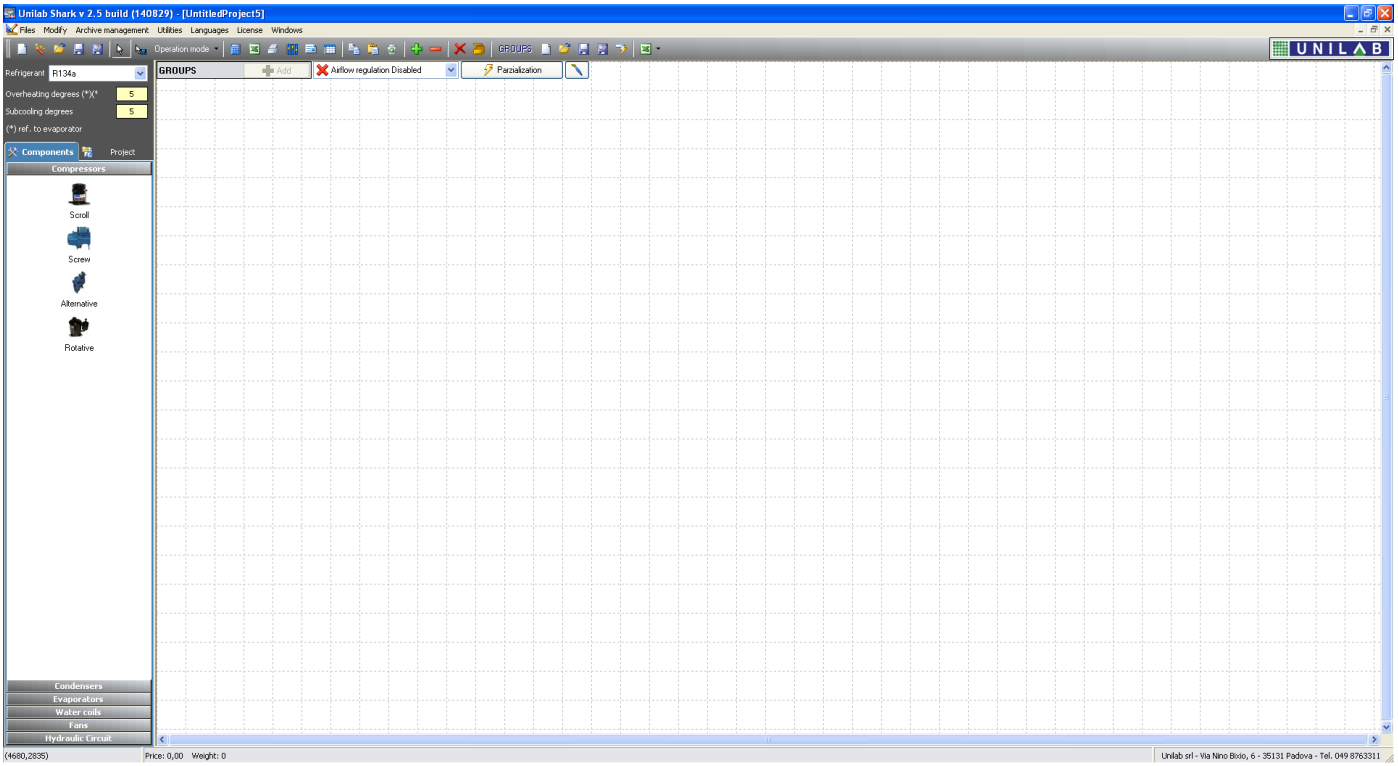
A new window will appear, that lets you load a project template. Select again "Create a new project":



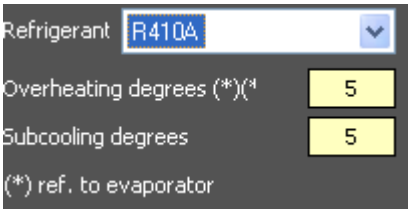
Now click "OK" to continue:



A new blank project will appear:



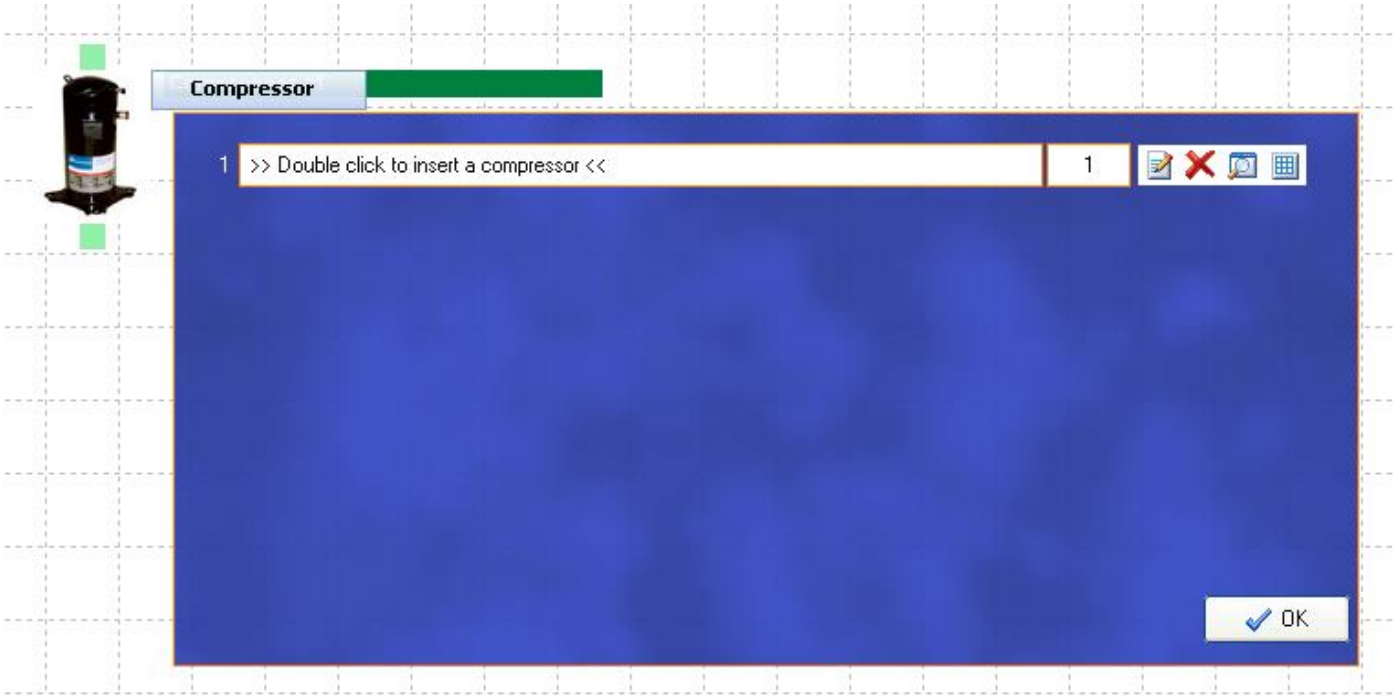
Now we should set the main settings of the project:



Adding components to the unit

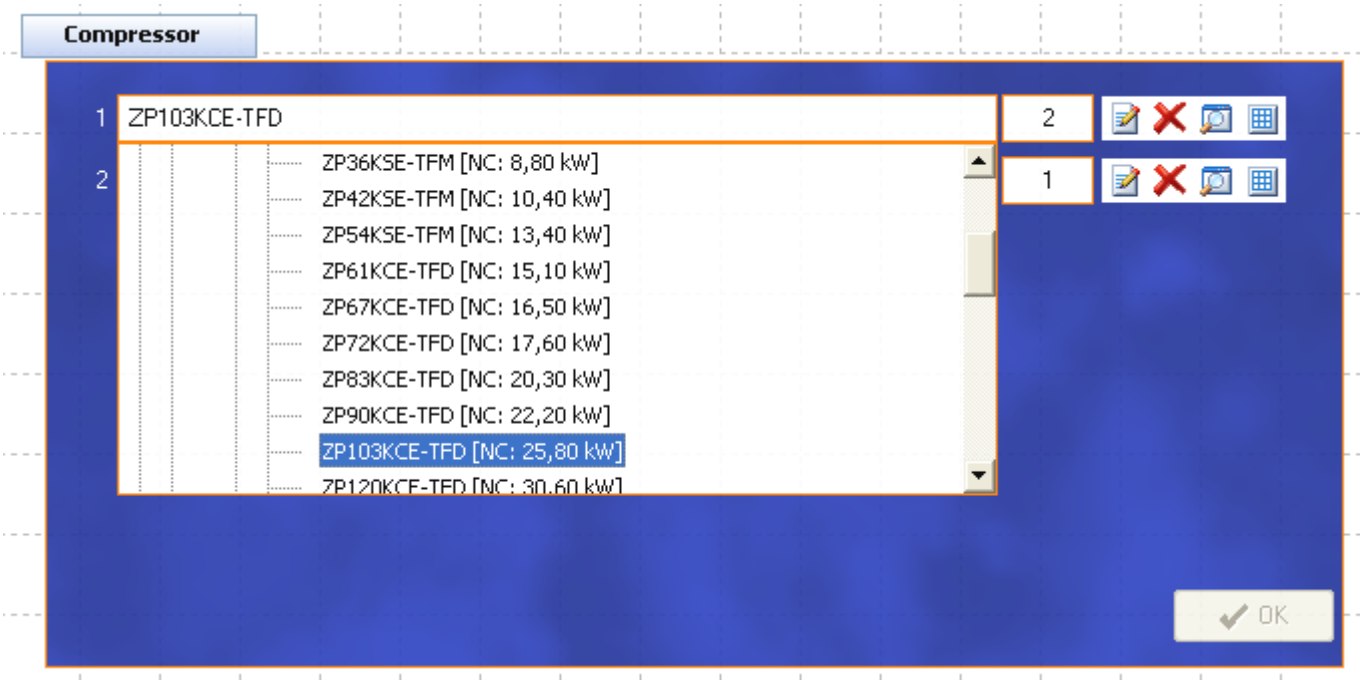
First click on the compressor in the left side of the program's window:

A new compressor group icon will be added to the project:

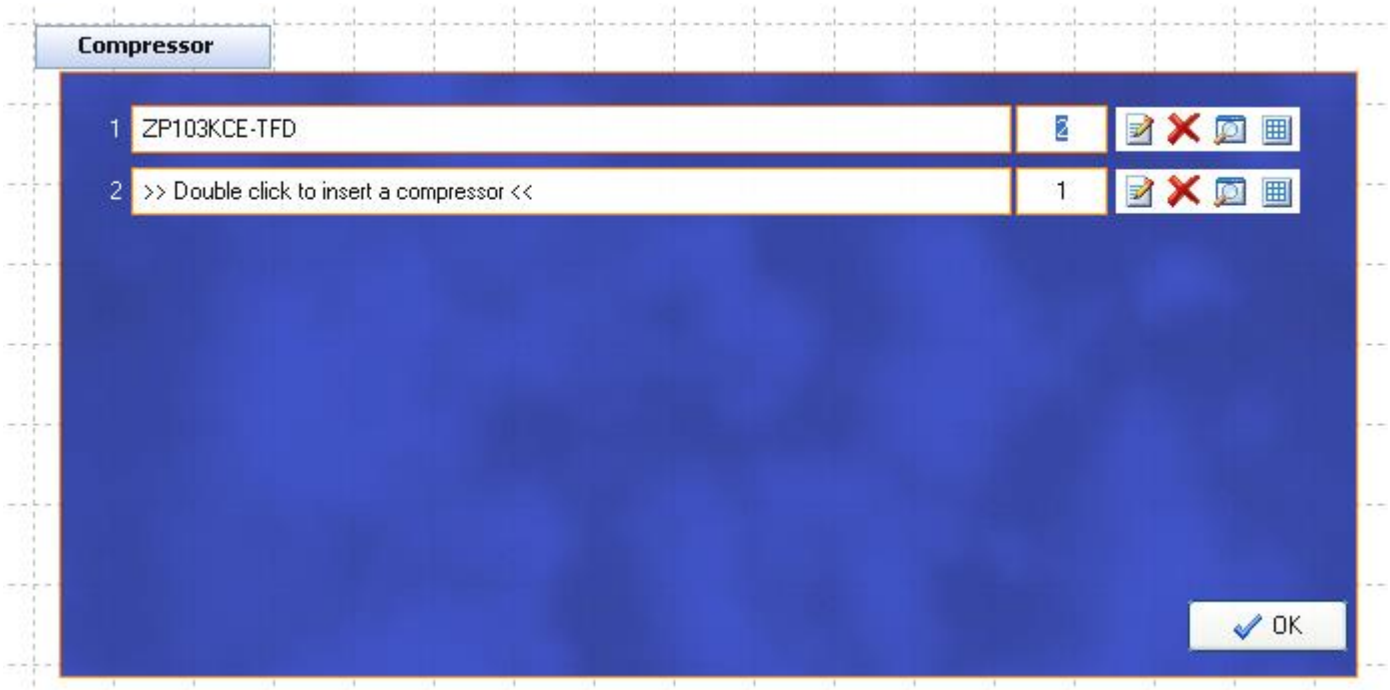


PLEASE NOTE:
Each icon represents a GROUP of components of the same type, not a single component. Multiple scroll compressors for example, should be specified in the Quantity box, next to the model.

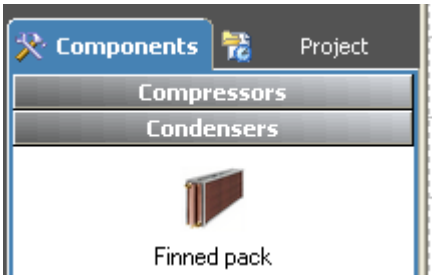
Now we should select the model of the compressor, just by doing a double click on the model field:



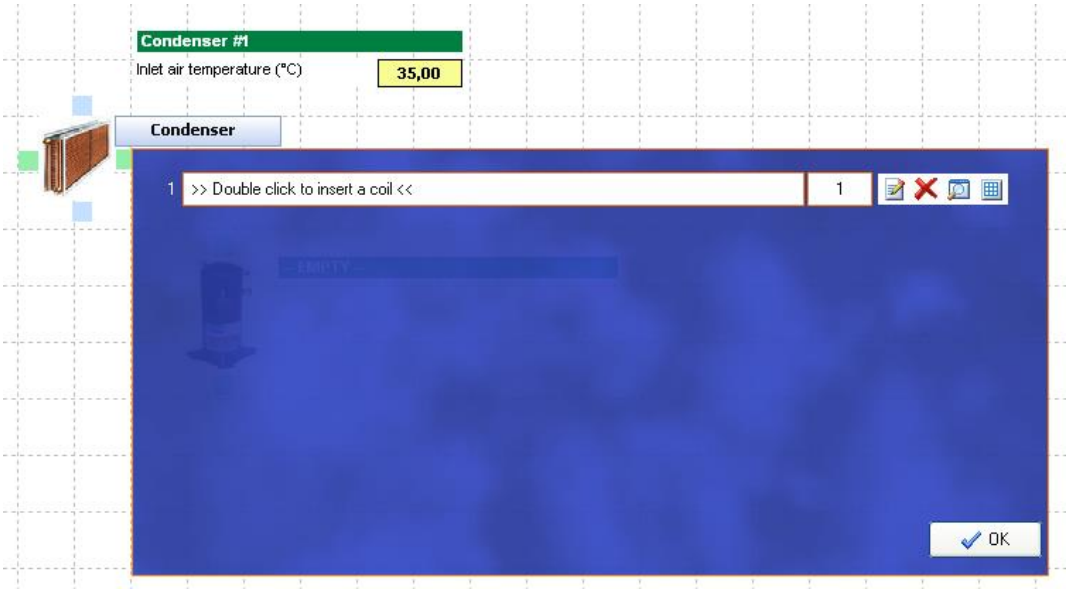
After selecting the compressor model wanted, we should set the number of compressors in tandem of the same type, by specifying its quantity in the field next to the model:



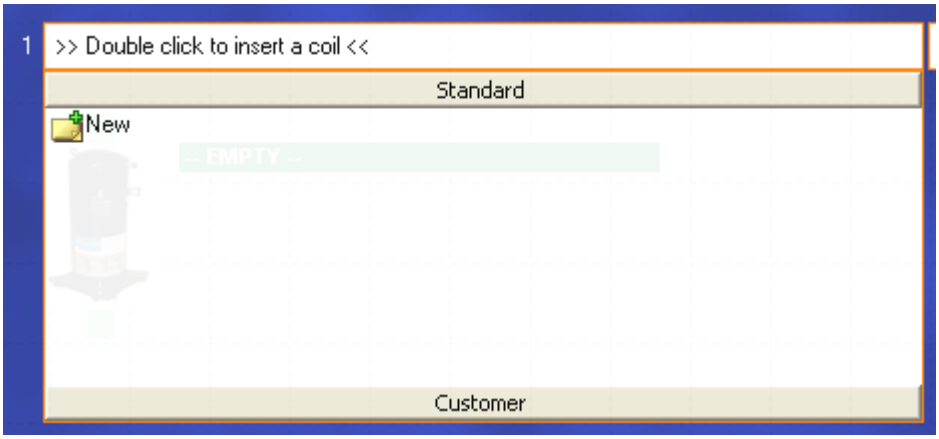
Let's now add the condenser of finned pack type:



A new condensers group will be added to the project:



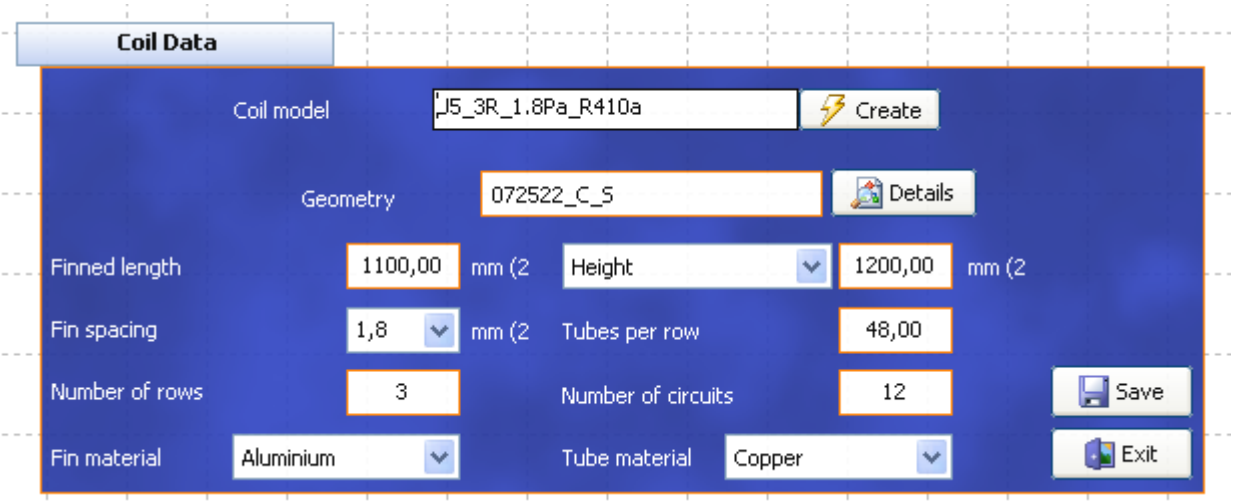
When we double click on the model field, we can see the following:



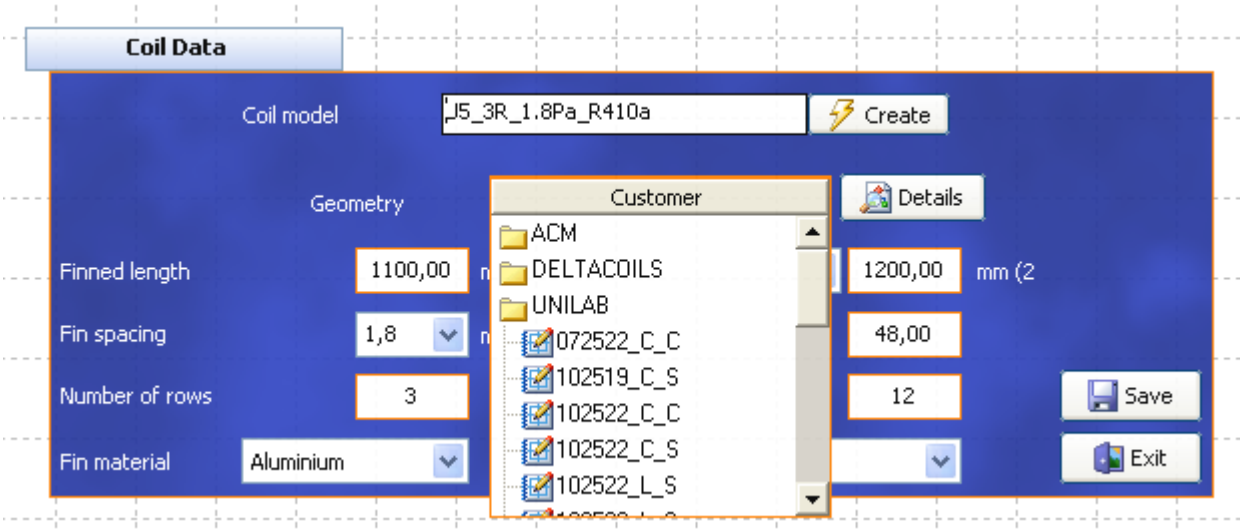
As you can see the list of coils is empty. Let's click on "New" to add one.

PLEASE NOTE:
There's a big difference in the Standard and Customer tabs shown here. Please refer to the section "The two databases structure of Shark". Please also note that coils from the Customer Archive can use only geometries from the same corresponding database, and that is the same for Standard Archive.

Let's now specify the coils parameters like the following:

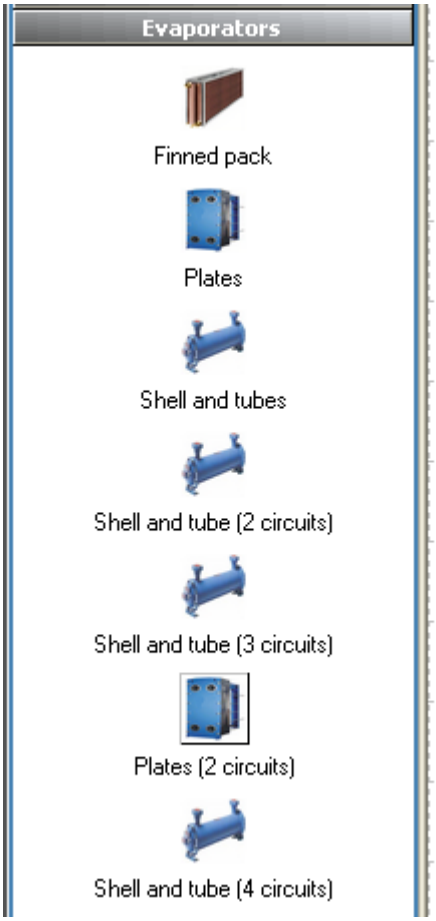


Please note the geometry selection, which is loading from Customer database because we are adding this coil into the Customer database:

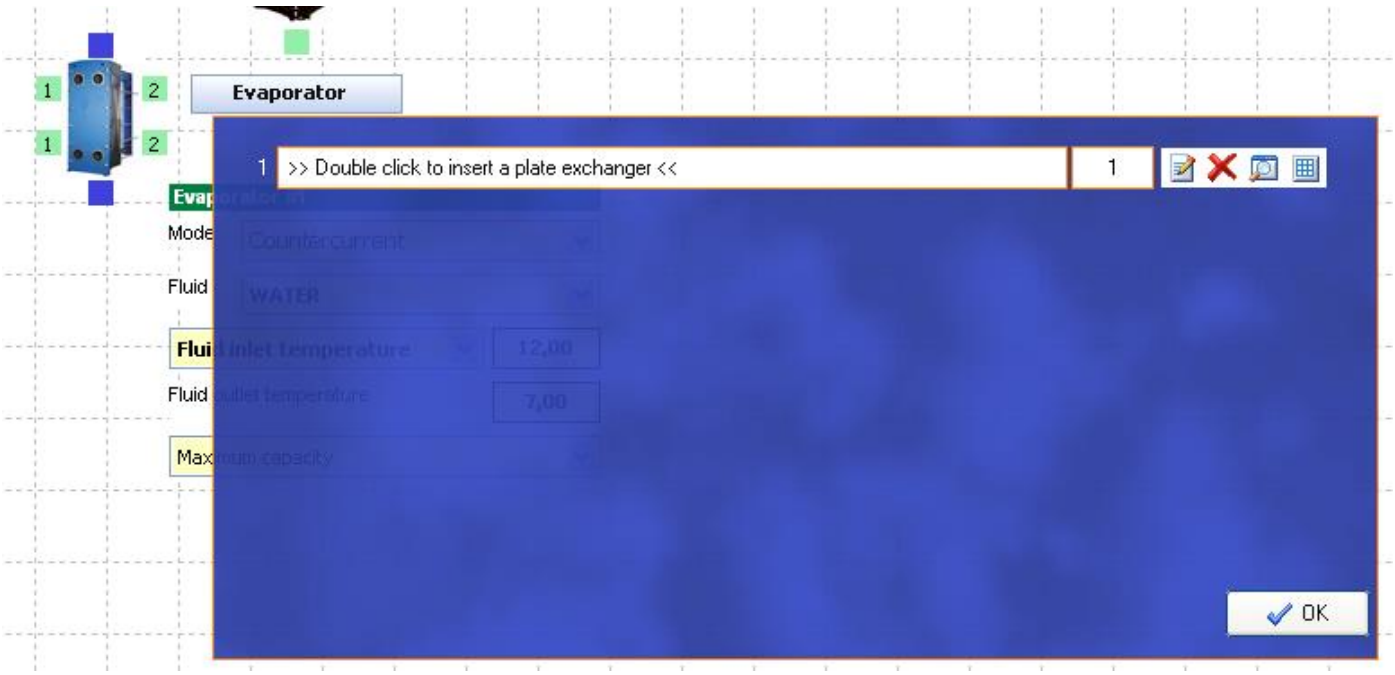


Once ready, click "Save" to continue.

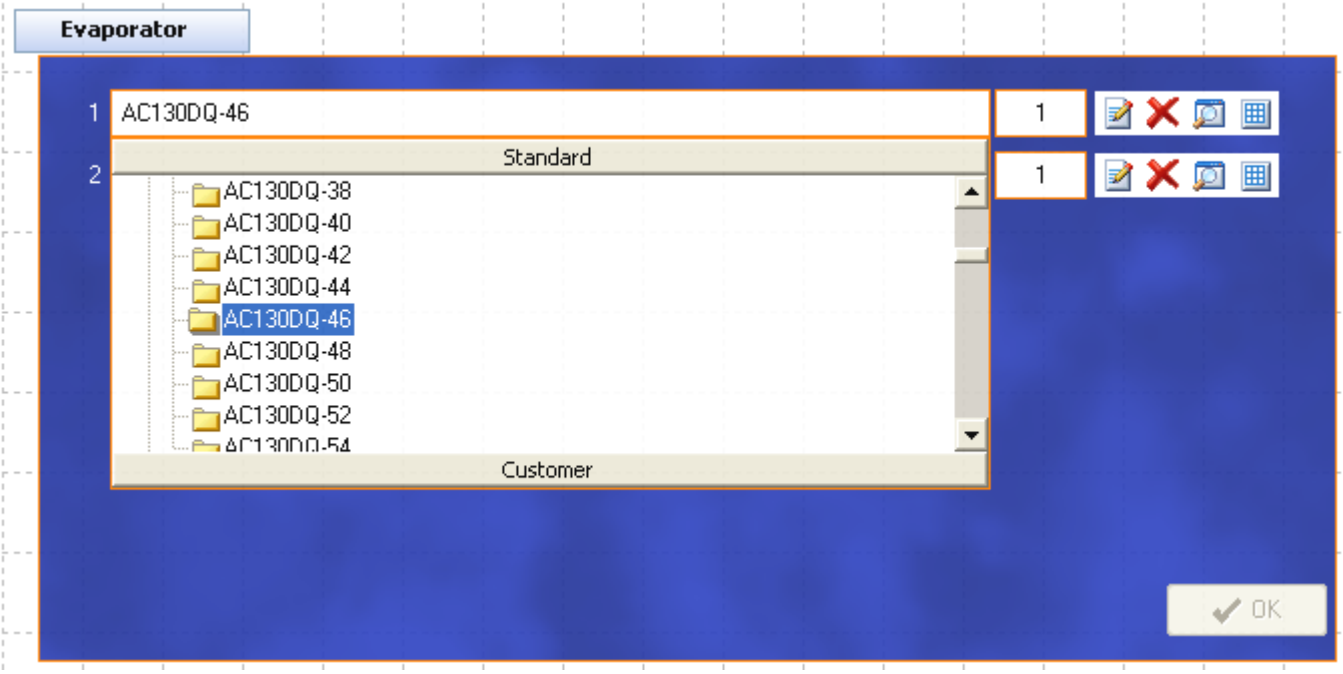
Now let's select the evaporator, which will be a plate heat exchanger. We will develop a new double circuit unit, so we have to select a "2 circuits plate heat exchanger":



Now a new plate evaporator (2 circuits) group will be added to the project:

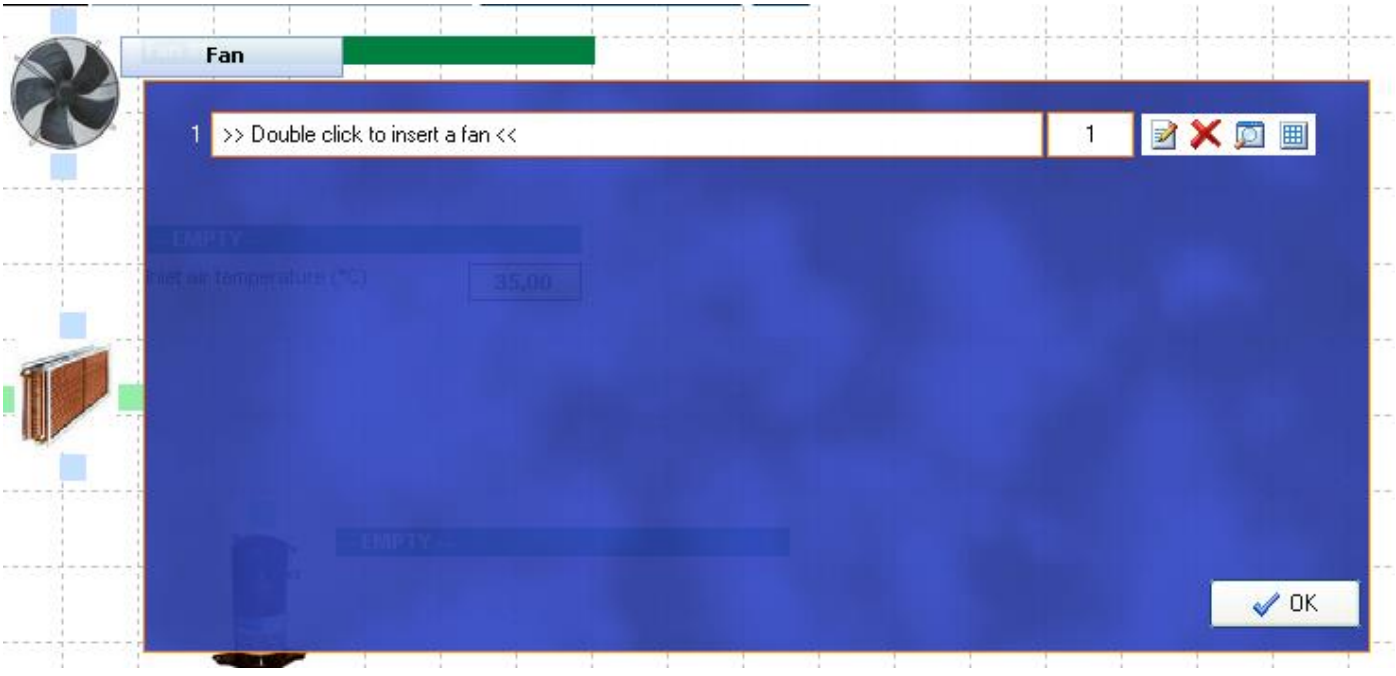


In the usual model field, double click to select the model that we want for this project:

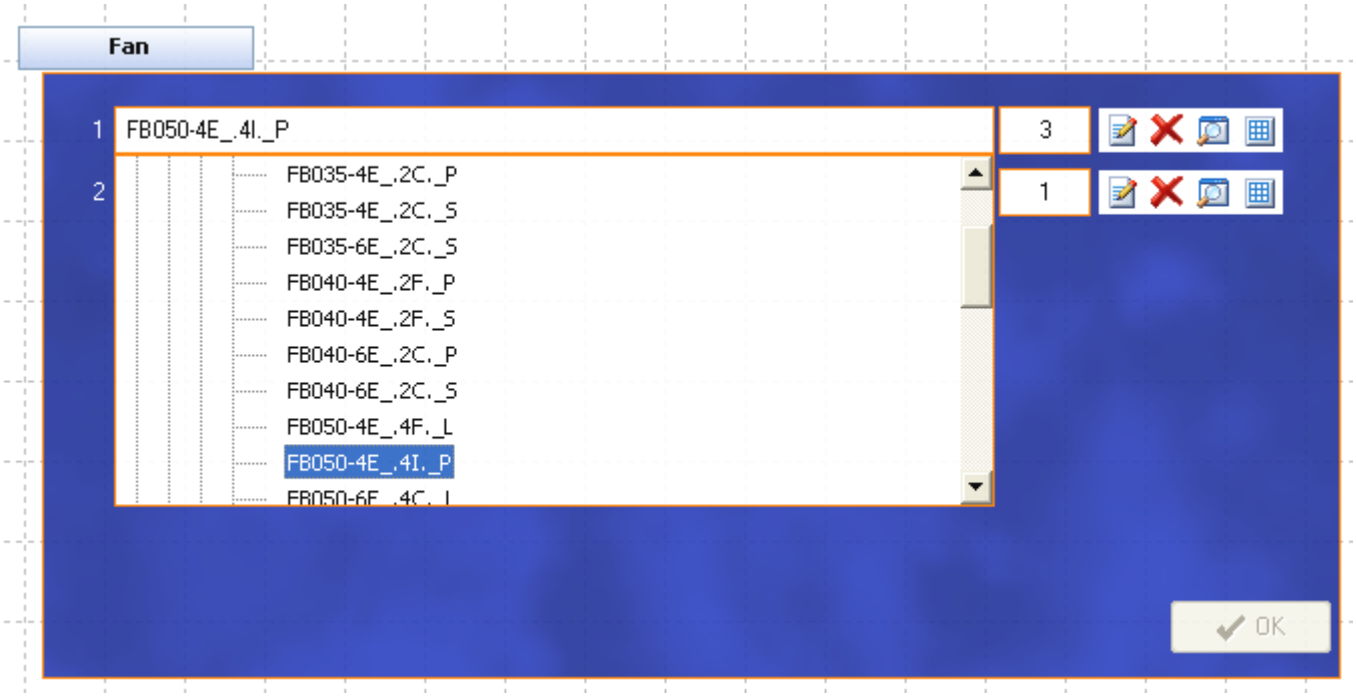


Let's now add a fan to the project. We will use a monophase axial fan:

A new fan group will be added to the design area:



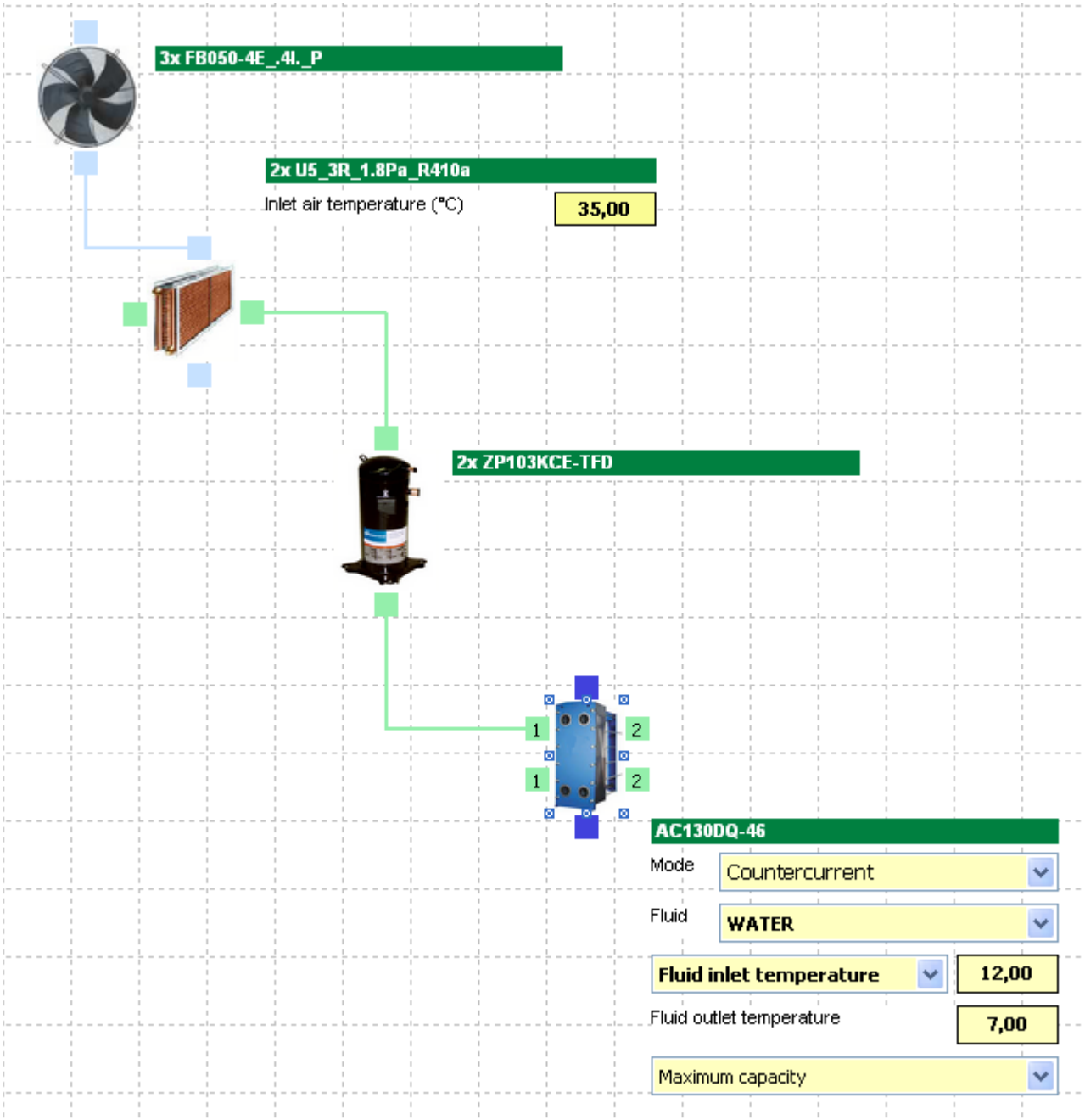
We double click to select the model, a Ziehl Abegg one:



And we specify 3 fans for the same coil:

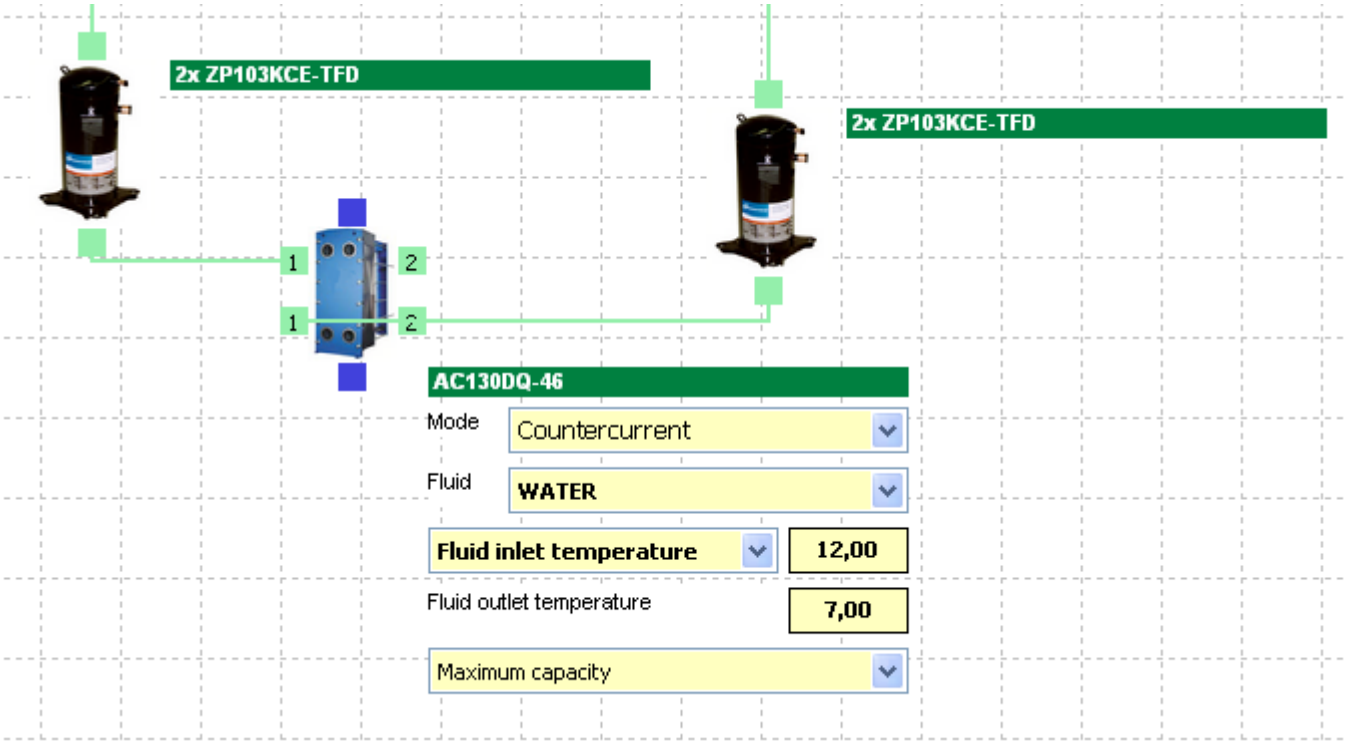
Linking components together

Now we should link the components together so that the program can understand how they are working. This is simply obtained by dragging a line between the link boxes of the same colors, independently from their position. The result should be like this:



The green links are for the refrigerant circuit, the blue links are for the water circuit, and the grey links are for the air flow.

PLEASE NOTE:
For exchanger of multiple circuits, like the plate evaporator above, the number in the box represent the circuit identification: 1 means circuit one, and 2 means circuits two. They shall never be linked like this:

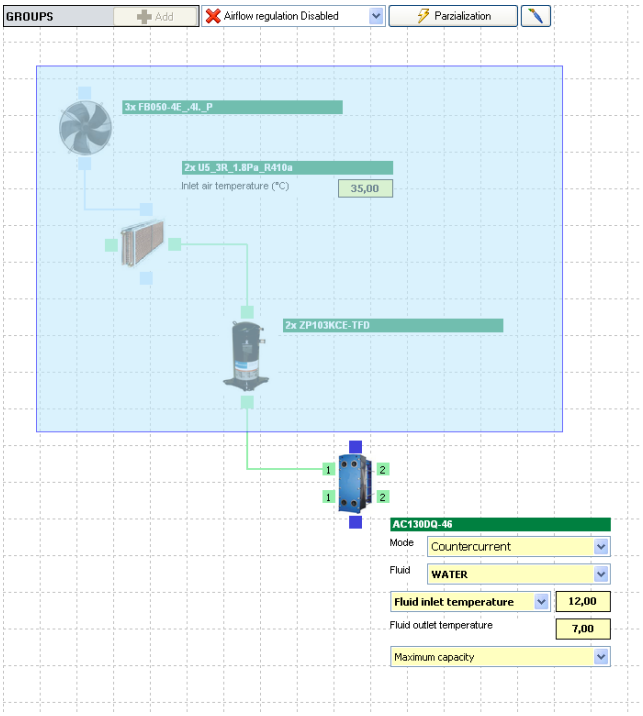


This is wrong, because the program will misunderstand the circuiting of the unit.

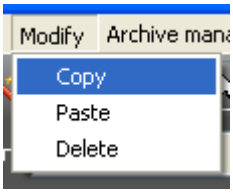
Using Copy/Paste to shorten the process

Let's now duplicate the first circuit to create the second circuit, by using the Copy/Paste tool.

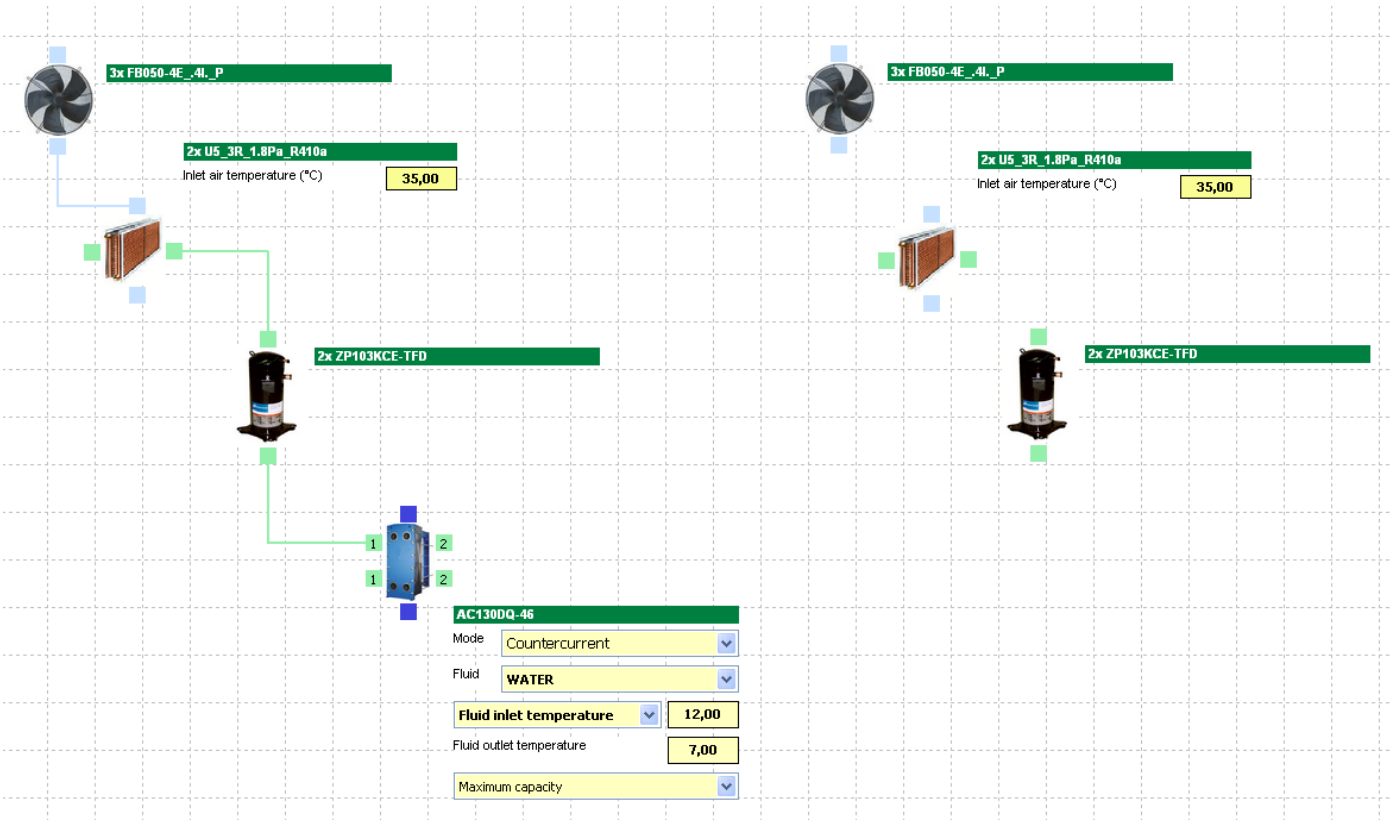
First we just draw a rectangular selection over the three components that we want to duplicate:



Then we click on the "Modify" Menu, then "Copy":

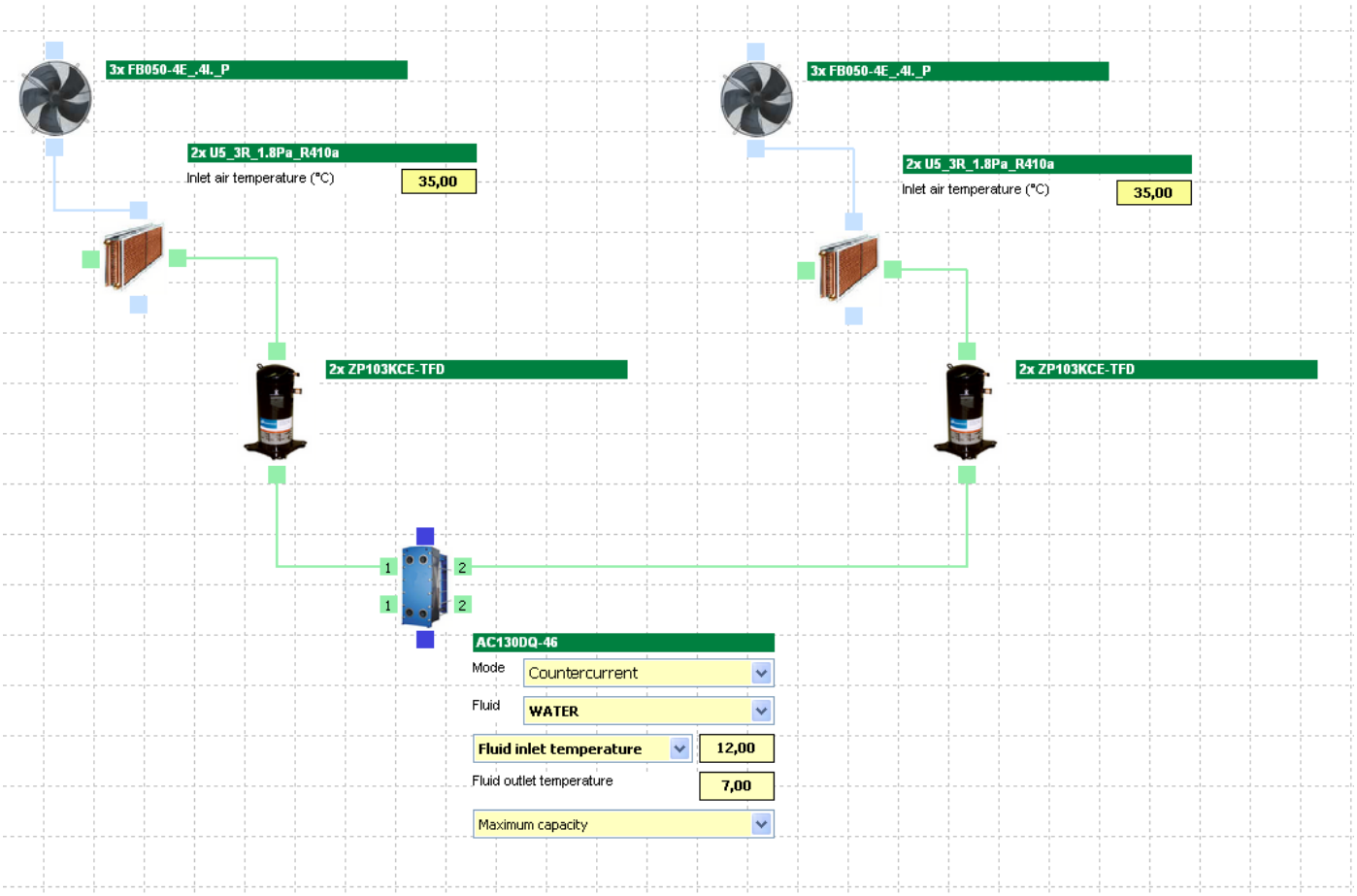


Then we click on "Paste" on the same menu and we will get this result:



PLEASE NOTE:
Sometimes the program will overlap the components and it will look like nothing happened. Please move the components one by one manually to get result above.

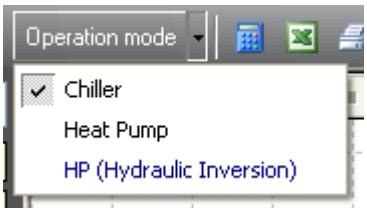
Now we shall complete the circuiting like the follow:



Performing calculation in chiller mode

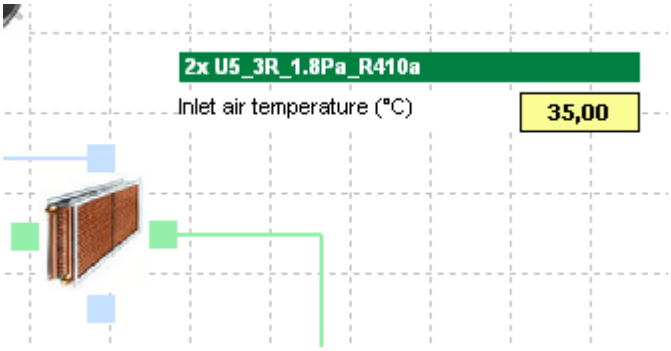
First of all, we have to check the calculation options. Firstly that we have selected the whole unit calculation mode:

And the operation mode is set to "Chiller":

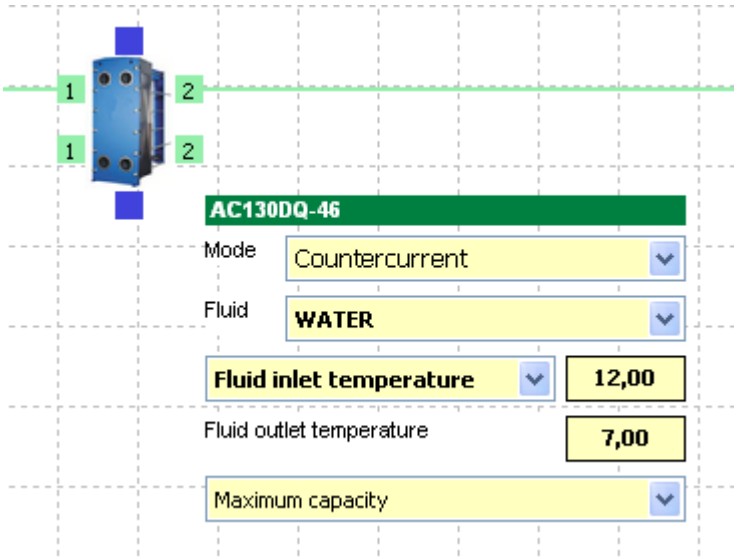


Now we shall check the exchanger's fluids conditions.

First the condenser finned pack air inlet temperature, to be repeated for the two circuits:

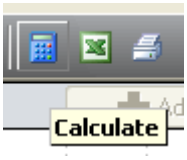


Then the fluid / calculation conditions for the evaporator (please note the Countercurrent mode is selected):

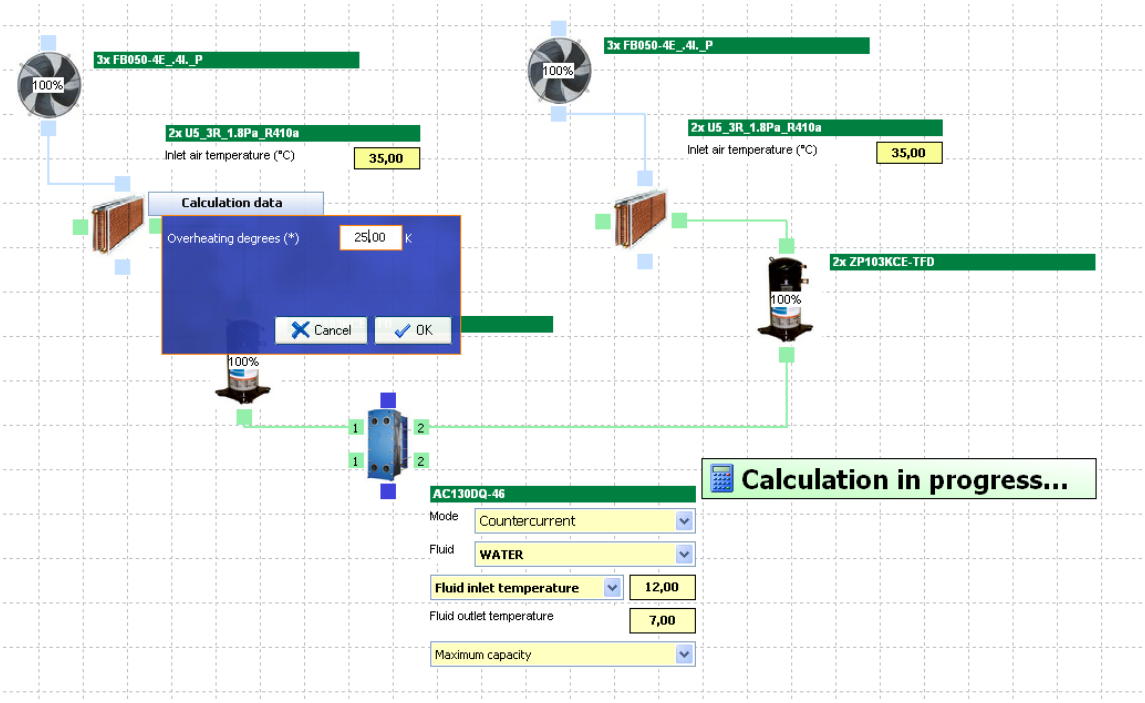


PLEASE NOTE:
The field "Maximum capacity/Capacity compatible with the compressor" applies a specific method on the calculation of plate heat exchangers, and may change drastically the results. It is not recommended to be changed.

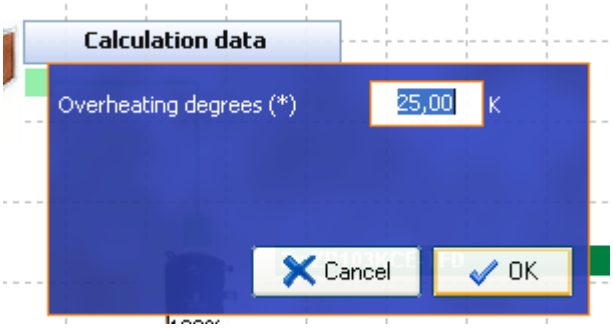
Finally we can click on the calculate button:



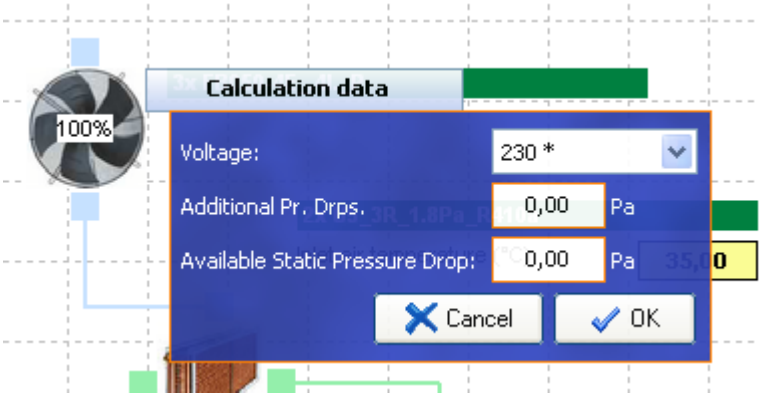
Now the program will see the variables that we specified, and the ones that are missing, and will show small input windows like the following for us to specify the missing parameters:



The first is to specify the overheating degrees on the condenser:

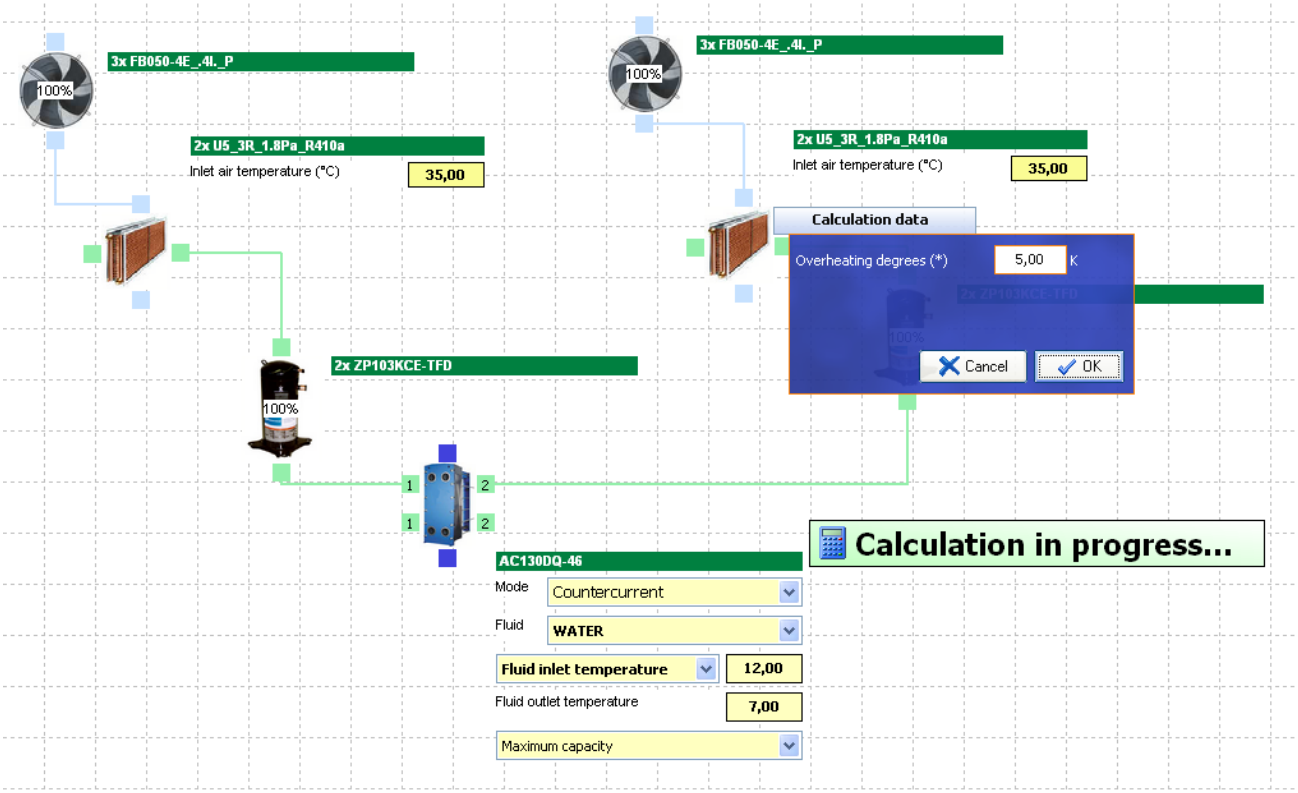


The second to specify the fan selected voltage and if we want we can add some pressure drop to be considered:

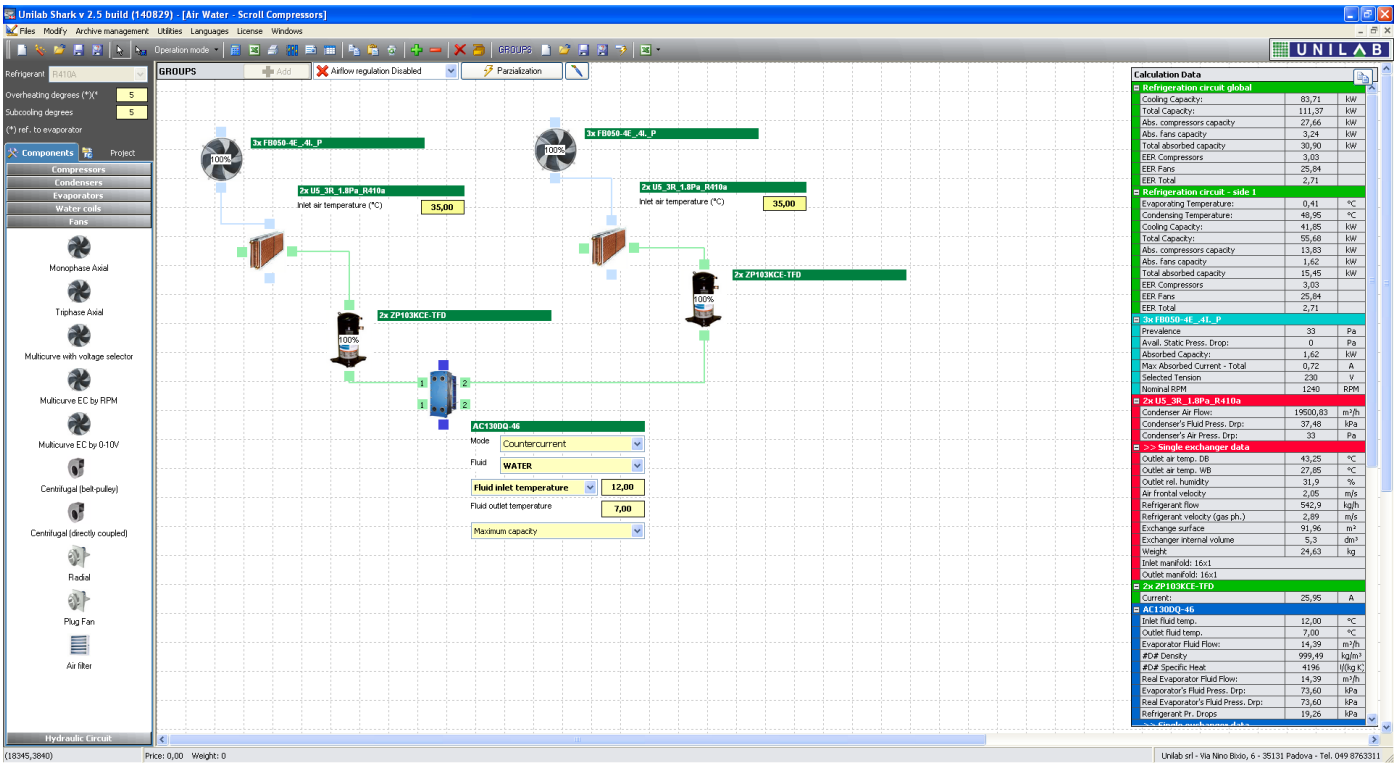


Additional pressure drops can be used to specify the pressure drop of the grid, and the Available static pressure drop is to specify a requested ESP.

Then when the input parameter of the first circuit is all set, the program will require the parameters of the second circuit too:



When the calculation is completed, a list of calculated outputs will be shown:



Here's the list in details:

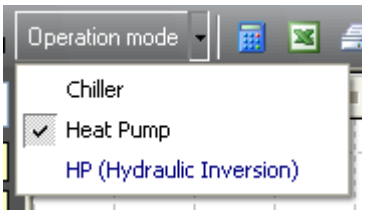
Calculation Data		
Refrigeration circuit global		
Cooling Capacity:	83,71	kW
Total Capacity:	111,37	kW
Abs. compressors capacity	27,66	kW
Abs. fans capacity	3,24	kW
Total absorbed capacity	30,90	kW
EER Compressors	3,03	
EER Fans	25,84	
EER Total	2,71	
Refrigeration circuit - side 1		
Evaporating Temperature:	0,41	°C
Condensing Temperature:	48,95	°C
Cooling Capacity:	41,85	kW
Total Capacity:	55,68	kW
Abs. compressors capacity	13,83	kW
Abs. fans capacity	1,62	kW
Total absorbed capacity	15,45	kW
EER Compressors	3,03	
EER Fans	25,84	
EER Total	2,71	
3x FB050-4E_.4I._P		
Prevalence	33	Pa
Avail. Static Press. Drop:	0	Pa
Absorbed Capacity:	1,62	kW
Max Absorbed Current - Total	0,72	A
Selected Tension	230	V
Nominal RPM	1240	RPM
2x U5_3R_1.8Pa_R410a		
Condenser Air Flow:	19500,83	m³/h
Condenser's Fluid Press. Drp:	37,48	kPa
Condenser's Air Press. Drp:	33	Pa
>> Single exchanger data		
Outlet air temp. DB	43,25	°C
Outlet air temp. WB	27,85	°C
Outlet rel. humidity	31,9	%
Air frontal velocity	2,05	m/s
Refrigerant flow	542,9	kg/h
Refrigerant velocity (gas ph.)	2,89	m/s
Exchange surface	91,96	m²
Exchanger internal volume	5,3	dm³
Weight	24,63	kg
Inlet manifold: 16x1		
Outlet manifold: 16x1		
2x ZP103KCE-TFD		
Current:	25,95	A
AC130DQ-46		
Inlet fluid temp.	12,00	°C
Outlet fluid temp.	7,00	°C
Evaporator Fluid Flow:	14,39	m³/h

The button above lets you export this table in the Clipboard (copy/paste into Excel for example).

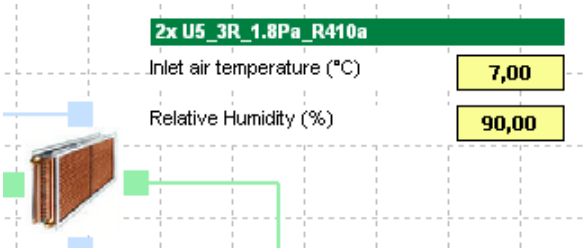
Performing calculation in heat pump mode

First of all, we have to check the calculation options. Firstly that we have selected the whole unit calculation mode:

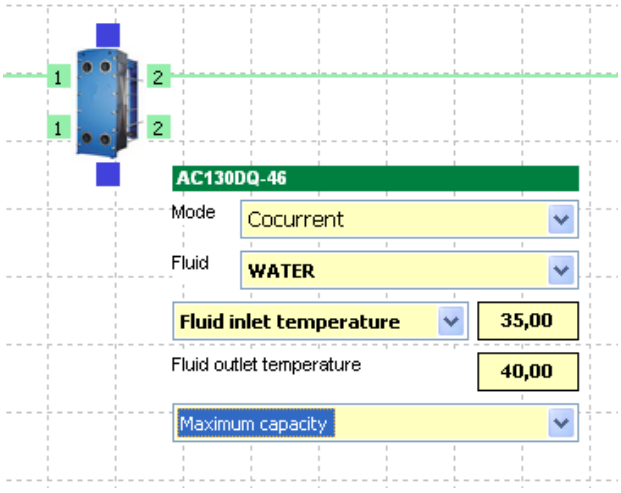
And the operation mode is set to "Heat Pump":



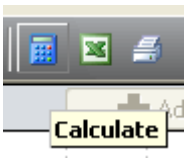
When we change the operating mode in Heat Pump, the input parameters will be changed for each exchanger. For example the air condenser (that now is working as an evaporator) will require:



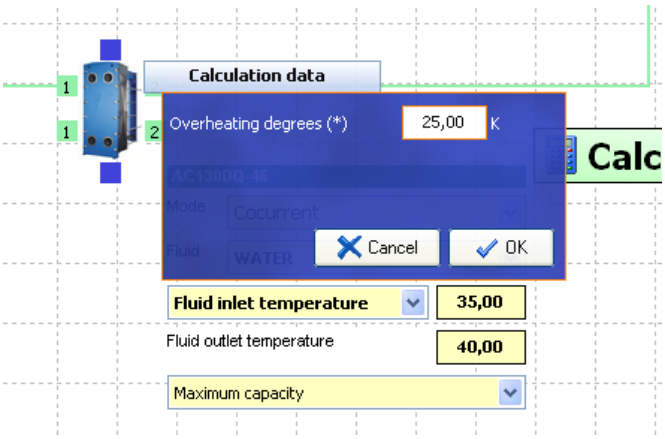
And the plate evaporator (that now is working as a condenser) will require:



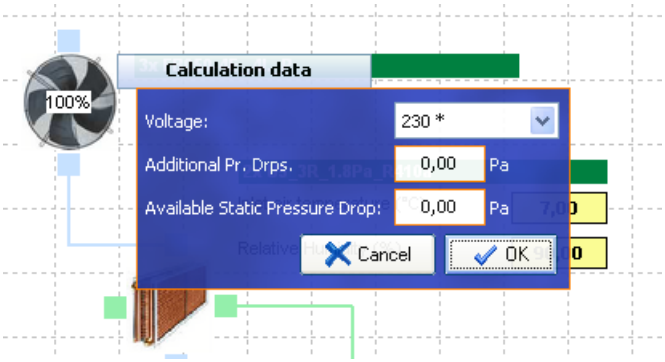
Please notice that the mode is now set to "Cocurrent". Finally we can click on the calculate button:



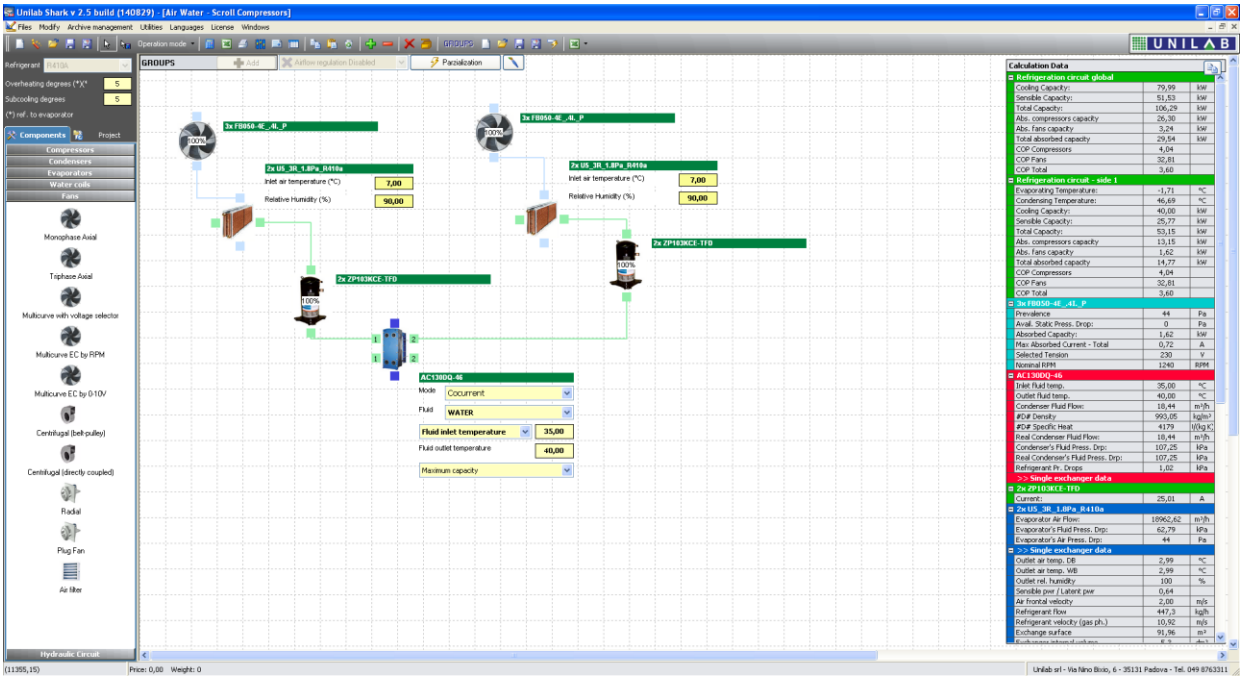
And the program will start to ask the missing parameters like for the chiller mode. The first is the condenser:



And finally the fans info:



When the calculation is complete, the results table will appear:



This is the table in detail:

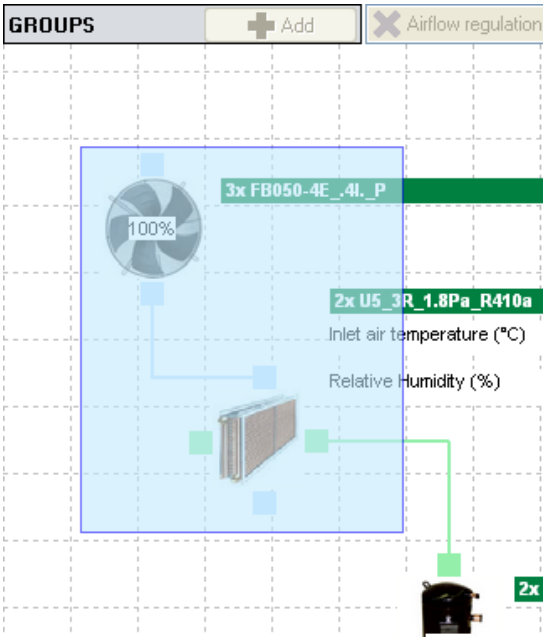
Calculation Data		
Refrigeration circuit global		
Cooling Capacity:	79,99	kW
Sensible Capacity:	51,53	kW
Total Capacity:	106,29	kW
Abs. compressors capacity	26,30	kW
Abs. fans capacity	3,24	kW
Total absorbed capacity	29,54	kW
COP Compressors	4,04	
COP Fans	32,81	
COP Total	3,60	
Refrigeration circuit - side 1		
Evaporating Temperature:	-1,71	°C
Condensing Temperature:	46,69	°C
Cooling Capacity:	40,00	kW
Sensible Capacity:	25,77	kW
Total Capacity:	53,15	kW
Abs. compressors capacity	13,15	kW
Abs. fans capacity	1,62	kW
Total absorbed capacity	14,77	kW
COP Compressors	4,04	
COP Fans	32,81	
COP Total	3,60	
3x FB050-4E_.4I._P		
Prevalence	44	Pa
Avail. Static Press. Drop:	0	Pa
Absorbed Capacity:	1,62	kW
Max Absorbed Current - Total	0,72	A
Selected Tension	230	V
Nominal RPM	1240	RPM
AC130DQ-46		
Inlet fluid temp.	35,00	°C
Outlet fluid temp.	40,00	°C
Condenser Fluid Flow:	18,44	m³/h
#D# Density	993,05	kg/m³
#D# Specific Heat	4179	J/(kg K)
Real Condenser Fluid Flow:	18,44	m³/h
Condenser's Fluid Press. Drp:	107,25	kPa
Real Condenser's Fluid Press. Drp:	107,25	kPa
Refrigerant Pr. Drops	1,02	kPa
>> Single exchanger data		
2x ZP103KCE-TFD		
Current:	25,01	A
2x U5_3R_1.8Pa_R410a		
Evaporator Air Flow:	18962,62	m³/h
Evaporator's Fluid Press. Drp:	62,79	kPa
Evaporator's Air Press. Drp:	44	Pa
>> Single exchanger data		
Outlet air temp. DB	2,99	°C
Outlet air temp. WB	2,99	°C
Outlet rel. humidity	100	%
Sensible pwr / Latent pwr	0,64	
Air frontal velocity	2,00	m/s
Refrigerant flow	447,3	kg/h
Refrigerant velocity (gas ph.)	10,92	m/s
Exchange surface	91,96	m²
Exchanger internal volume	5,3	dm³

Performing partial calculation

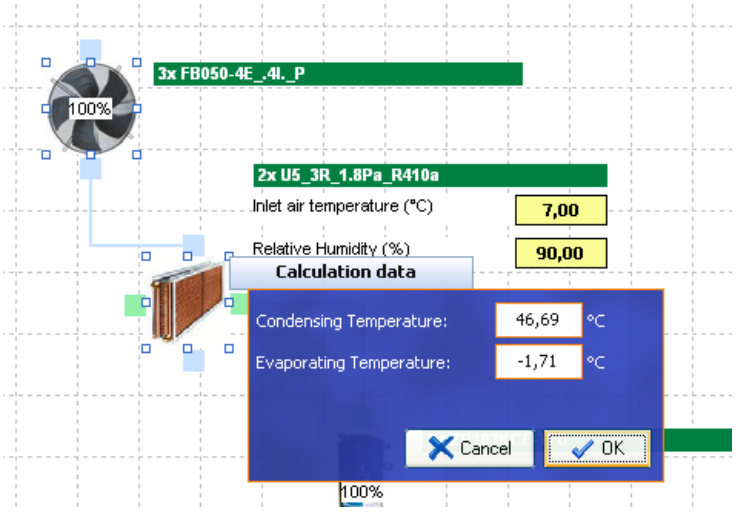
To better analyze the calculation, Shark provides a tool to perform the calculation of a restricted number of components.

For example, let's see the balance point between the fans and the coils. Click on the "Selection with calculation" tool:

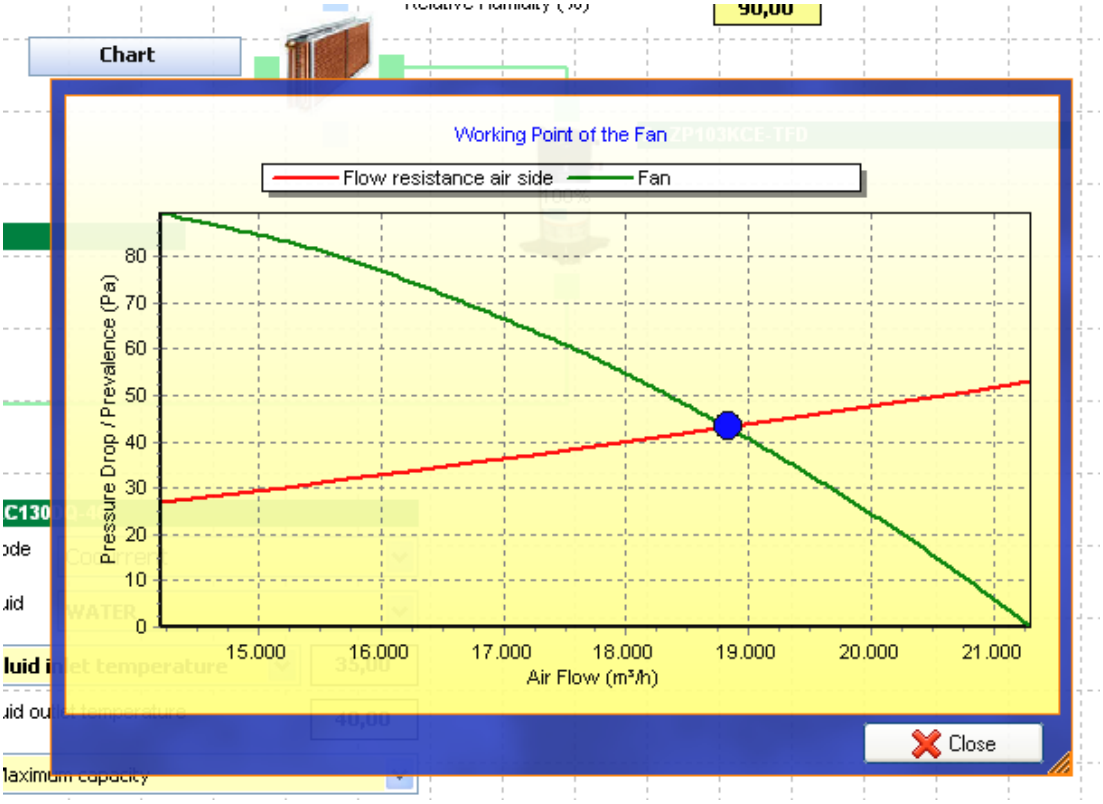
Now we have to draw a selection rectangle around the components that we want to consider, in this case the fan and the condensers:



The program will ask for the missing values, showing eventually the results from the previous calculation:



And it will perform the calculation and draw a chart of the balance point:

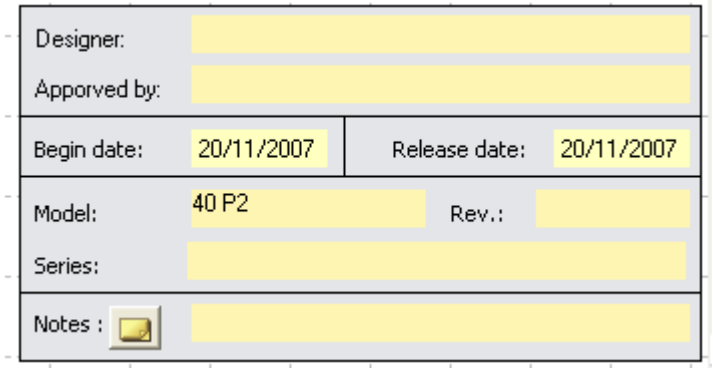


This can be applied to any combination of components connected together.

Completing the project with design details

Shark allows adding some details to complete the project design, like the designer name, the unit name and the series name. To access this information, click on the Scroll icon on the toolbar:

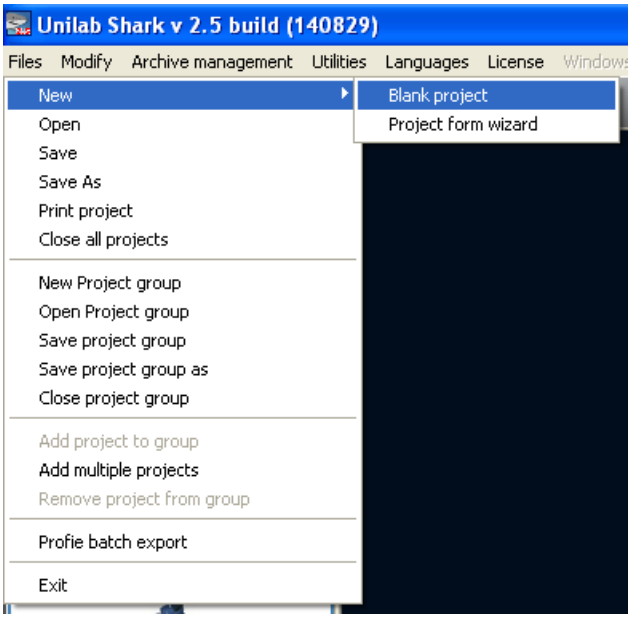
The following input form will appear in the design area, on the bottom:



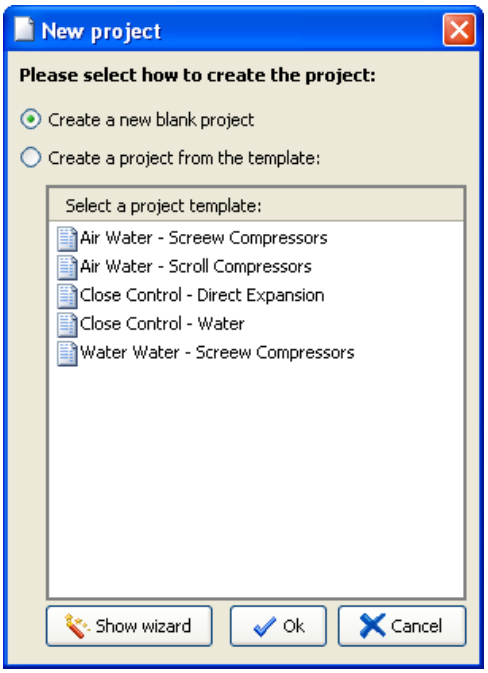
Water / Water chiller with fluid hydraulic inversion

Creating a new project

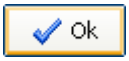
Now we can create a blank project:



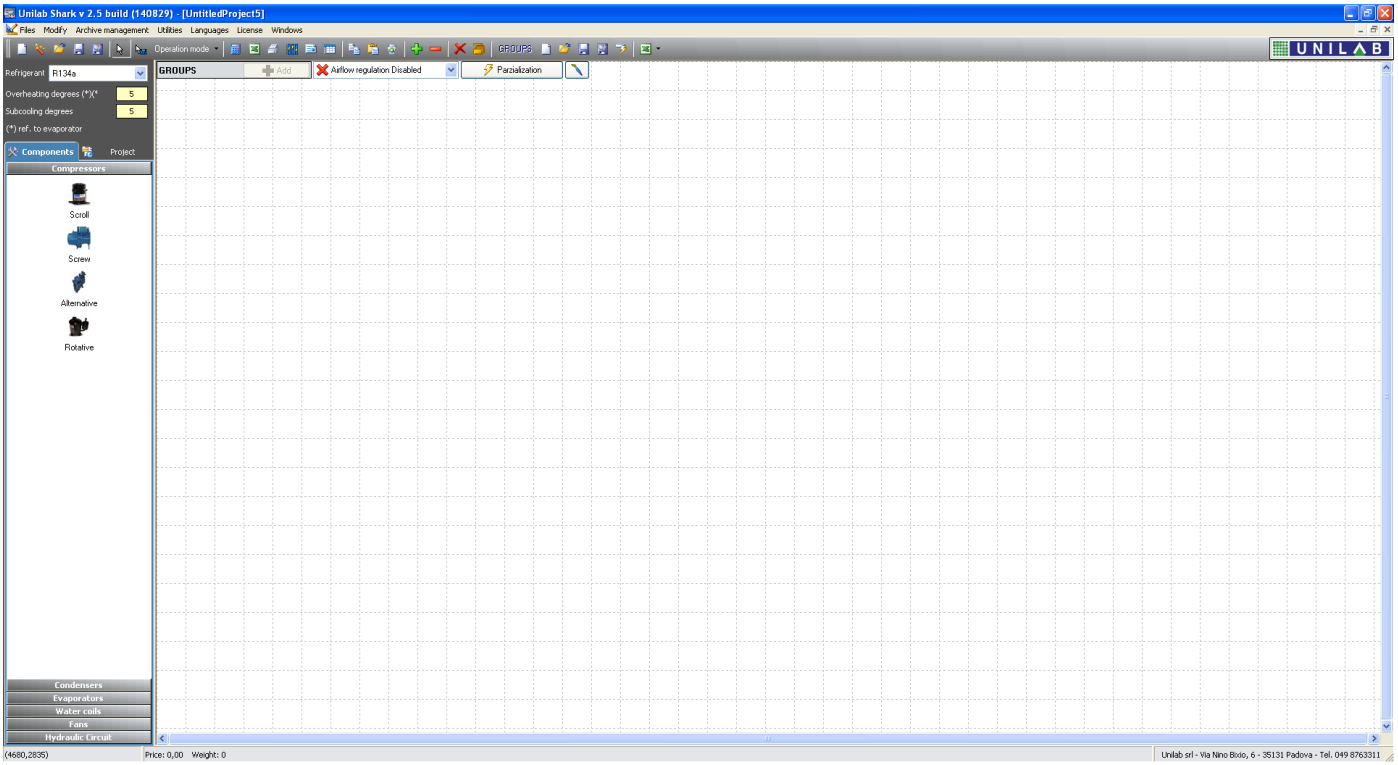
A new window will appear, that lets you load a project template. Select again "Create a new project":



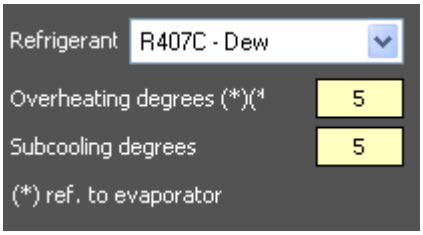
Now click "OK" to continue:



A new blank project will appear:

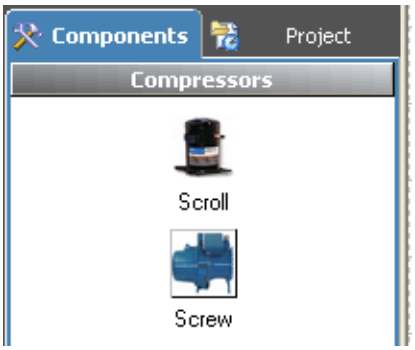


Now we should set the main settings of the project:

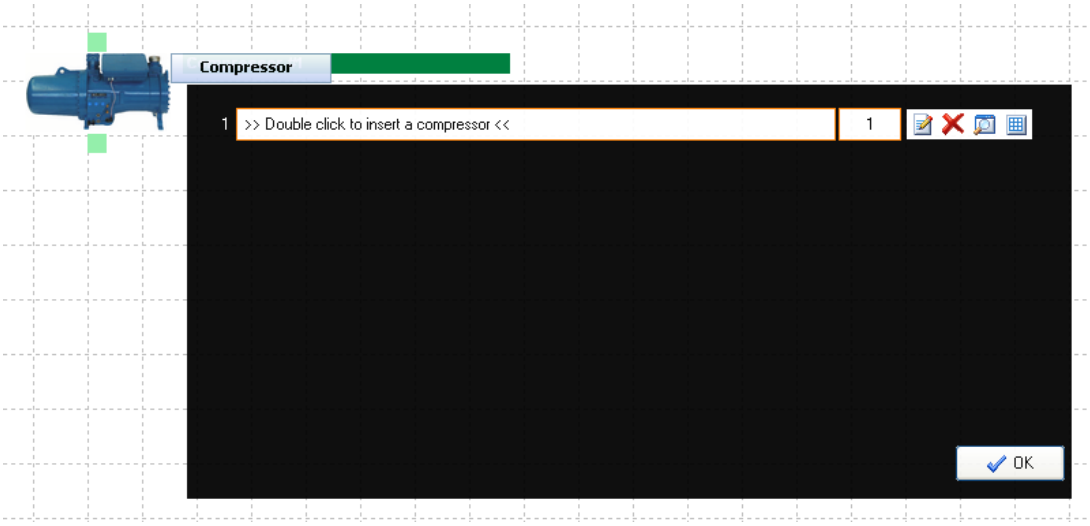


Adding components to the unit

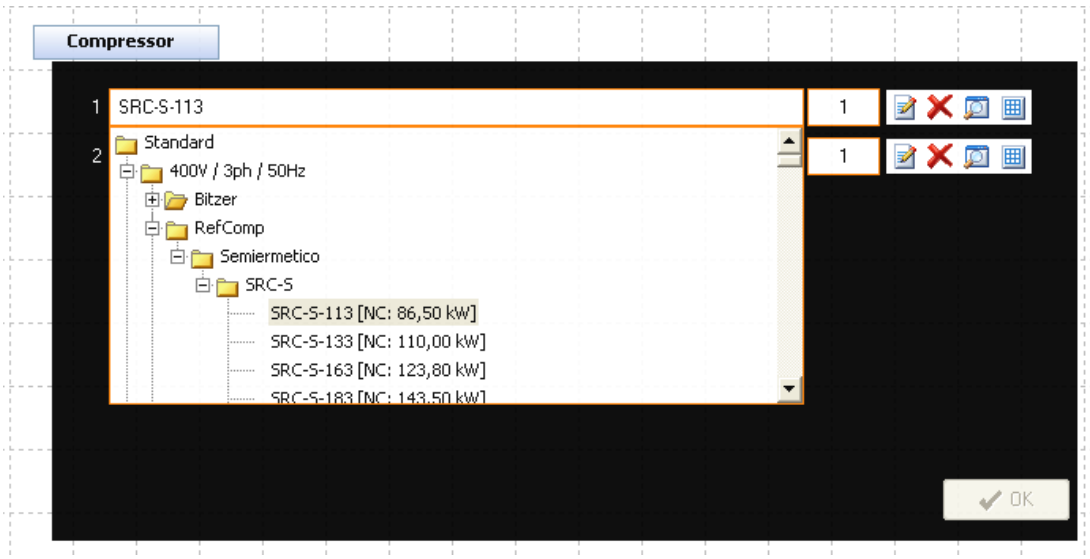
Let's now start by adding the components to the project. We will start with the screw compressor:



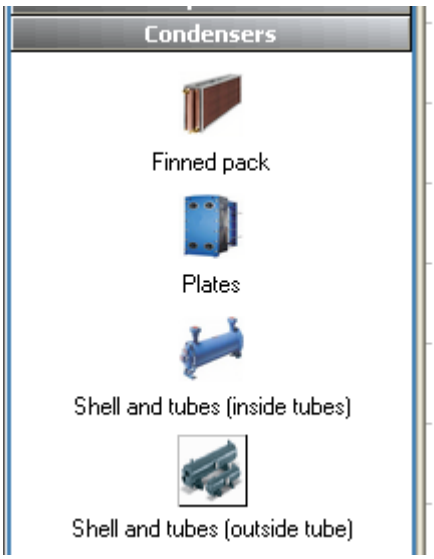
The new group has been added:



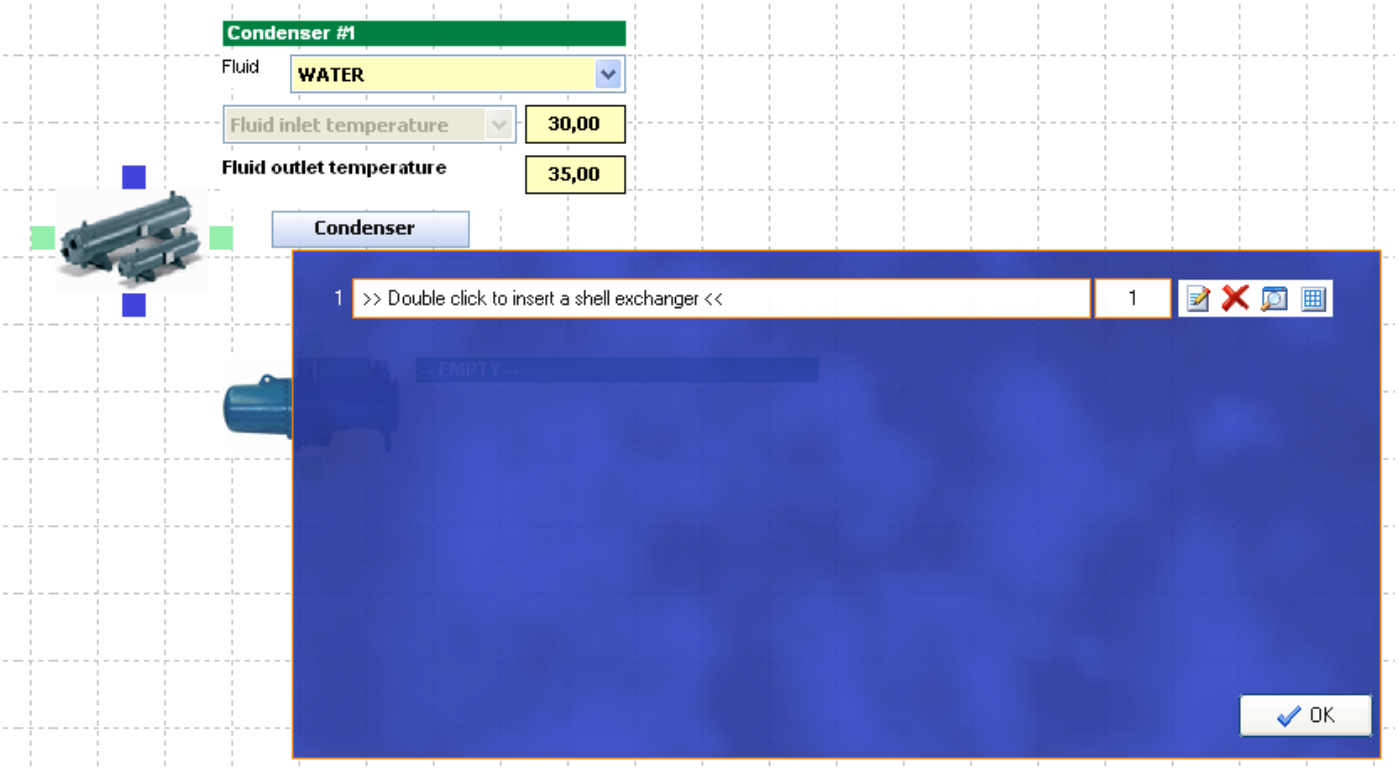
We select now the model that we want to use:



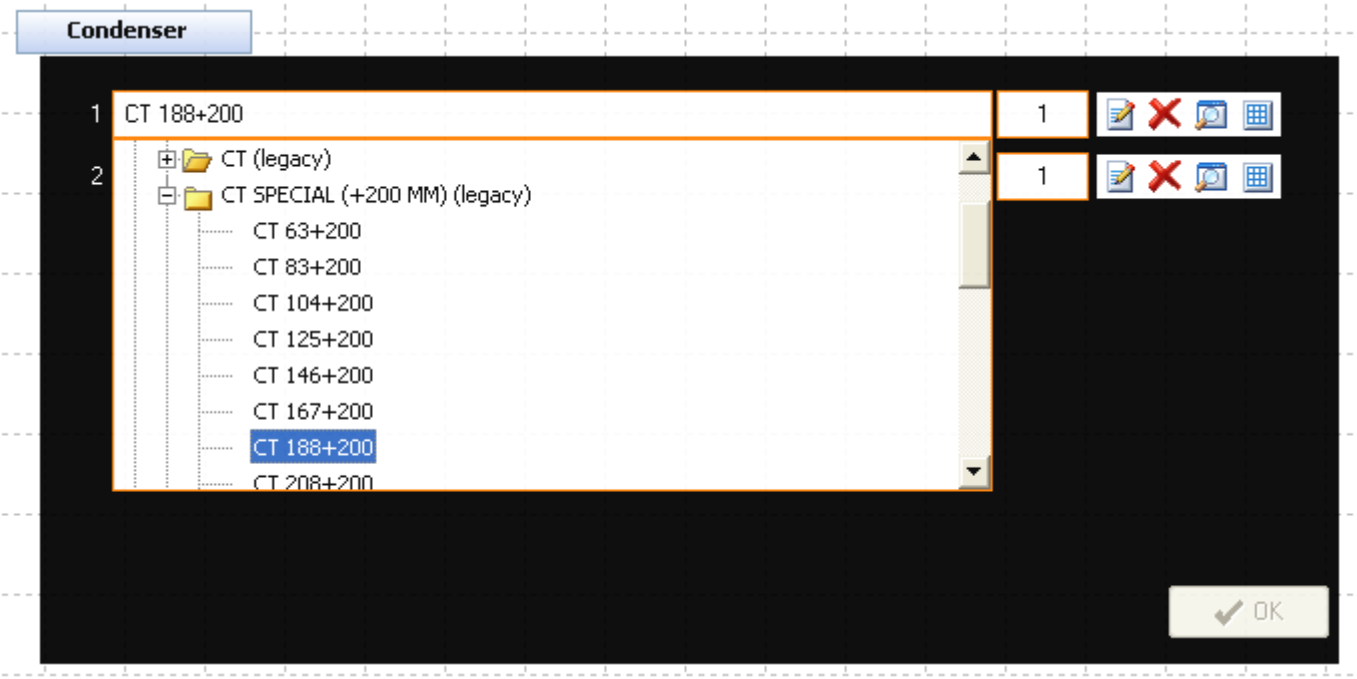
Then we add a new condenser. This time will be a Shell & Tube, with condensation Outside the Tubes:



The component group has been added to the project:

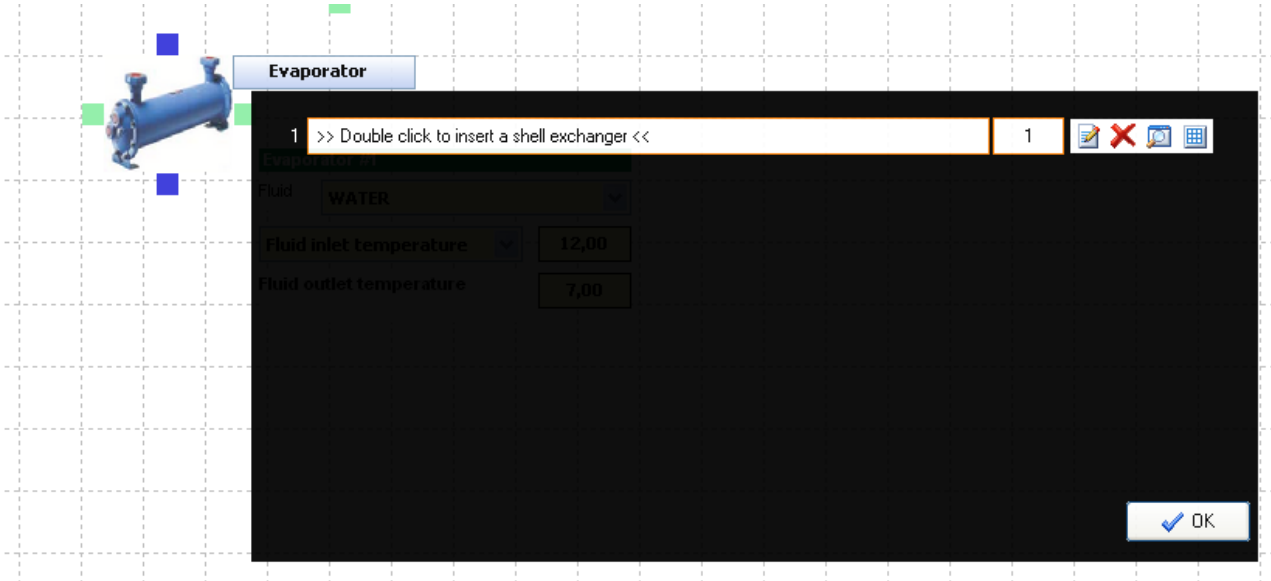


And we select the desired model:

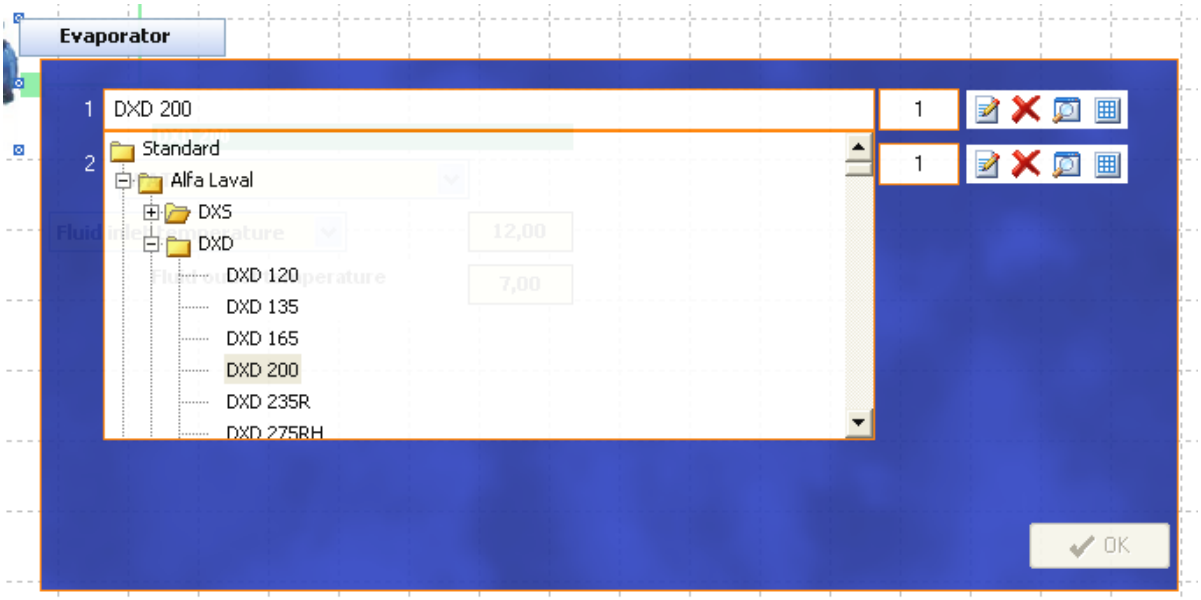


Finally we proceed with the Shell & Tube evaporator:

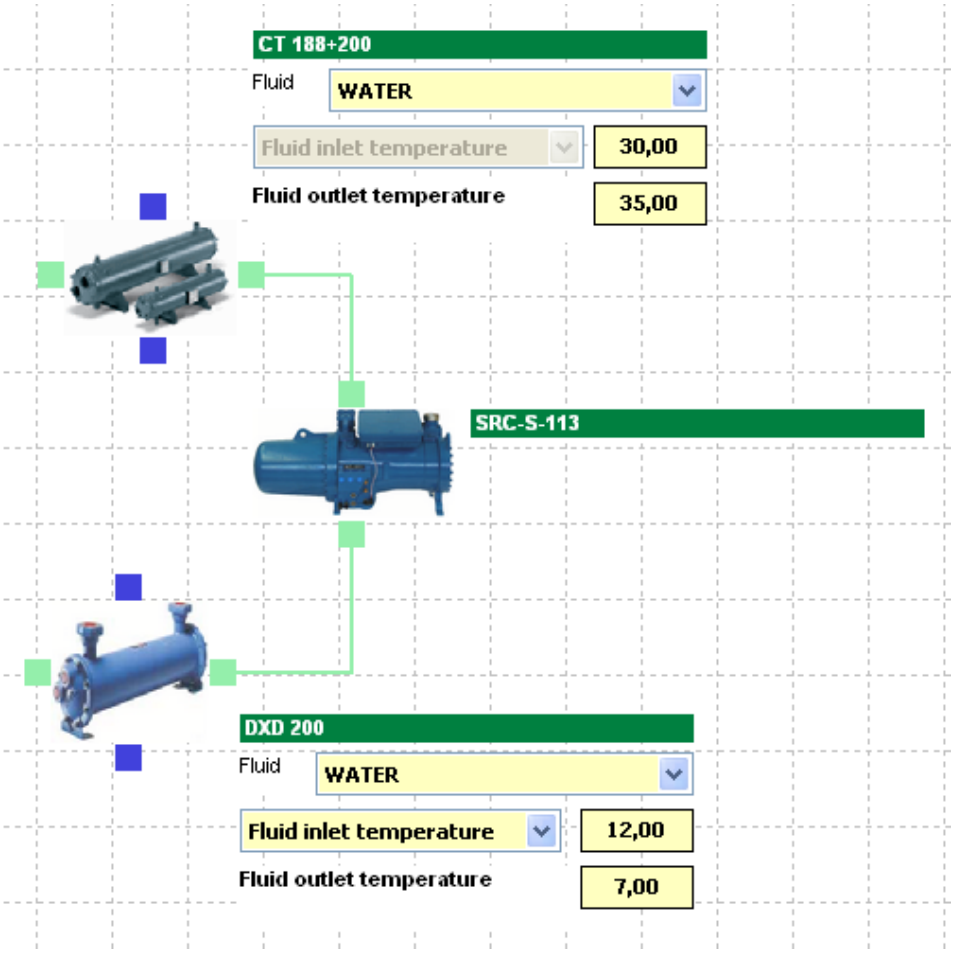
It has been added to the project:



And now we can select the chosen model:

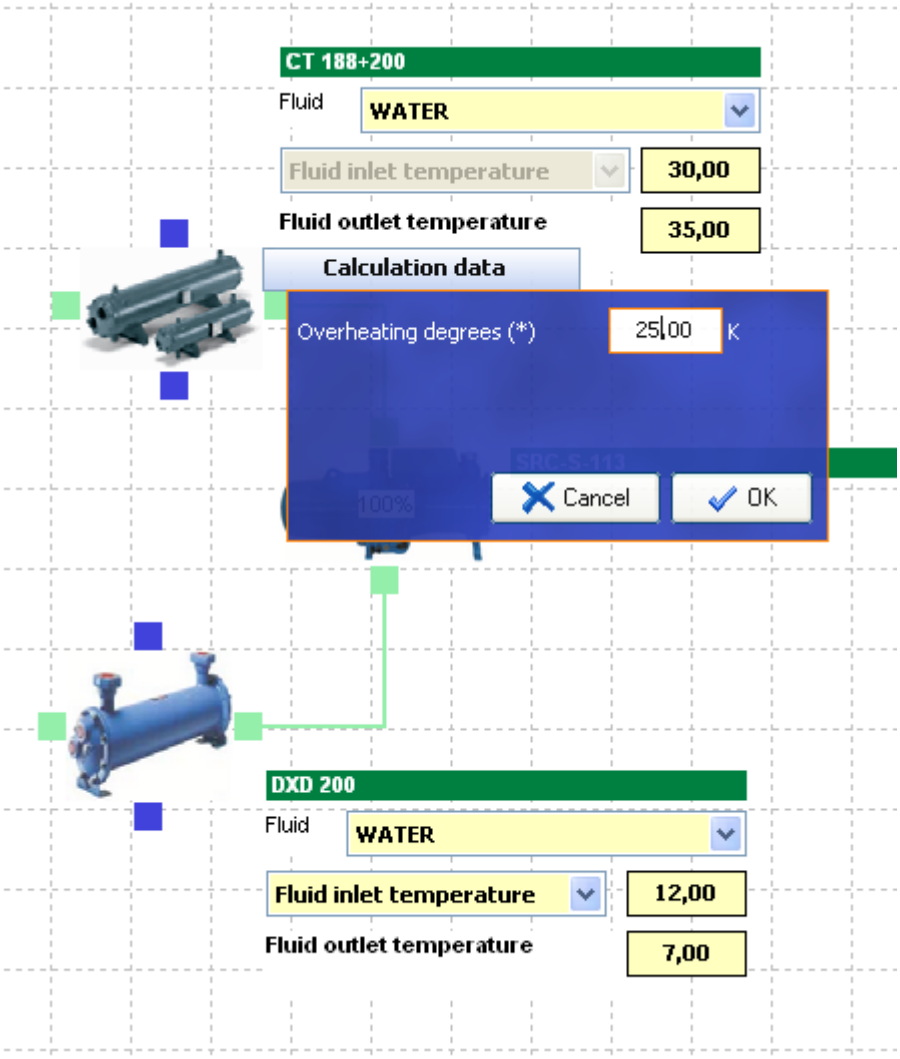


Now we should link together the components like the following:



And proceed with the calculation

As always, the program will ask for the missing parameters:

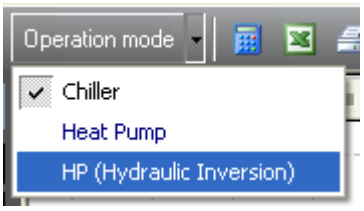


And quickly the results of the calculation will be shown:

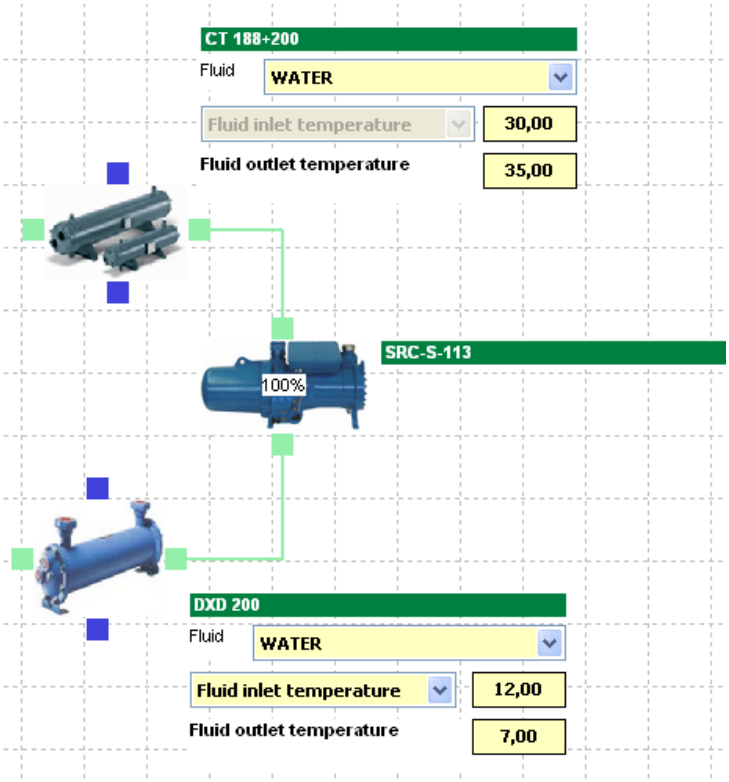
Calculation Data		
Refrigeration circuit - side 1		
Evaporating Temperature:	4,49	°C
Condensing Temperature:	43,07	°C
Cooling Capacity:	127,35	kW
Total Capacity:	157,09	kW
Absorbed Capacity:	29,74	kW
EER	4,28	
CT 188+200		
Inlet fluid temp.	30,00	°C
Outlet fluid temp.	35,00	°C
Condenser Fluid Flow:	27,23	m³/h
#D# Density	994,55	kg/m³
#D# Specific Heat	4180	J/(kg K)
Real Condenser Fluid Flow:	24,92	m³/h
Condenser's Fluid Press. Drp:	34,51	kPa
Real Condenser's Fluid Press. Drp:	28,89	kPa
>> Single exchanger data		
Volume shell side	35,4	dm³
Fluid velocity	2,50	m/s
SRC-S-113		
Current:	49,83	A
DXD 200		
Inlet fluid temp.	12,00	°C
Outlet fluid temp.	7,00	°C
Evaporator Fluid Flow:	21,86	m³/h
#D# Density	999,49	kg/m³
#D# Specific Heat	4196	J/(kg K)
Real Evaporator Fluid Flow:	19,54	m³/h
Evaporator's Fluid Press. Drp:	16,25	kPa
Real Evaporator's Fluid Press. Drp:	12,98	kPa
Refrigerant Pr. Drops	3,20	kPa
>> Single exchanger data		
Volume shell side	49,3	dm³
Volume tube side	23,8	dm³
Fluid velocity	5,82	m/s

Calculation with inverse fluid cycle

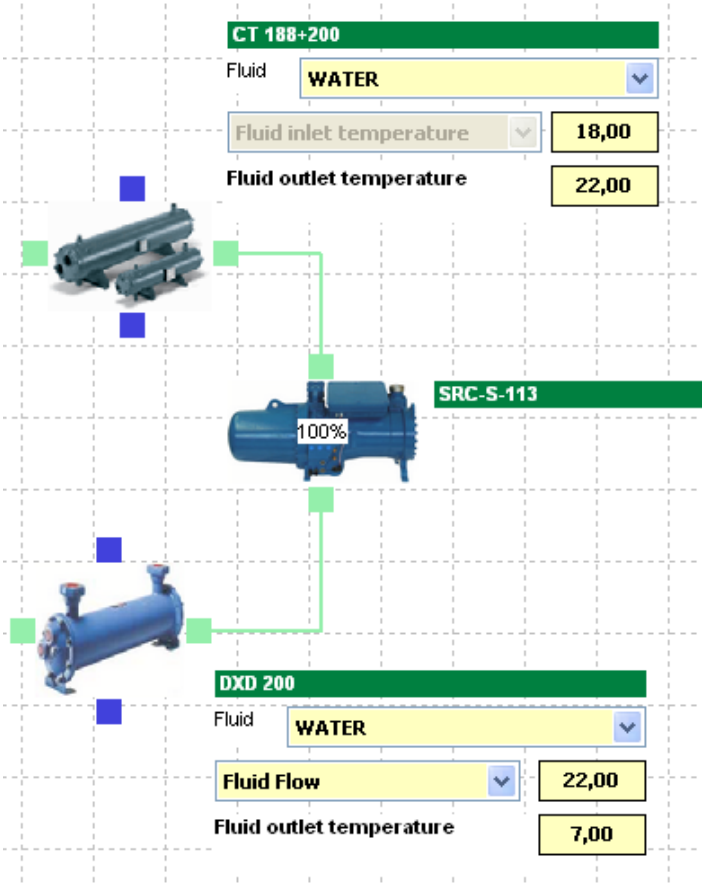
To set this type of calculation, we have to click on the "Operation mode" button, and then "HP Hydraulic Inversion" mode:



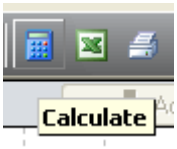
In this case the temperatures on the components won't change, because each component is still working in its native modality. Is an external valve that switches the fluids flow:



Let's set differently the temperature:



And perform the calculation:



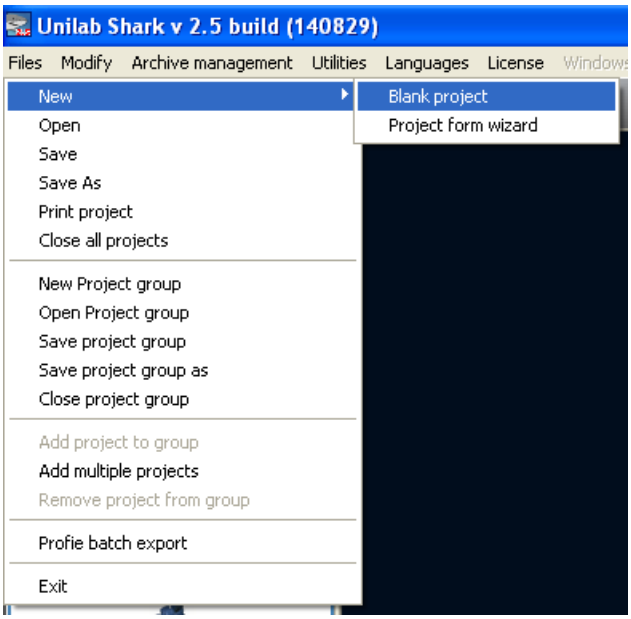
The result table will be shown:

Calculation Data		
Refrigeration circuit - side 1		
Evaporating Temperature:	4,44	°C
Condensing Temperature:	30,65	°C
Cooling Capacity:	136,13	kW
Total Capacity:	158,94	kW
Absorbed Capacity:	22,81	kW
COP	6,97	
CT 188+200		
Inlet fluid temp.	18,00	°C
Outlet fluid temp.	22,00	°C
Condenser Fluid Flow:	34,29	m³/h
#D# Density	998,30	kg/m³
#D# Specific Heat	4182	J/(kg K)
Real Condenser Fluid Flow:	34,29	m³/h
Condenser's Fluid Press. Drp:	54,29	kPa
Real Condenser's Fluid Press. Drp:	54,29	kPa
>> Single exchanger data		
Volume shell side	35,4	dm³
Fluid velocity	3,43	m/s
SRC-S-113		
Current:	44,42	A
DXD 200		
Inlet fluid temp.	12,95	°C
Outlet fluid temp.	7,00	°C
Evaporator Fluid Flow:	19,66	m³/h
#D# Density	999,49	kg/m³
#D# Specific Heat	4196	J/(kg K)
Real Evaporator Fluid Flow:	19,66	m³/h
Evaporator's Fluid Press. Drp:	13,14	kPa
Real Evaporator's Fluid Press. Drp:	13,14	kPa
Refrigerant Pr. Drops	3,91	kPa
>> Single exchanger data		
Volume shell side	49,3	dm³
Volume tube side	23,8	dm³
Fluid velocity	6,22	m/s

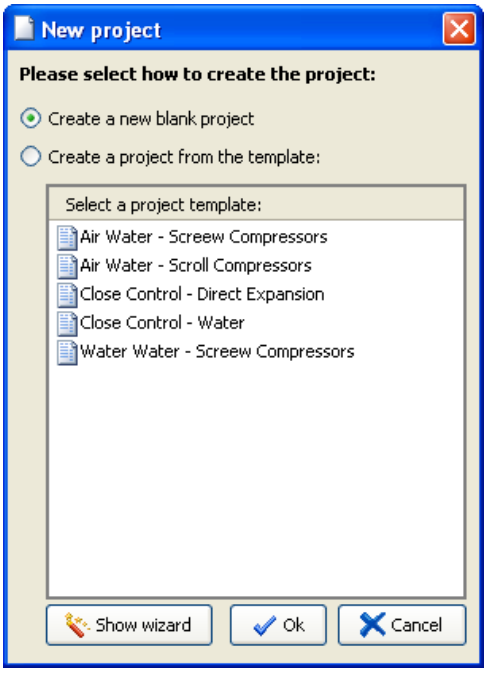
Complete indoor Close Control (Air / Air) unit with water condenser

Creating a new project

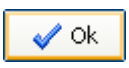
Now we can create a blank project:



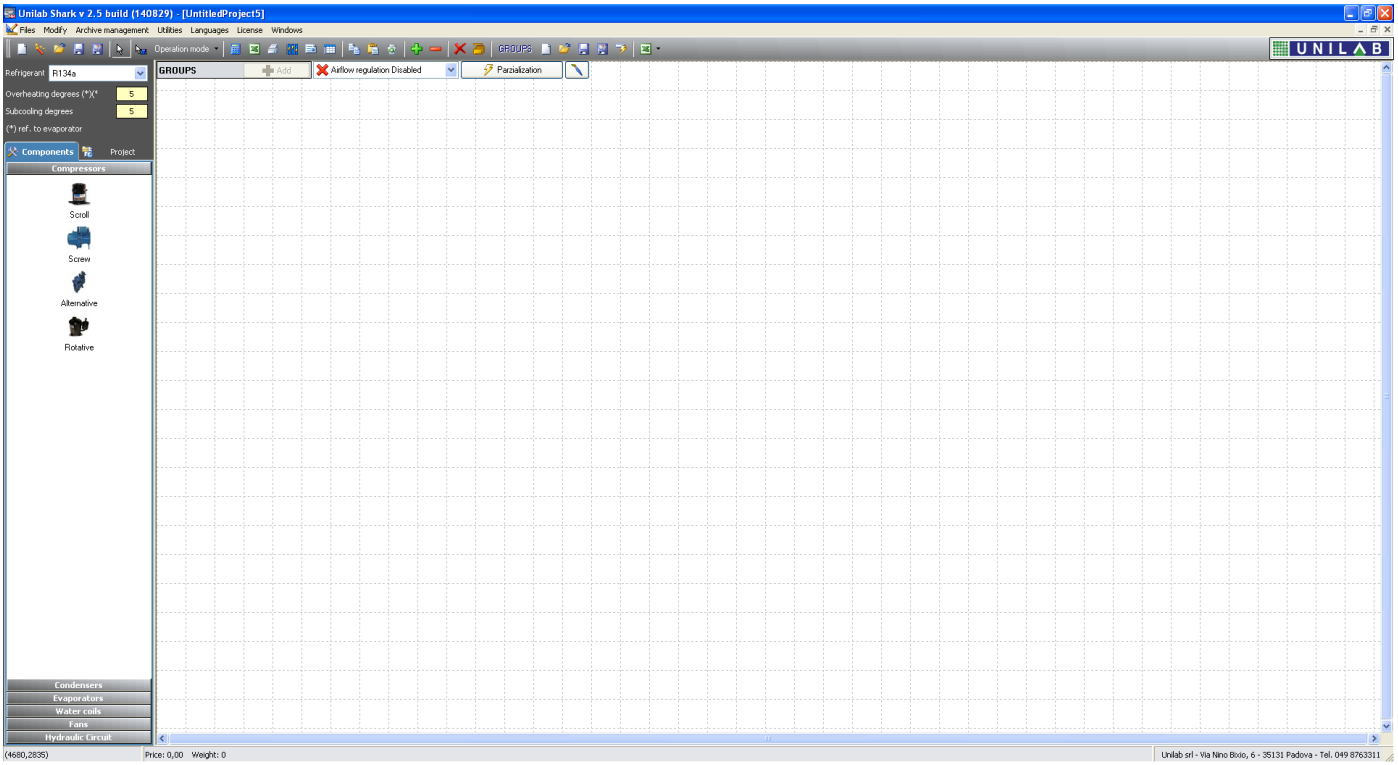
A new window will appear, that lets you load a project template. Select again "Create a new project":



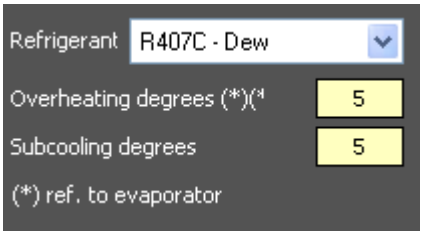
Now click "OK" to continue:



A new blank project will appear:



Now we should set the main settings of the project:

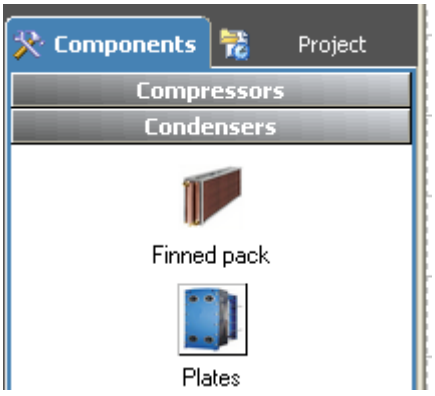


Adding components to the unit

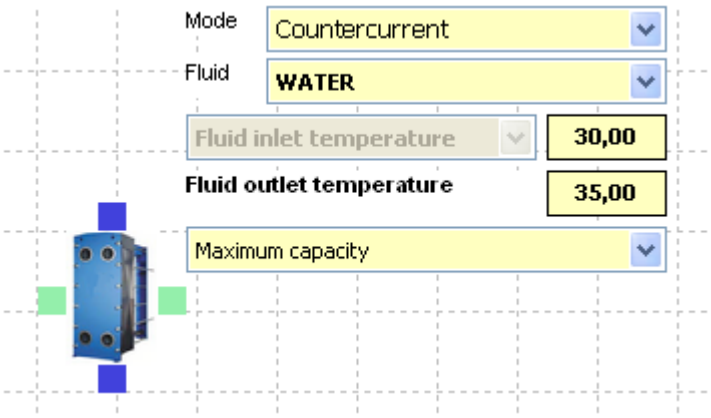
Let's start from the Compressor:

After adding the group to the design area, we can select the model:

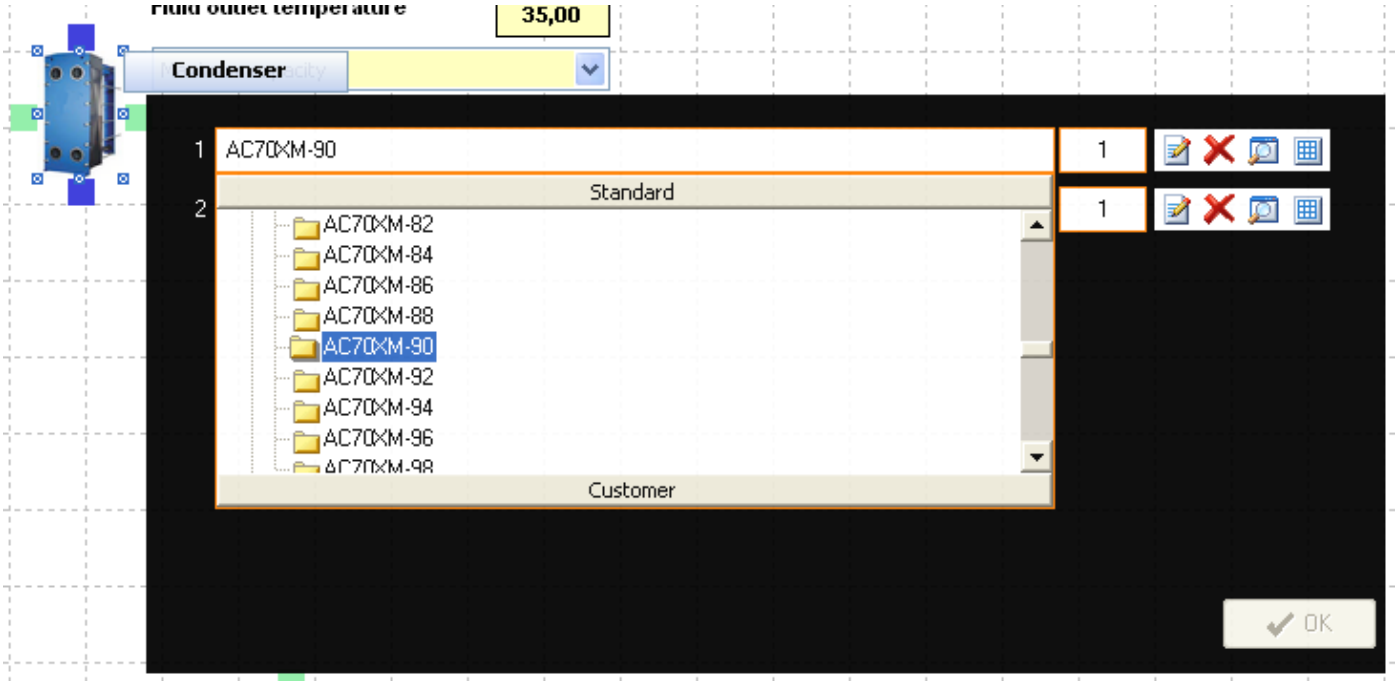
Now we can add the plate condenser:



The plate condenser group will be added to the project:

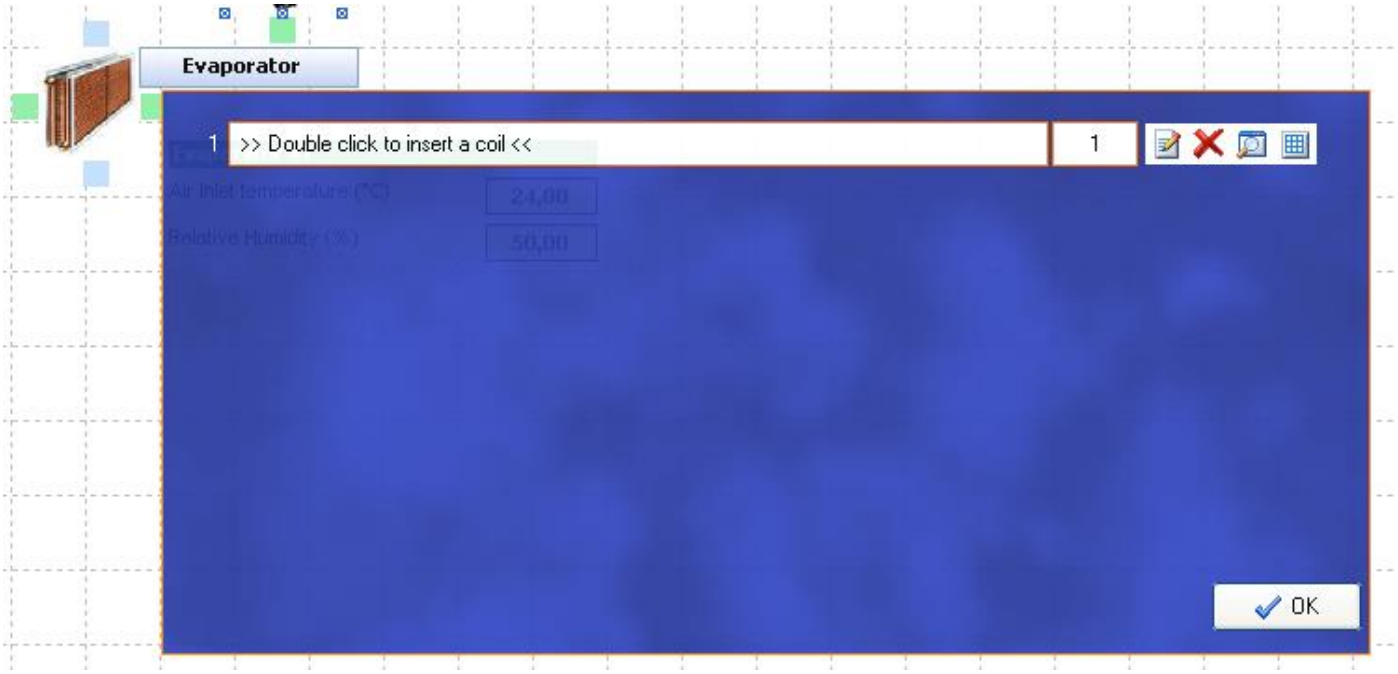


Now we can select the model:



Now we can add the finned pack evaporator:

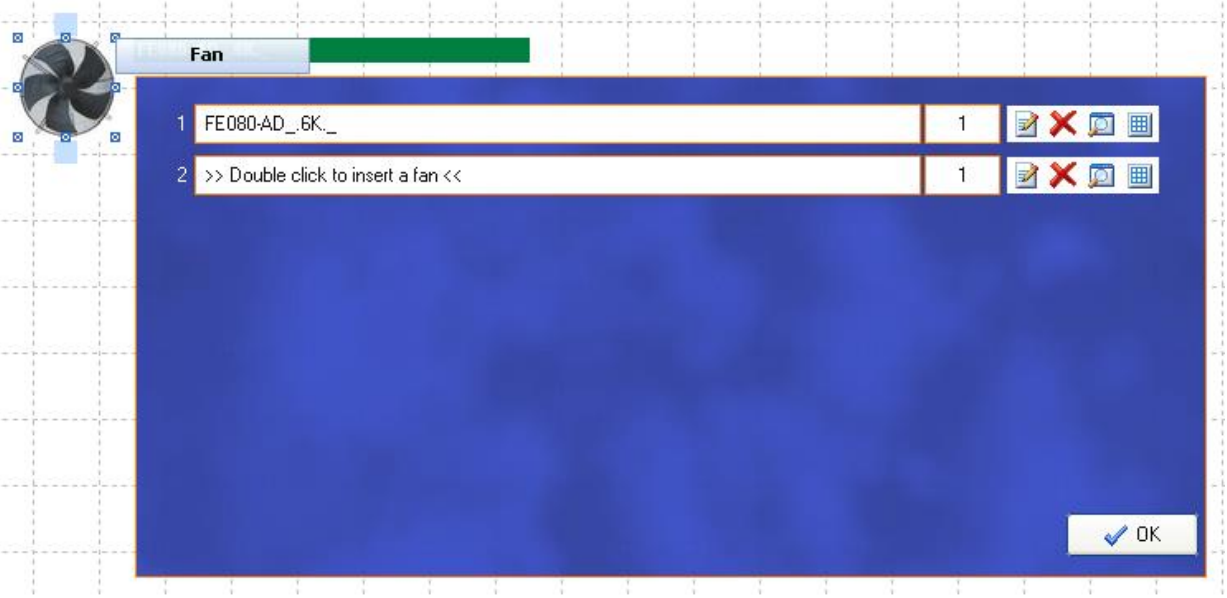
The group will be added to the design area:



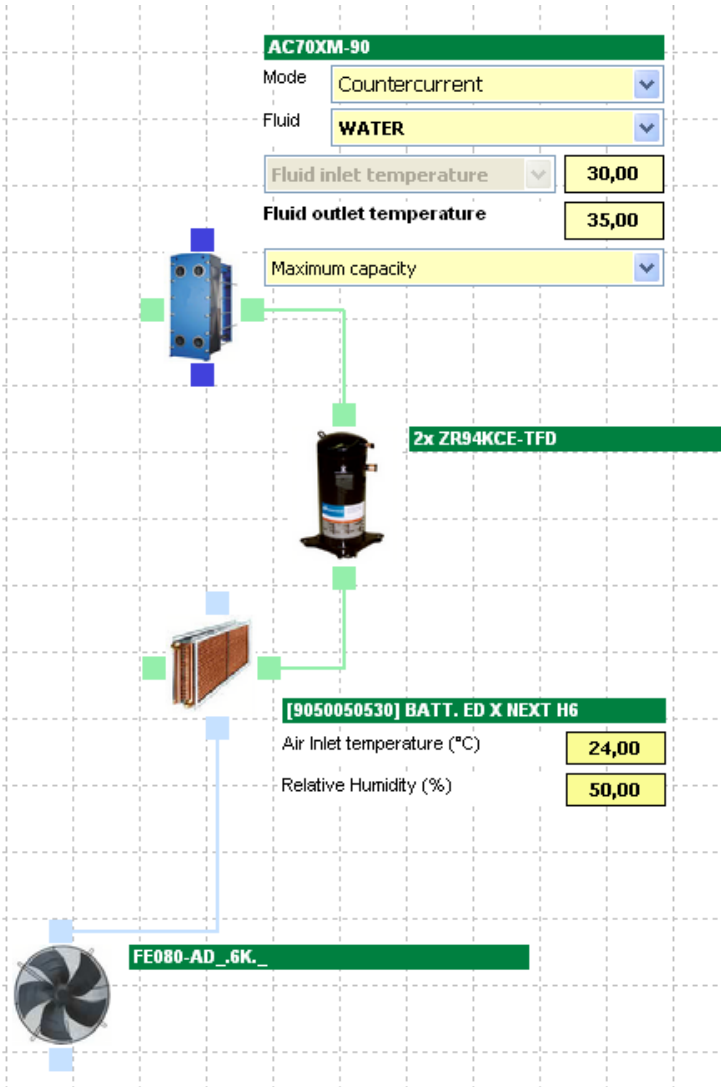
And we can either select a model from the list of coils, or add a new coil with the method seen before:

Now we can add the fan:

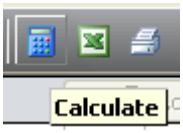
And select the appropriate model from the list:



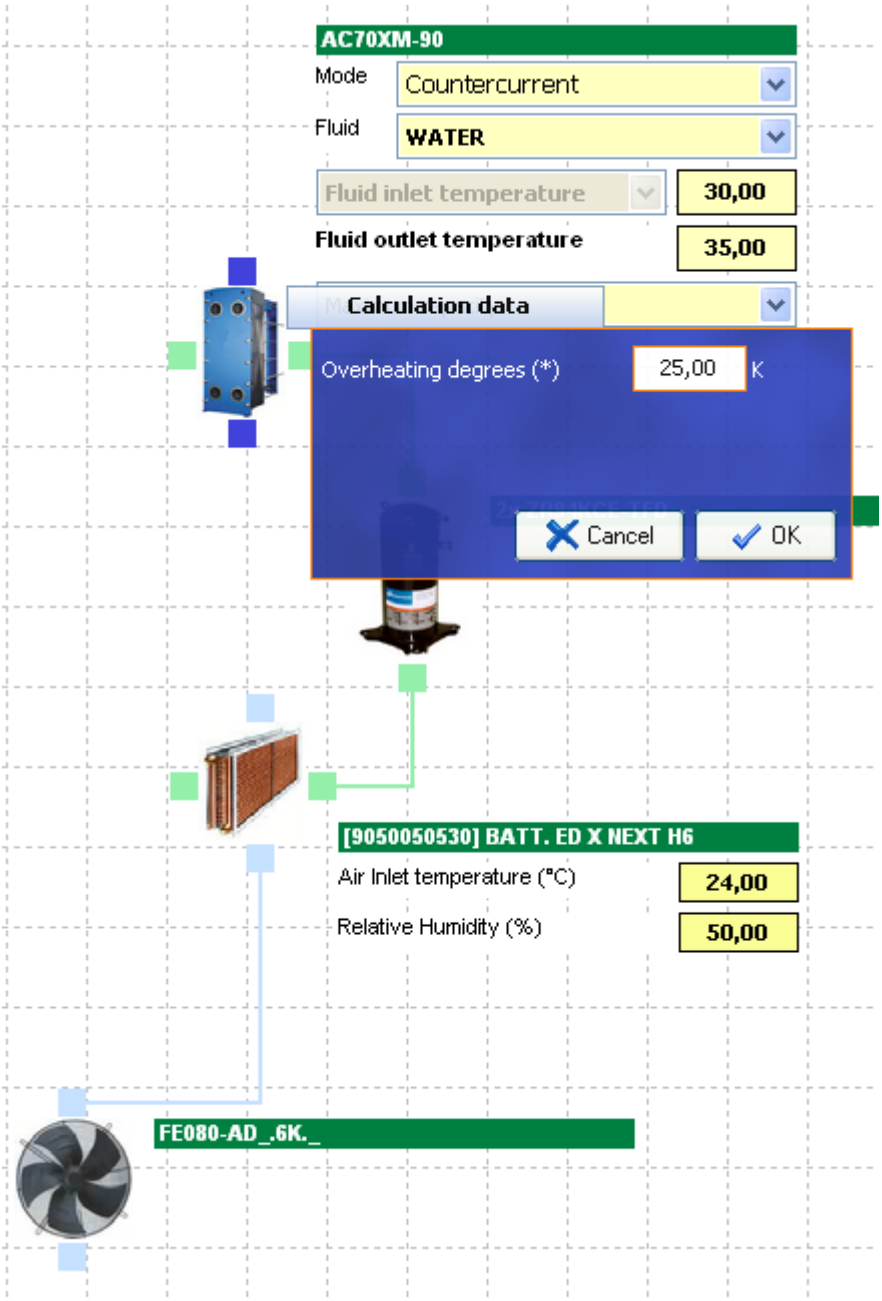
Finally we can link together the components like below:



We can now perform the calculation:



Which will require some additional information:



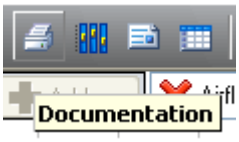
And at the end, it will present the results:

Calculation Data		
Refrigeration circuit - side 1		
Evaporating Temperature:	7,76	°C
Condensing Temperature:	46,28	°C
Cooling Capacity:	50,43	kW
Sensible Capacity:	39,72	kW
Total Capacity:	61,86	kW
Abs. compressors capacity	11,43	kW
Abs. fans capacity	0,93	kW
Total absorbed capacity	12,36	kW
EER Compressors	4,41	
EER Fans	54,23	
EER Total	4,08	
FE080-AD_.6K._		
Prevalence	73	Pa
Avail. Static Press. Drop:	0	Pa
Absorbed Capacity:	0,93	kW
Max Absorbed Current - Total	2	A
Selected Link	Delta	
Nominal RPM	630	RPM
AC70XM-90		
Inlet fluid temp.	30,00	°C
Outlet fluid temp.	35,00	°C
Condenser Fluid Flow:	10,71	m³/h
#D# Density	994,55	kg/m³
#D# Specific Heat	4180	J/(kg K)
Real Condenser Fluid Flow:	10,71	m³/h
Condenser's Fluid Press. Drp:	17,88	kPa
Real Condenser's Fluid Press. Drp:	17,88	kPa
Refrigerant Pr. Drops	1,22	kPa
>> Single exchanger data		
2x ZR94KCE-TFD		
Current:	22,68	A
[9050050530] BATT. ED X NEXT H6		
Evaporator Air Flow:	10488,64	m³/h
Evaporator's Fluid Press. Drp:	22,00	kPa
Evaporator's Air Press. Drp:	73	Pa
>> Single exchanger data		
Outlet air temp. DB	12,89	°C
Outlet air temp. WB	11,66	°C
Outlet rel. humidity	86,88	%
Sensible pwr / Latent pwr	0,79	
Air frontal velocity	2,43	m/s
Refrigerant flow	1136,8	kg/h
Refrigerant velocity (gas ph.)	10,42	m/s
Exchange surface	92,24	m²
Exchanger internal volume	13,0	dm³
Weight	38,48	kg
Outlet manifold: 42x1,5		

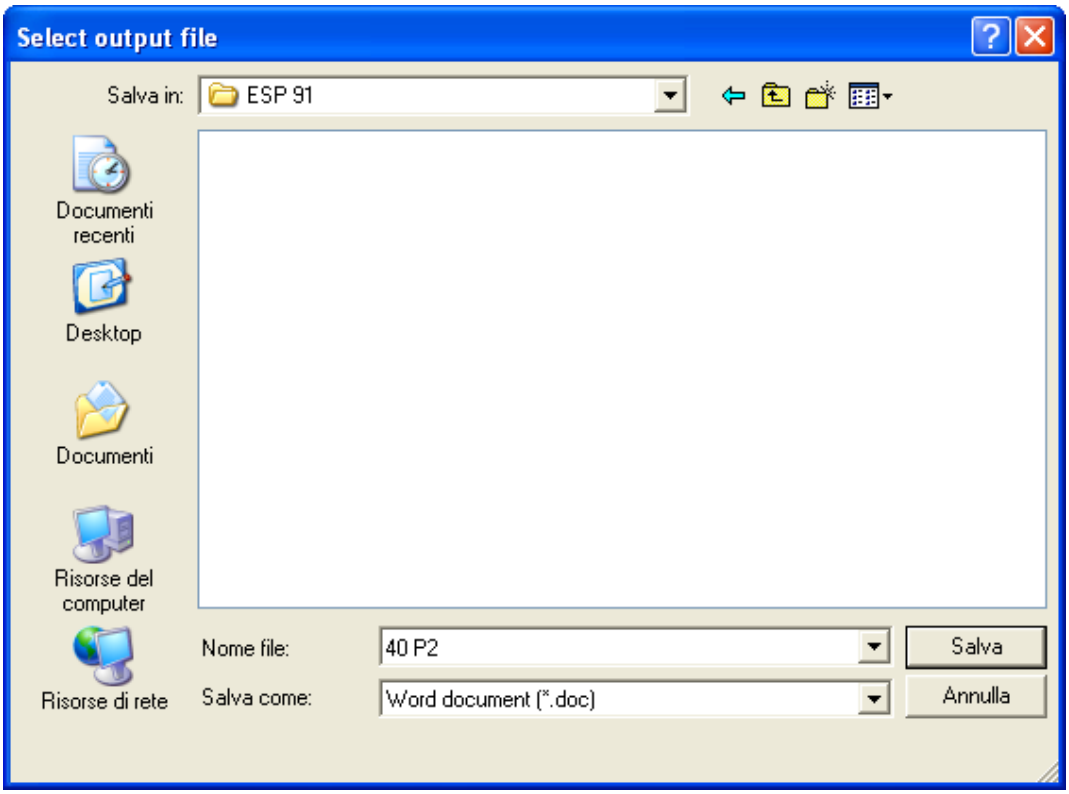
Output of the program

Datasheet of the unit

Shark is able to export a datasheet of the unit in MS Word format. To do this, click on the Documentation button on the tool bar:

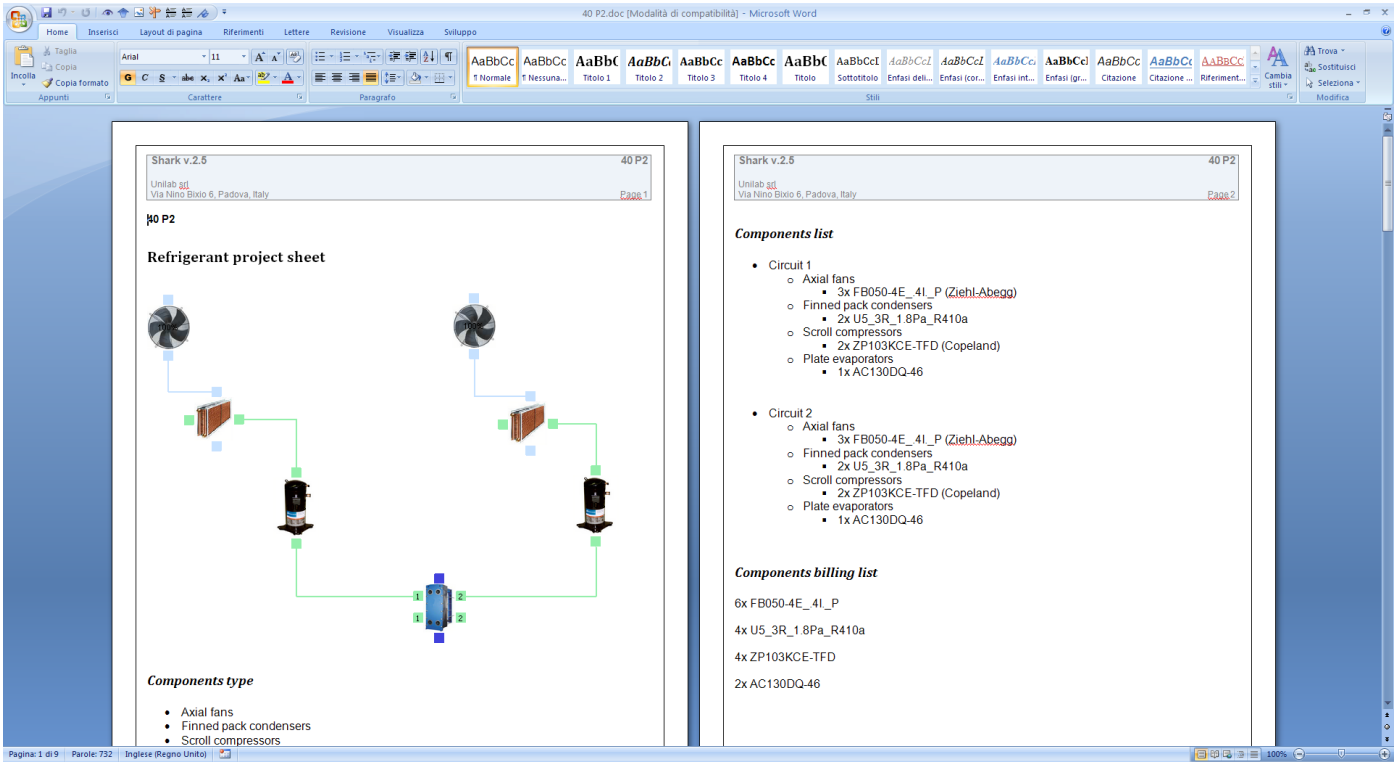


Now you have to specify where to save the .doc file:



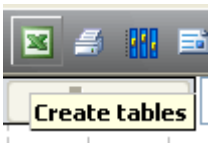
The program will perform a calculation and then export the document:

The result is a document of about 6-10 pages with all the detailed information of the unit.

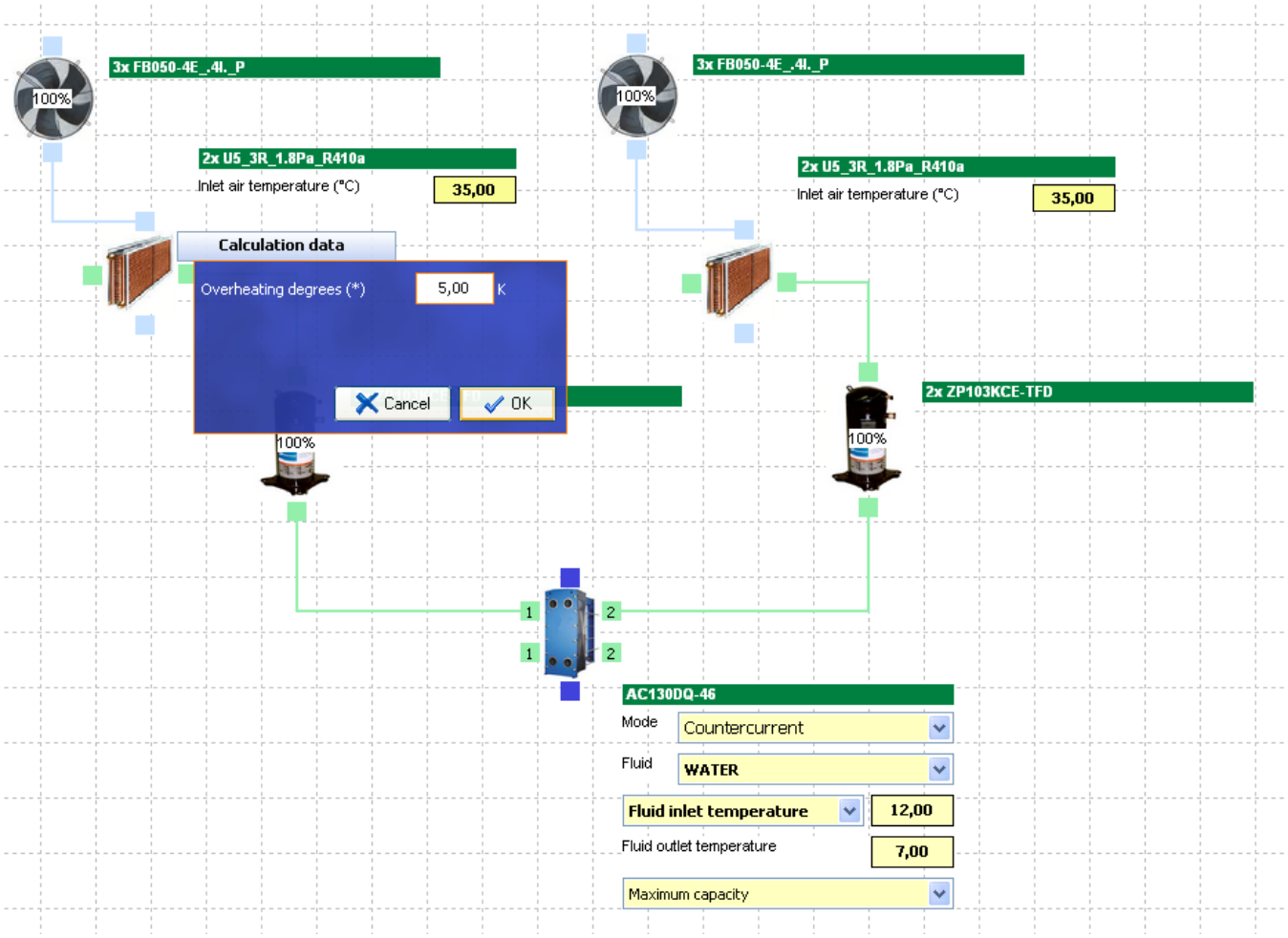


Excel tables

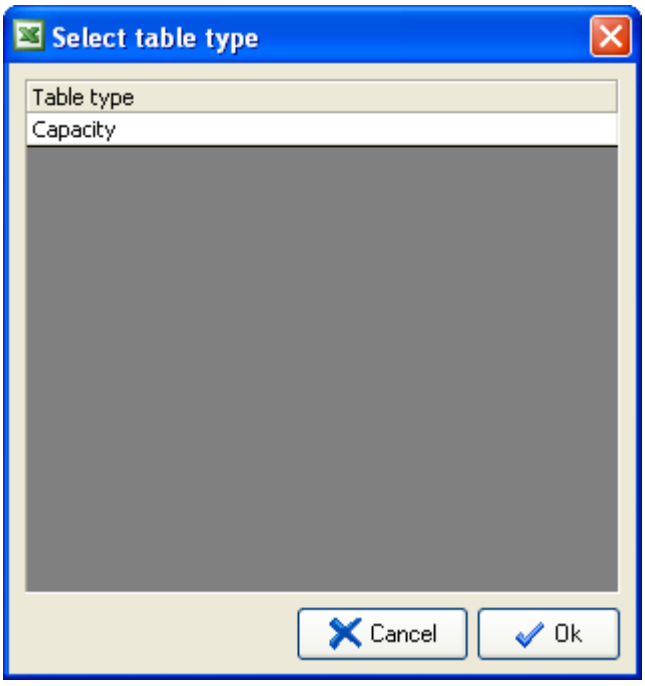
Shark is also able to export performances tables of the unit. To do so, click on the "Create Tables" icon in the tool bar:



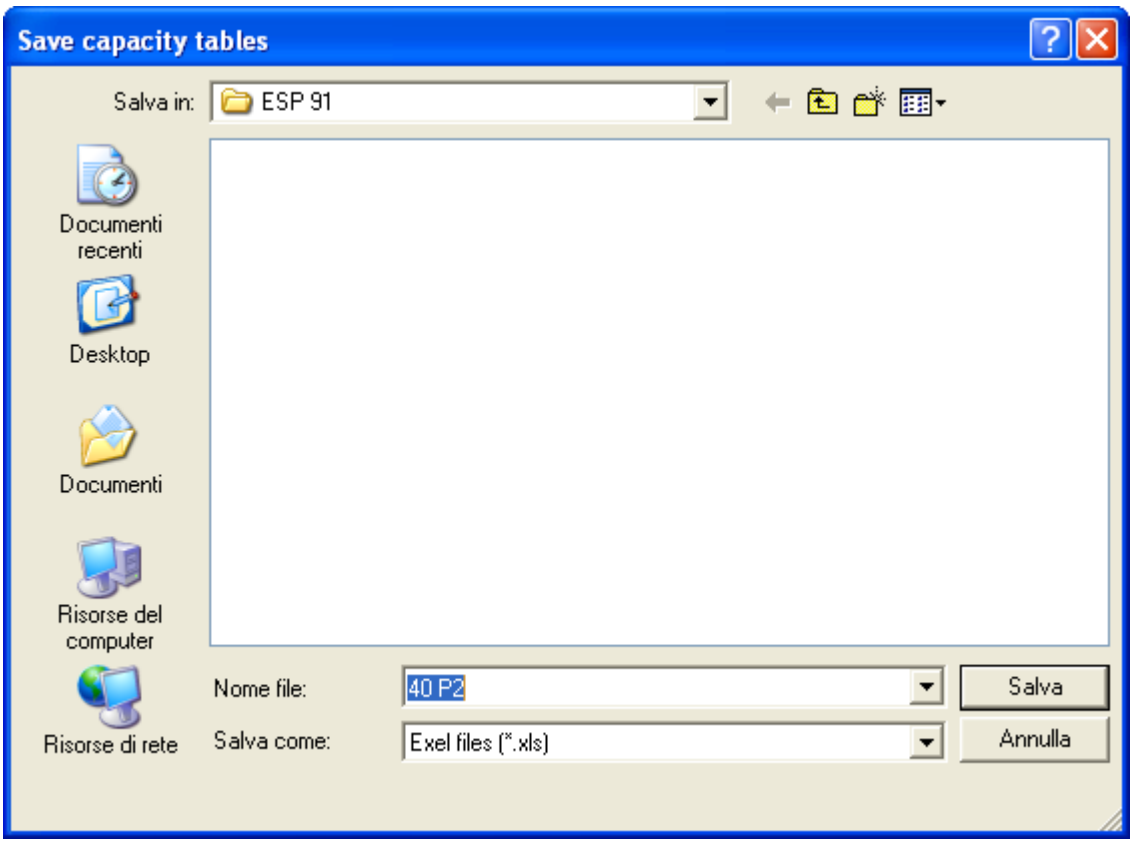
The program will start calculating the unit, and eventually asking for the input missing parameters:



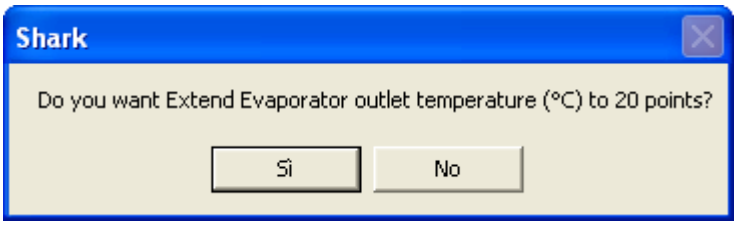
Once done the calculation, it will ask for the type of table that we want to export. This list depends on the typology of the unit. In this case we can create only Capacity tables:



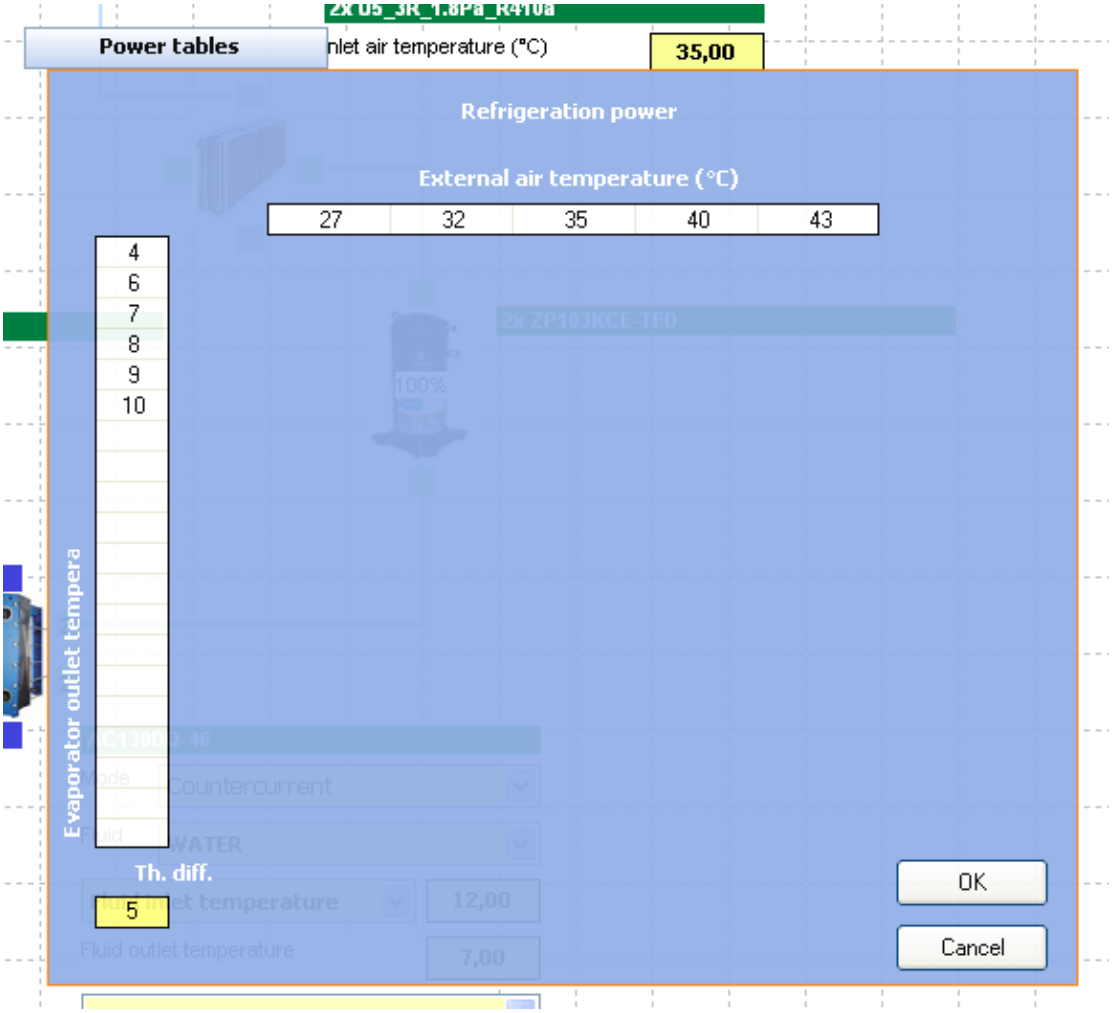
Then the program will ask for the output excel file:



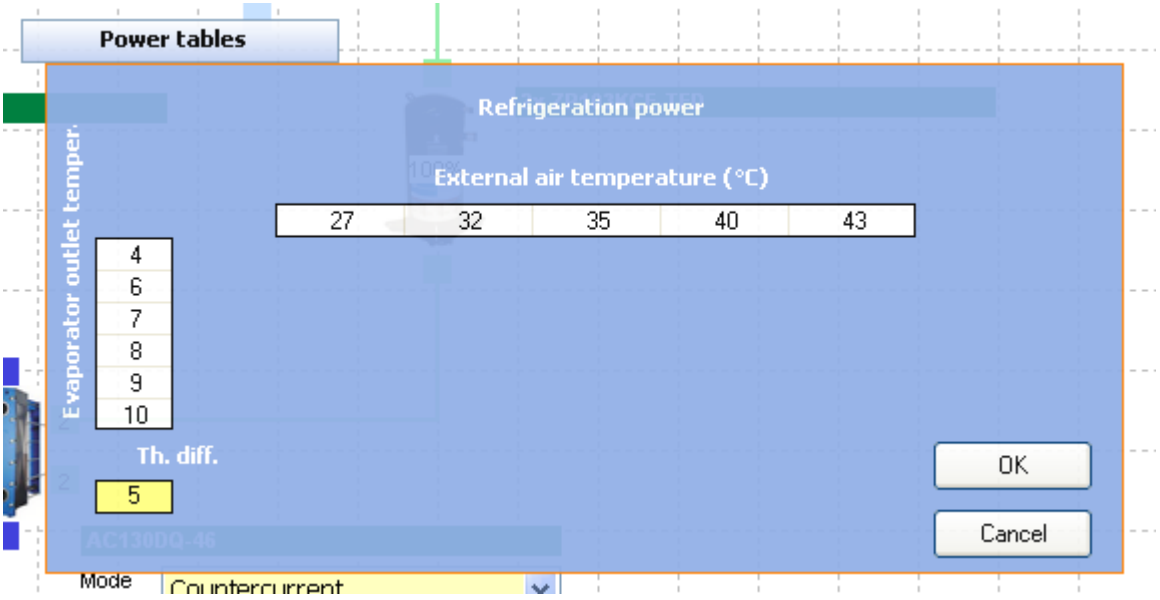
Eventually the program will ask if we want to extend the evaporator outlet temperature to 20 values:



The result looks like this:

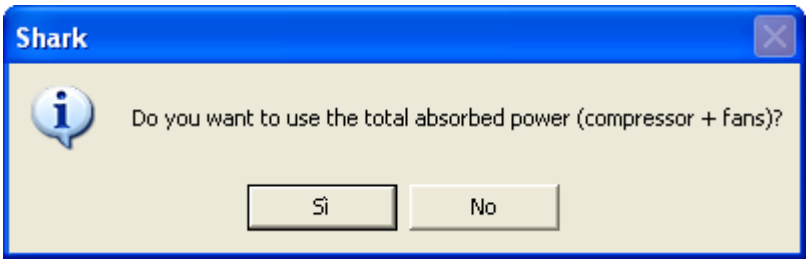


In our case we just want 6 points, so we will get an input for like this:



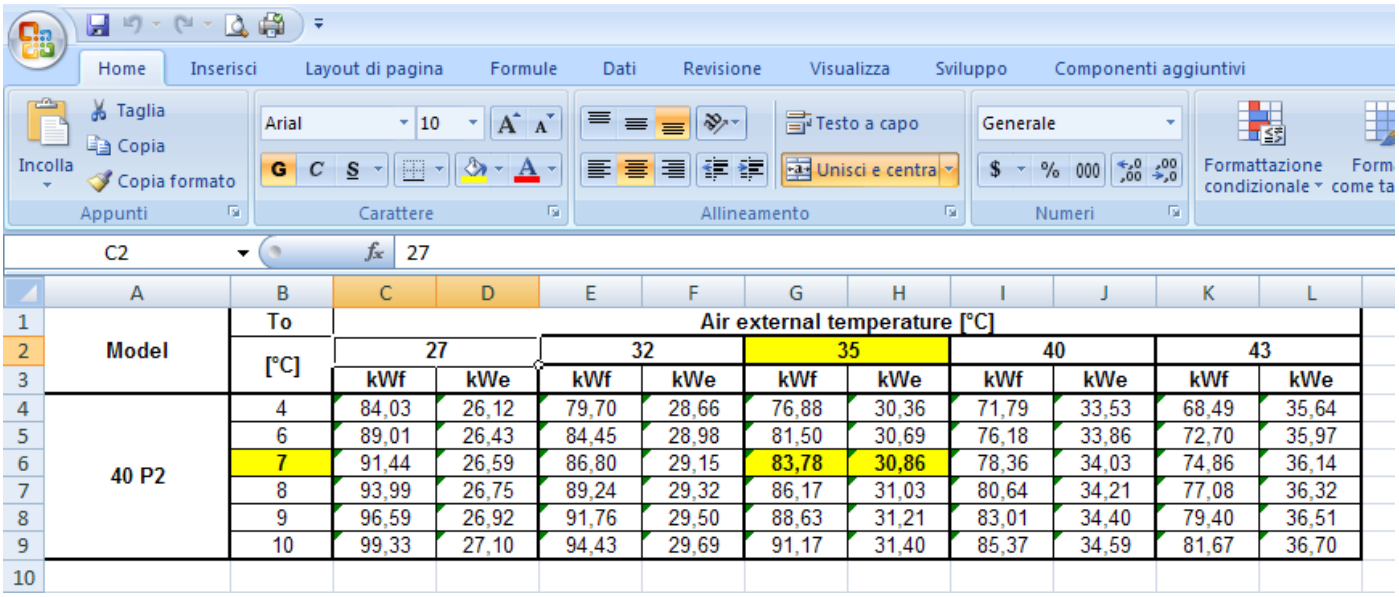
This lets us specify the temperature that will be used for the calculation of the table.

After we set the values that we want, and we click "Ok", the program asks if we want to consider the electrical absorbed power of the whole unit, fans included:



Then the program will calculate the table in a very short time:

And export the results in the specified excel file:

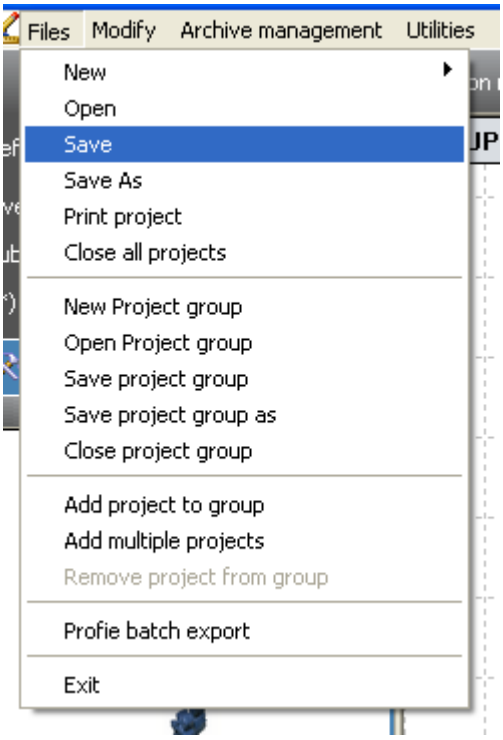


	A	B	C	D	E	F	G	H	I	J	K	L
1	Model	To	Air external temperature [°C]									
2		[°C]	27		32		35		40		43	
3			kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe	kWf	kWe
4	40 P2	4	84,03	26,12	79,70	28,66	76,88	30,36	71,79	33,53	68,49	35,64
5		6	89,01	26,43	84,45	28,98	81,50	30,69	76,18	33,86	72,70	35,97
6		7	91,44	26,59	86,80	29,15	83,78	30,86	78,36	34,03	74,86	36,14
7		8	93,99	26,75	89,24	29,32	86,17	31,03	80,64	34,21	77,08	36,32
8		9	96,59	26,92	91,76	29,50	88,63	31,21	83,01	34,40	79,40	36,51
9		10	99,33	27,10	94,43	29,69	91,17	31,40	85,37	34,59	81,67	36,70
10												

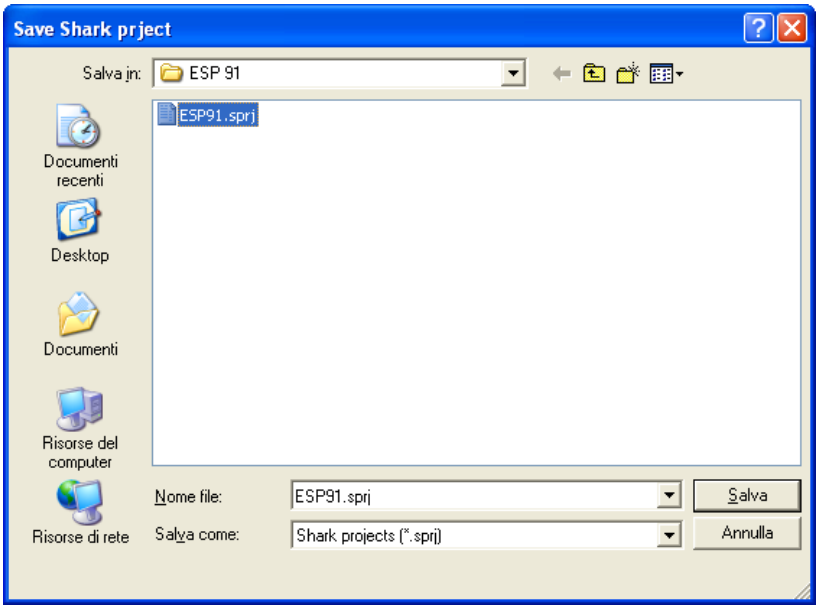
Projects management

Saving a project

In Shark, every project is a file that can be loaded, saved, moved just like a Word document. To save a project, click on the "Save" menu item in the "Files" menu:



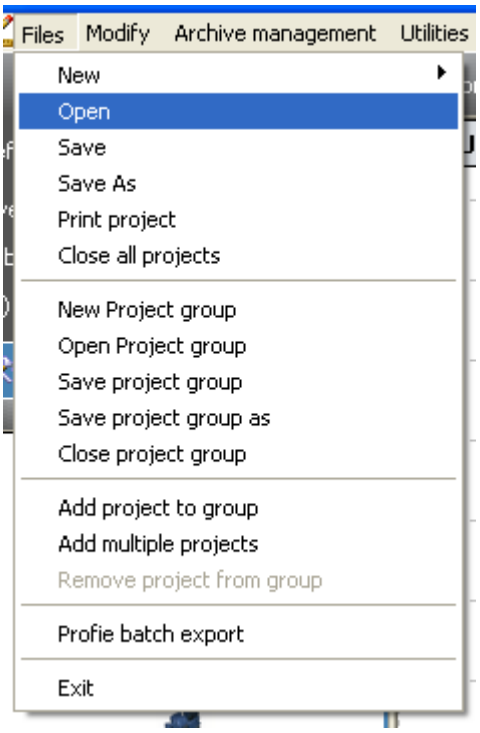
The program will ask the path where to save the project that can be any ware:



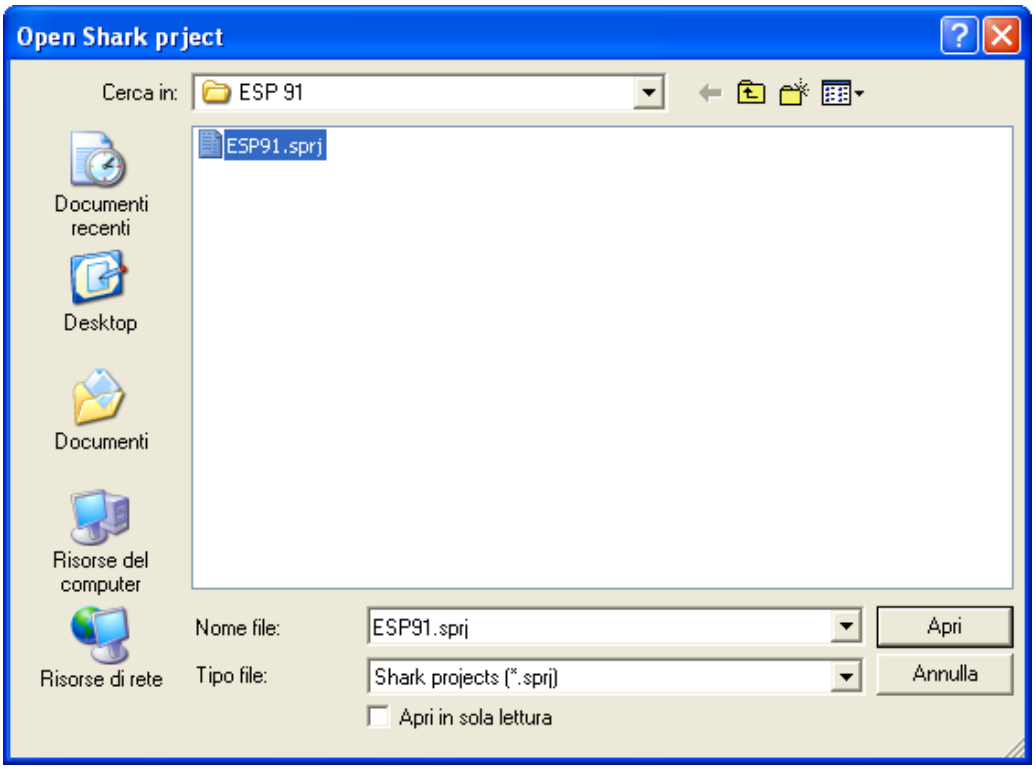
Once we click on the "Save" button, the file will be created or overwritten if necessary.

Loading a project

To load a project, click on the "Open" menu item in the "Files" menu:



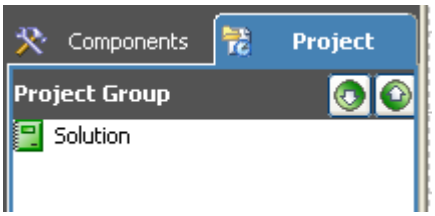
The program will ask the path where to open the project that can be any ware:



Once we click on the "Open" button, the project will be loaded in the design area.

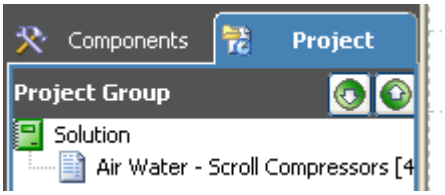
Creating a series

Shark lets you handle multiple projects in a series. This can be accessed on the left panel, in the "Project" tab:



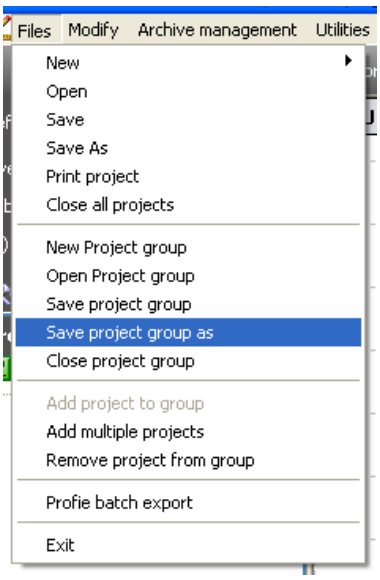
To add the selected project (that must be opened in the design area) to the series, we just click on the "Add project to group" button:

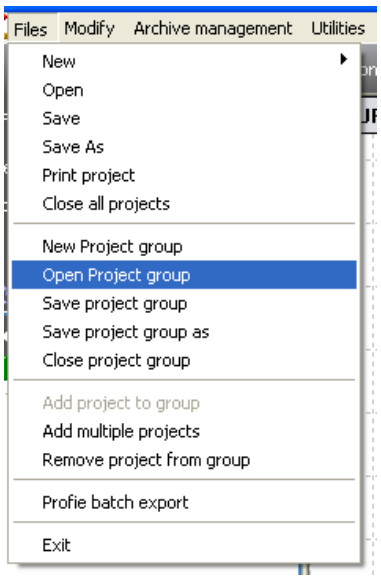
And the unit will be added to the series:



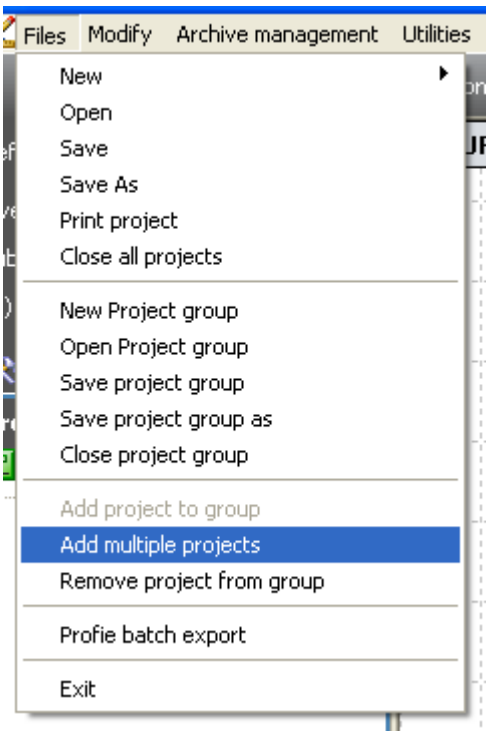
This can be repeated any number of time to create a complex series with no limitation on the number of units.

The group (or series) can be saved into a file for later use, and handled like a small file:

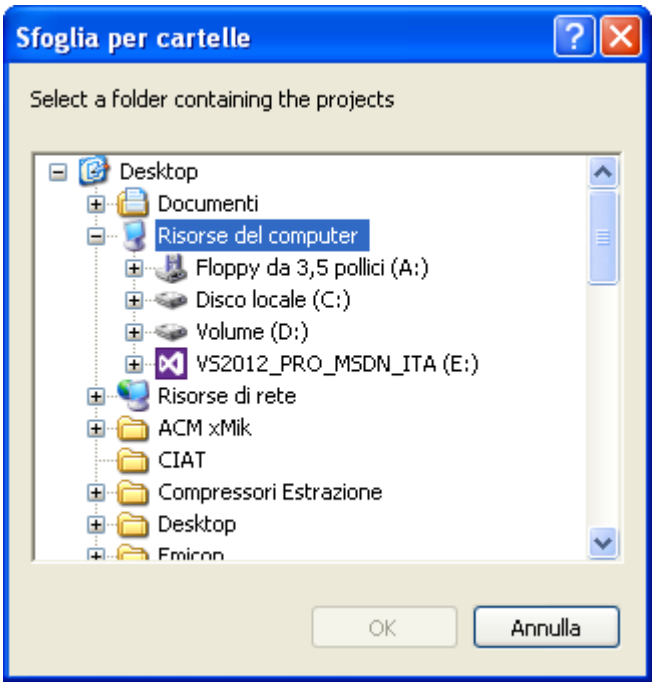




In the case that we have multiple files already stored in the same directory, and we want to create a series from them, we can proceed with the "Add multiple projects":



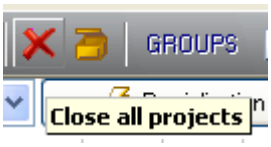
This will ask for the folder where the projects are:



As a result, the series with all the units will be created and can be handled like group file.

To remove a project from the series, we just have to click on the "Remove project from group":

To close all the opened projects, we just click on the button "Close all projects" on the toolbar:



Functionalities specific of series

When a series is loaded in Shark, the above buttons will be available. They allow you to (in order):

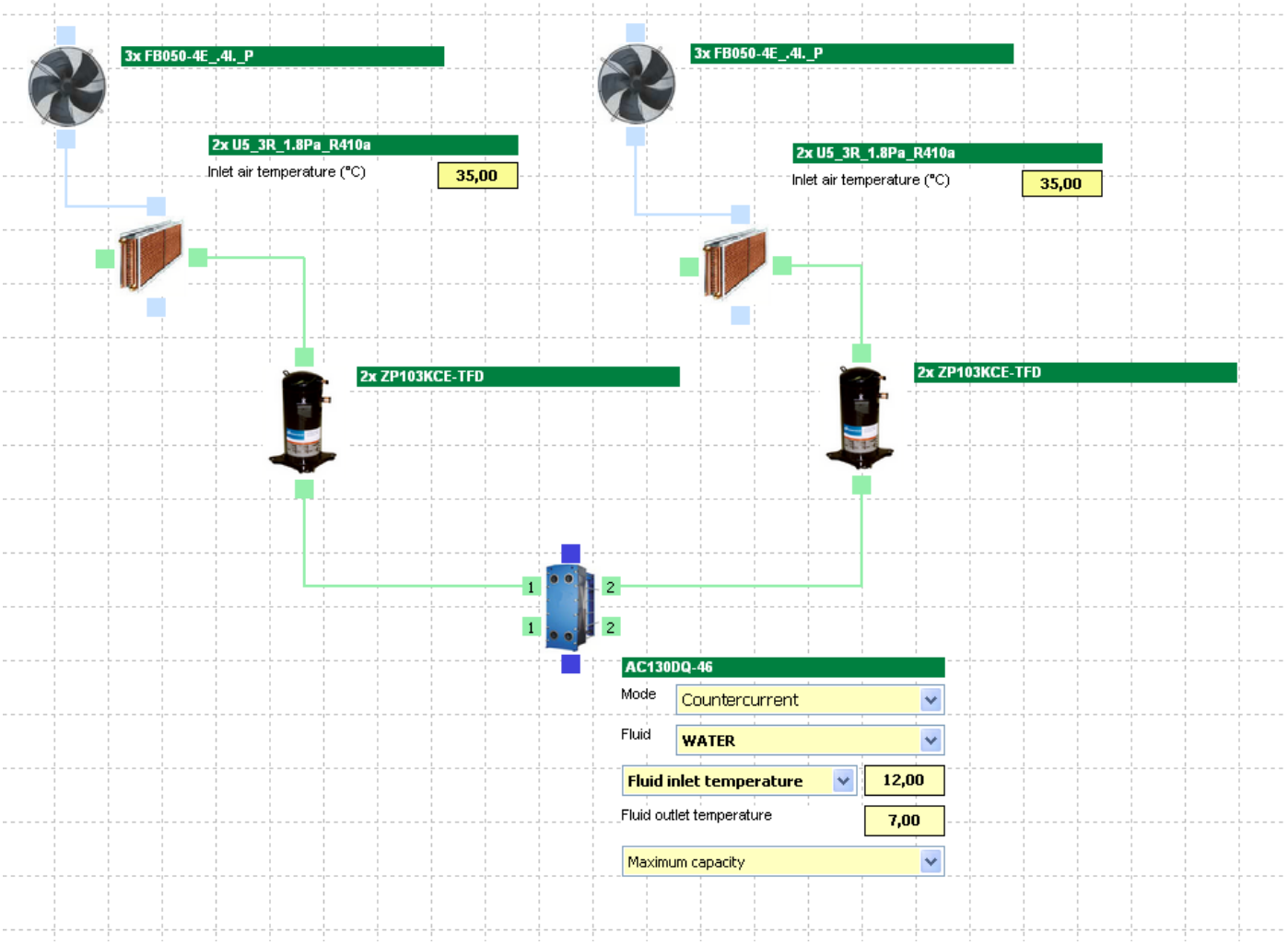
- Create a new series
- Load a series
- Save a series
- Save a series with a different name
- Calculate the ESEER (not used anymore)
- Create Excel performances table of the whole series.

Advanced simulations

Partialization of Air / Water chillers with Scroll Compressors

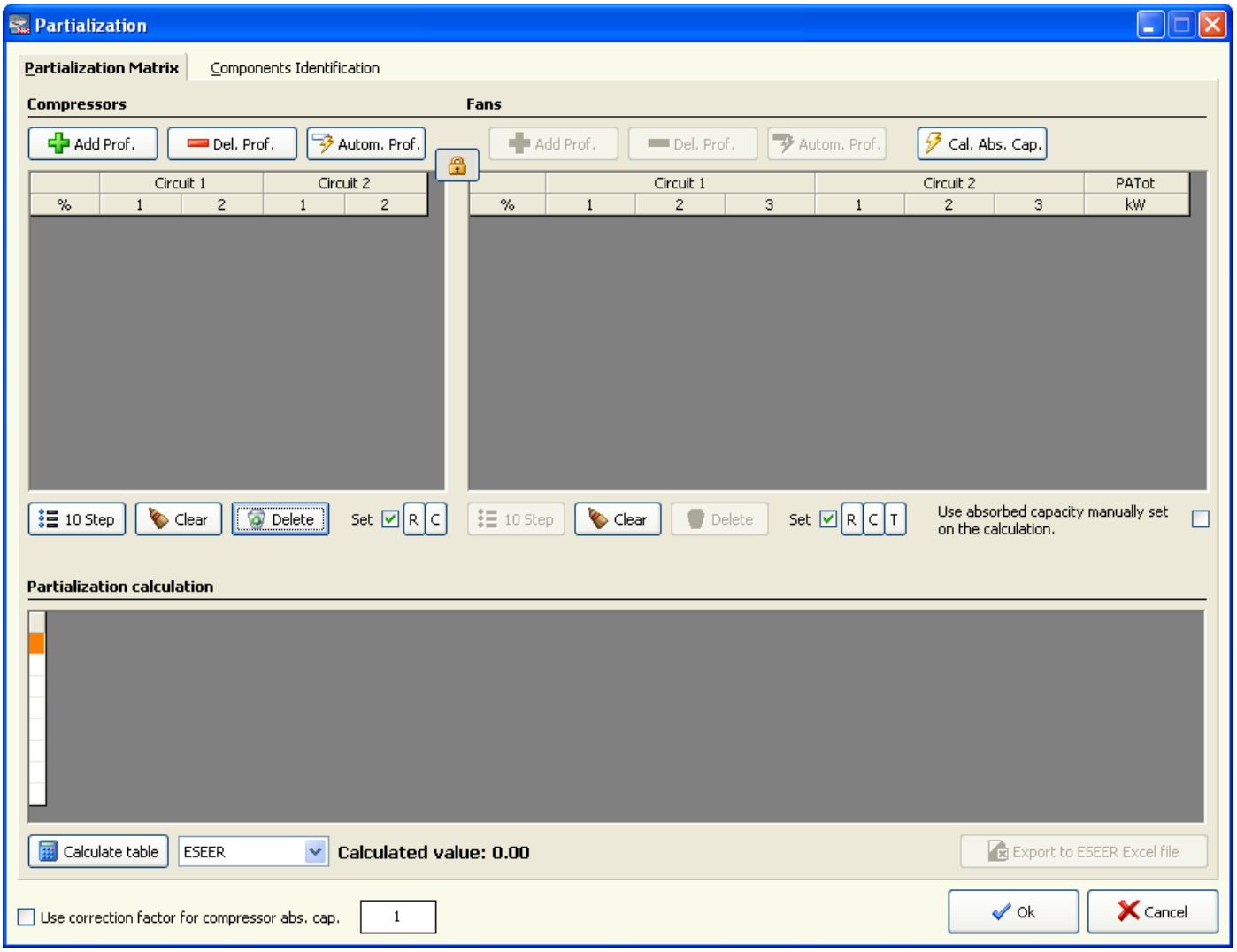
An important feature of SHARK is the simulation of the partialization of the unit.

Let's do an example with the unit below:

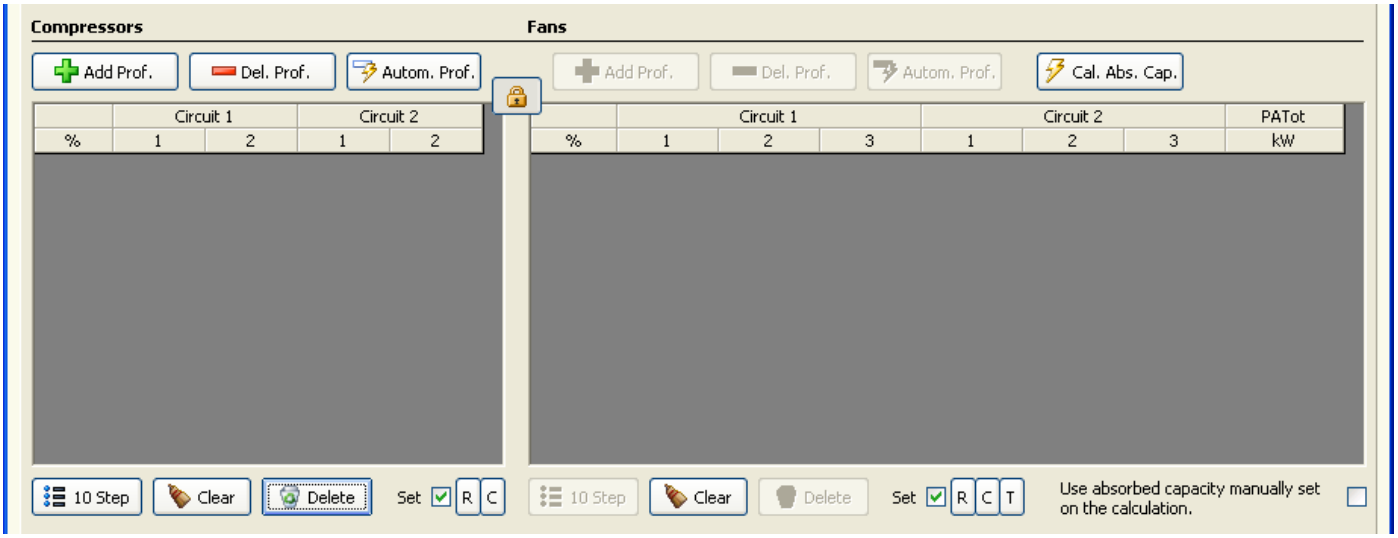


To access this feature, we click on the "Partialization" button on the top of the design window:

The following form will appear:

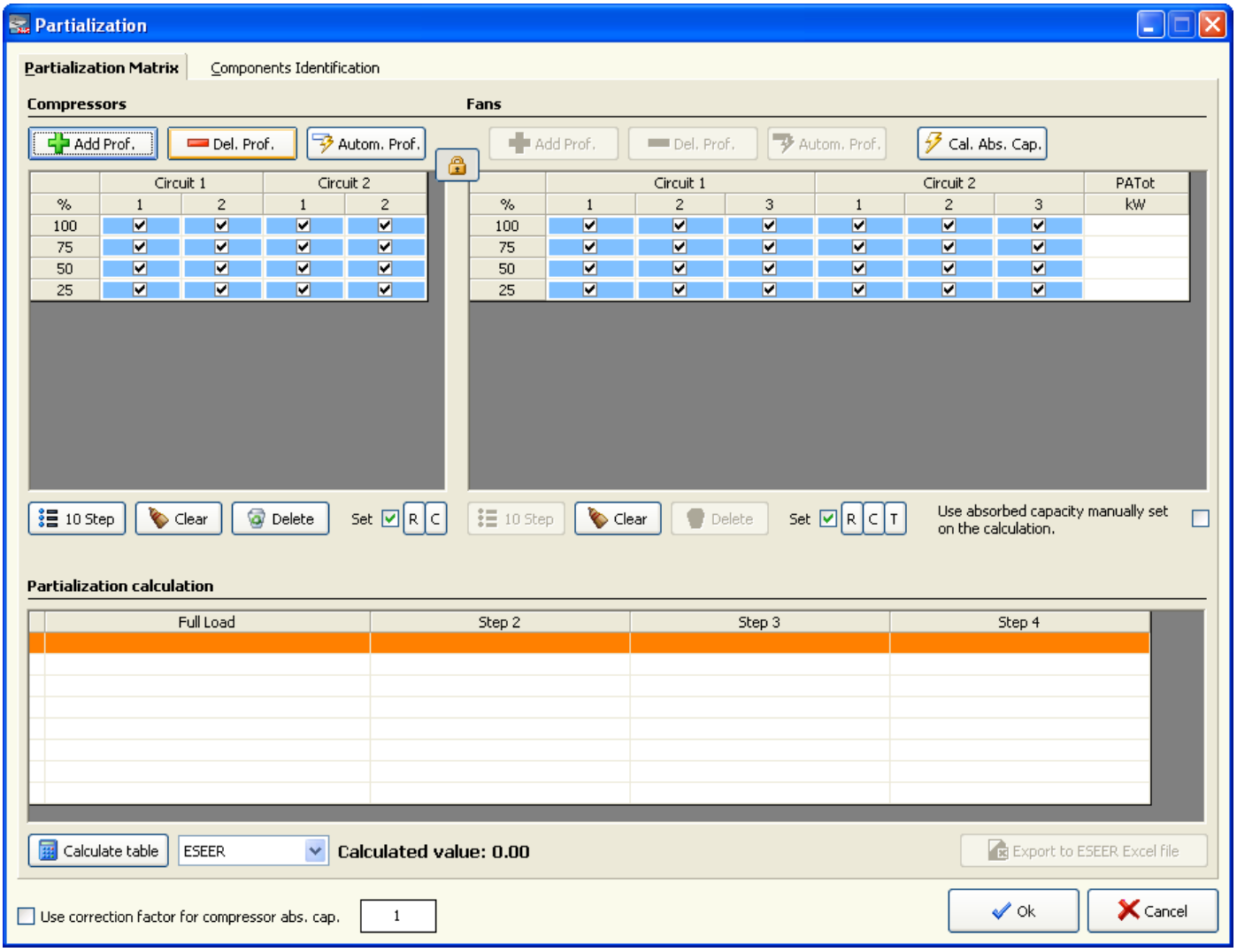


As you can see, this form is completely empty. It is divided into the Compressors partialization (left side) and the Fans partialization:

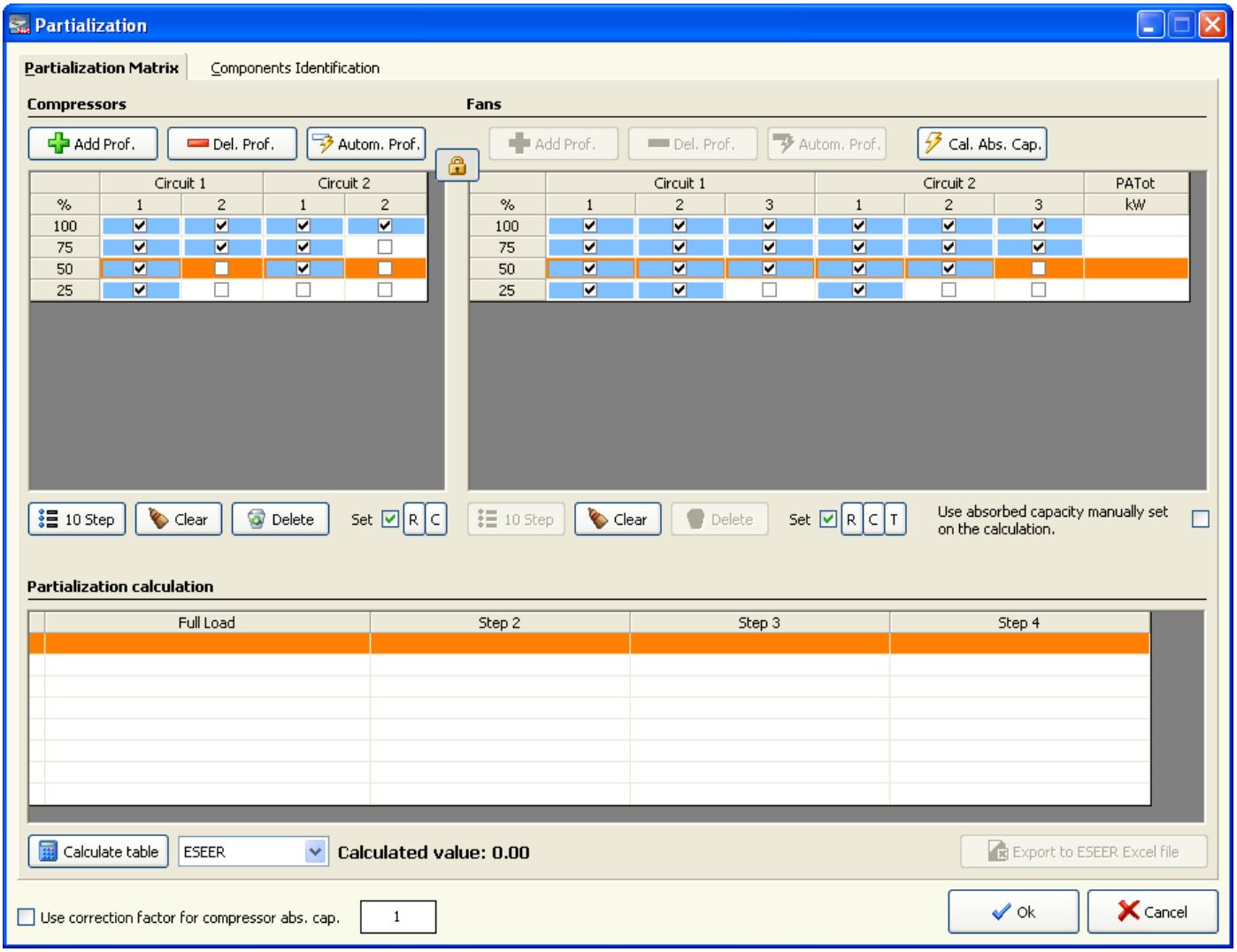


Let's now add a new partialization profile:

And, since our unit is made of 4 scroll compressors, repeat it 4 times in order to simulate a 100-75-50-25 partialization:

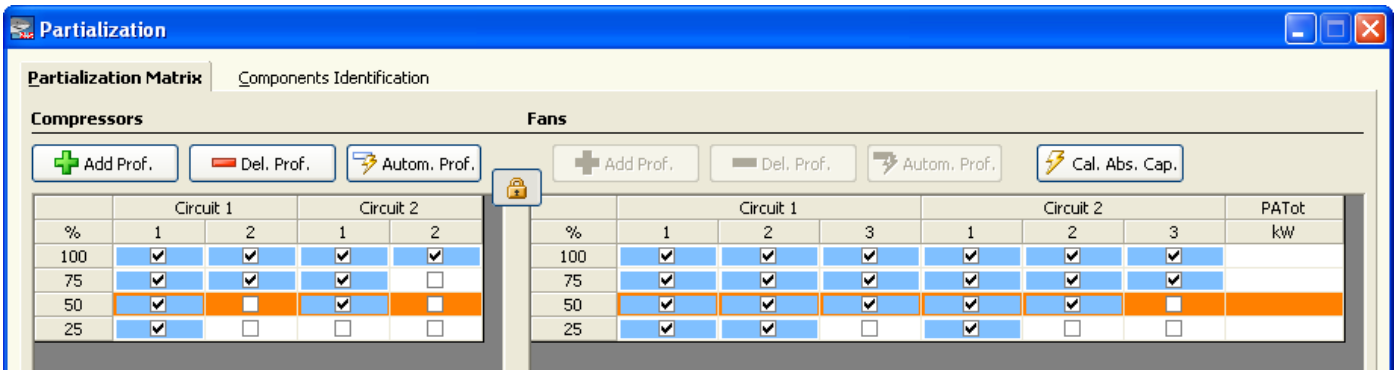


Each cell of the two grids represents the on/off state of the compressor or the fan:

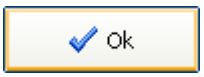


Look at the 50% row: in this case we set the first compressor of each circuit "on", but we can reproduce any other condition (like first circuit 100% and second circuit 0%):

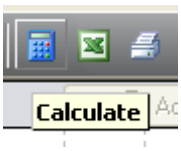
Let's now simulate the calculation at 50%. Select the 50% row and make it sure that it's highlighted:



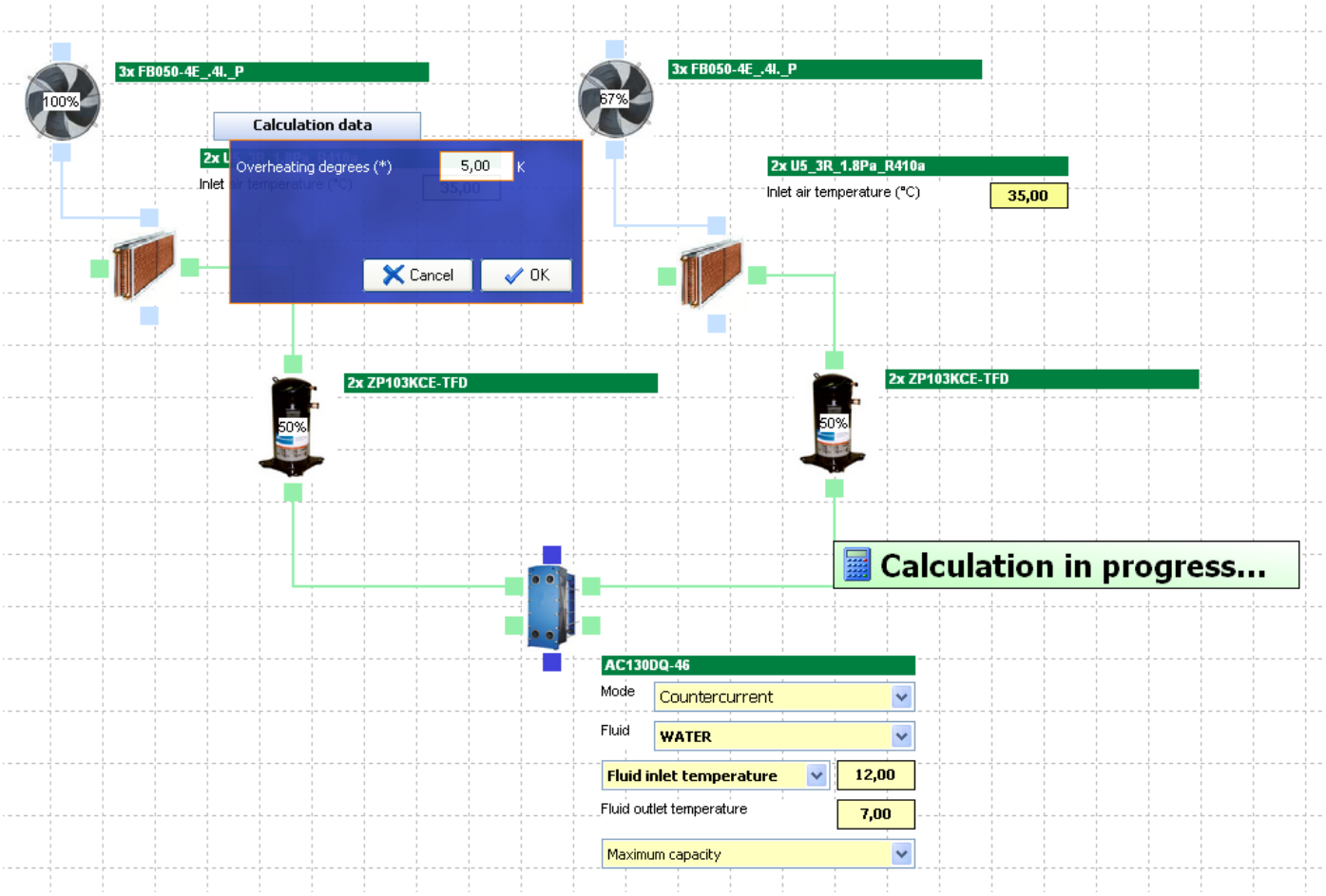
Then click on "Ok" button:



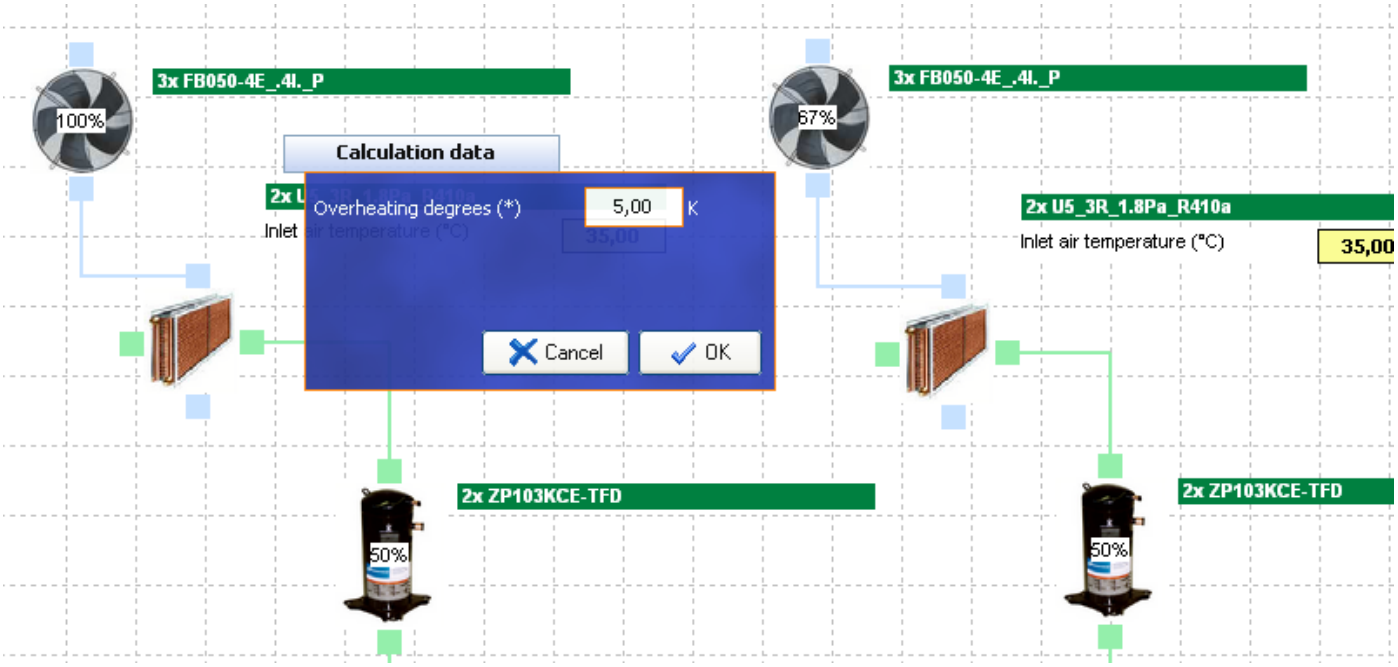
Let's now calculate:



As usual the program will ask for the missing parameters:



Please notice that the program is now showing for each component its working condition:



And the resulting capacity is changed:

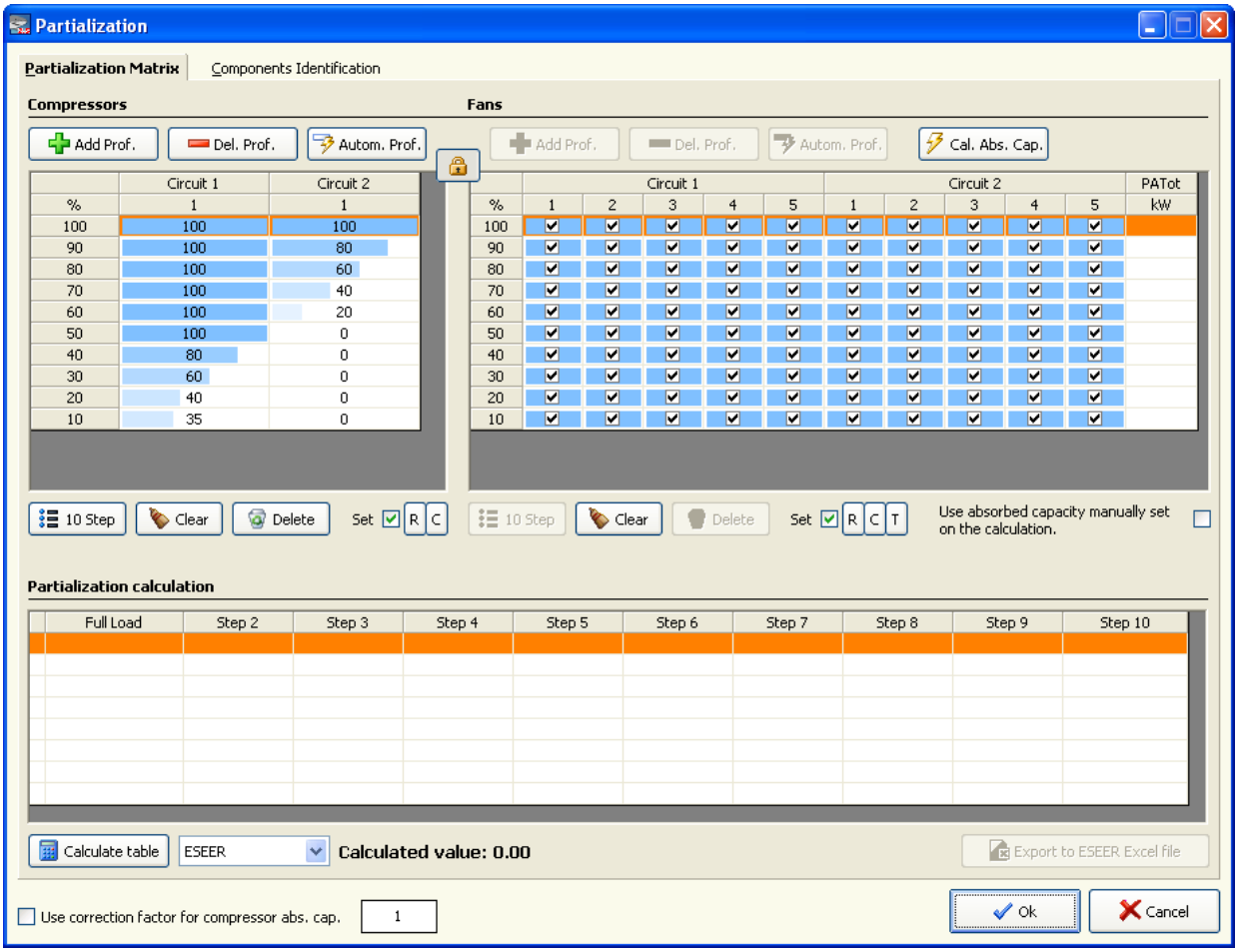
Calculation Data		
Refrigeration circuit global		
Cooling Capacity:	48,94	kW
Total Capacity:	61,09	kW
Abs. compressors capacity	12,15	kW
Abs. fans capacity	2,70	kW
Total absorbed capacity	14,85	kW
EER Compressors	4,03	
EER Fans	18,13	
EER Total	3,30	
Refrigeration circuit - side 1		
Evaporating Temperature:	2,55	°C
Condensing Temperature:	43,15	°C
Cooling Capacity:	24,47	kW
Total Capacity:	30,55	kW
Abs. compressors capacity	6,07	kW
Abs. fans capacity	1,62	kW
Total absorbed capacity	7,69	kW
EER Compressors	4,03	
EER Fans	15,11	
EER Total	3,18	

Please notice that 50% doesn't mean that the resulting capacity will be exactly 50% of the capacity at 100%. The program performs the simulation of the whole unit, indicating the new condensing and evaporating temperatures.

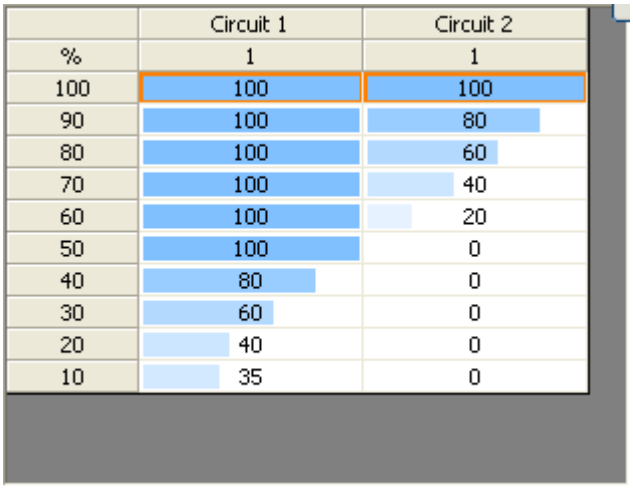
Partialization with Screw compressors:

The partialization with screw compressors gives the possibility to specify precisely the working partialization of each compressor, on a 0 to 100% continuous scale.

For example, for a unit with two compressors, the form will be like the following:

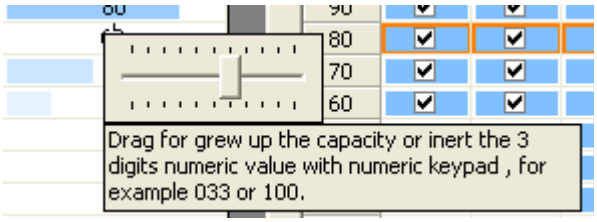


Where in details, the screw compressors partialization is represented like this:



%	Circuit 1	Circuit 2
	1	1
100	100	100
90	100	80
80	100	60
70	100	40
60	100	20
50	100	0
40	80	0
30	60	0
20	40	0
10	35	0

There is no limitation in the number of steps or in the values that can be inserted. But please remember that for a typical Screw Compressor, it is not safe to go below the 25%. To specify the partialization level, double click on the selected cell:

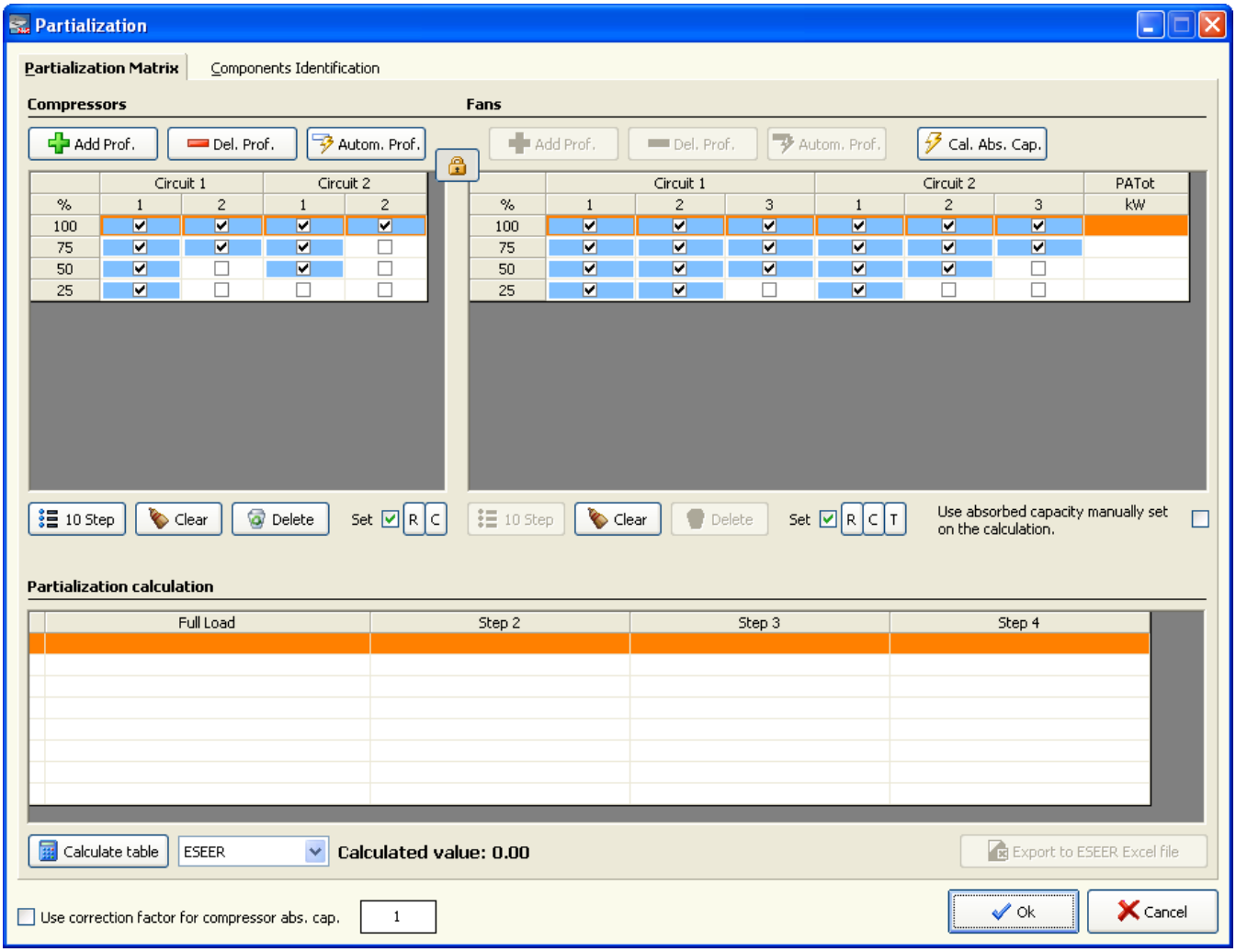


As you can see, you can drag the slider to set the value or enter the value with the keyboard.

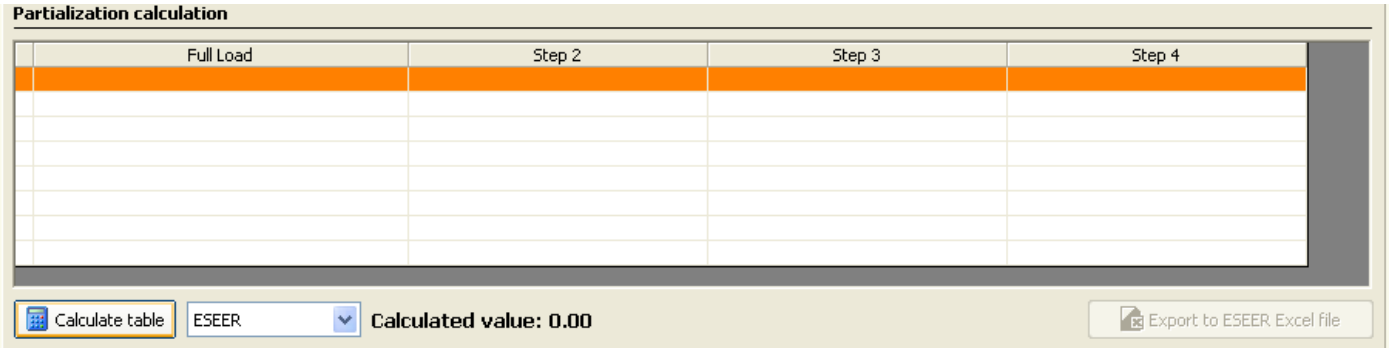
Please notice that 50% doesn't mean that the resulting capacity will be exactly 50% of the capacity at 100%. The program applies a correction factor to the calculation result of the compressors and performs the simulation of the whole unit, indicating the new condensing and evaporating temperatures.

ESEER and IPLV

To calculate the ESEER and the IPLV, it is important that the partialization of the unit is very well specified:

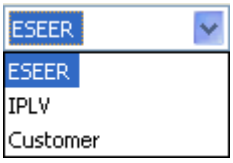


This part of the above form is involved in the calculation of the ESEER or the IPLV:



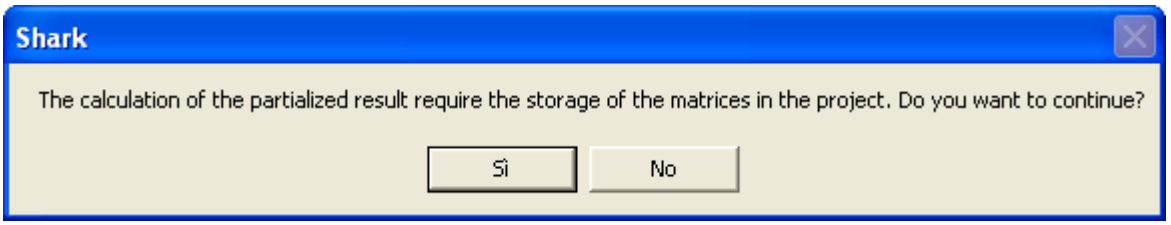
As you can see, this table represents the cooling and electric power of the unit at each partialization step and temperature conditions (both Eurovent and AHRI).

To perform the calculation of the ESEER or IPLV, we have to first select which type of index we should calculate:

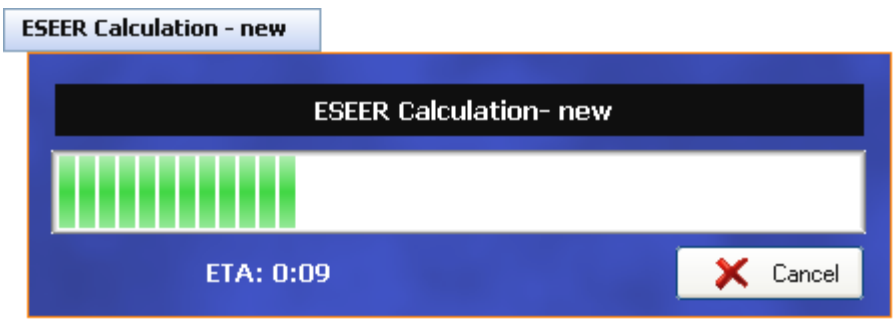


Customer is a special item that lets you specify the temperatures both evaporator and condenser sides.
Let's click on the "Calculate" button:

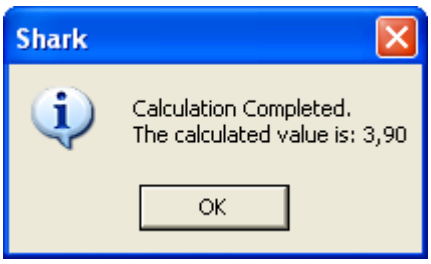
The program will ask to save the partialization tables in the project:



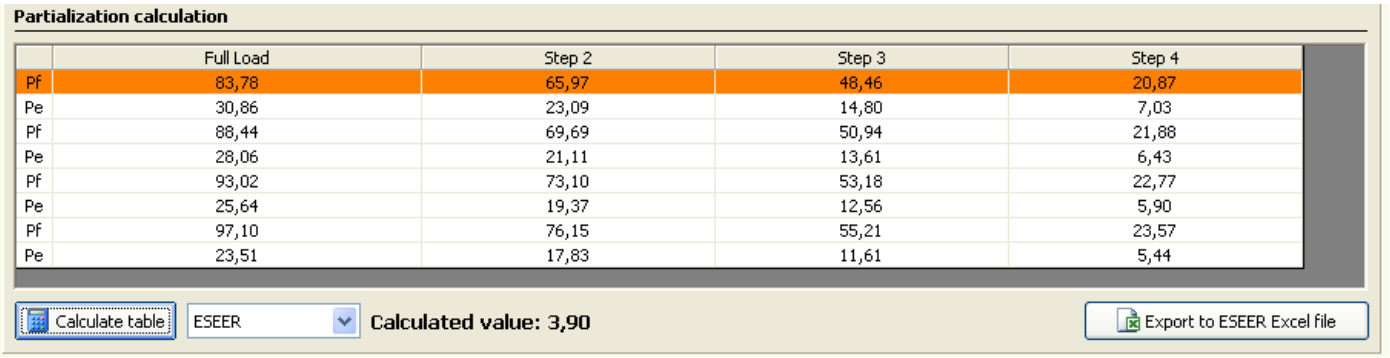
Let's click on Yes to continue. The program will perform the calculation of the unit at the specified conditions:



When the calculation is completed, the program will show the calculate value:



And it will complete the performance table:



Please note that, as per ESEER calculation specifications, the unit at 100% condition is calculated with a fixed DeltaT on the fluid side, and on all the other conditions the unit is calculated with the resulting fluid flow.

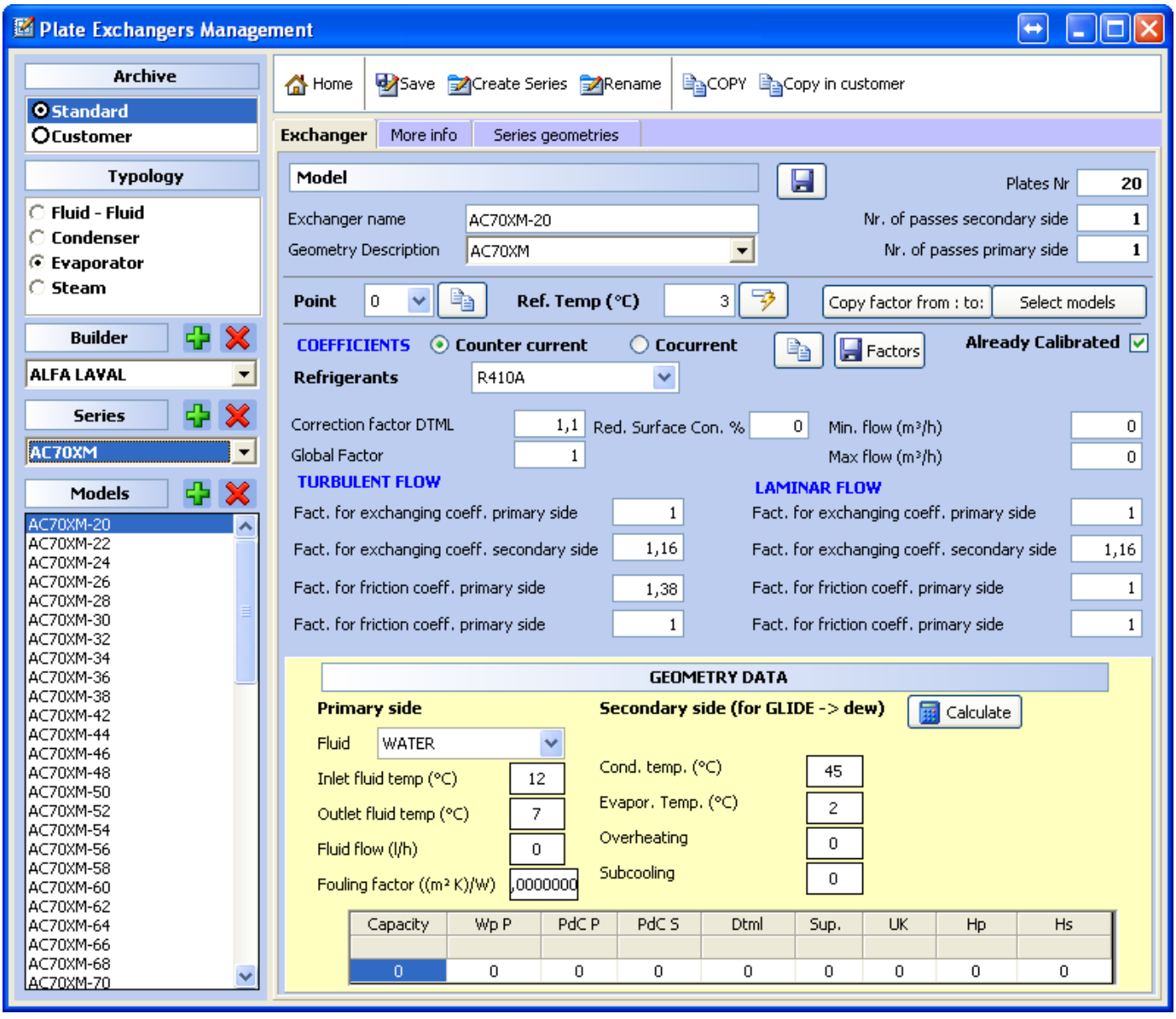
Factors usage in SHARK

SHARK allows applying the factors to rate the calculation at various levels, so that the results can be adjusted on the correct part of the correct part of the calculation. The factors can be applied on three levels:

- At the component level in the archive
- At the unit level, but referred to the component
- At global level

Factors at component level

These factors depend on the typology of the component, if it is a plate heat exchanger, a shell and tube or a coil. The management window of each component allows the modification of such factors. Following is an example: the management window of the plate heat exchangers.



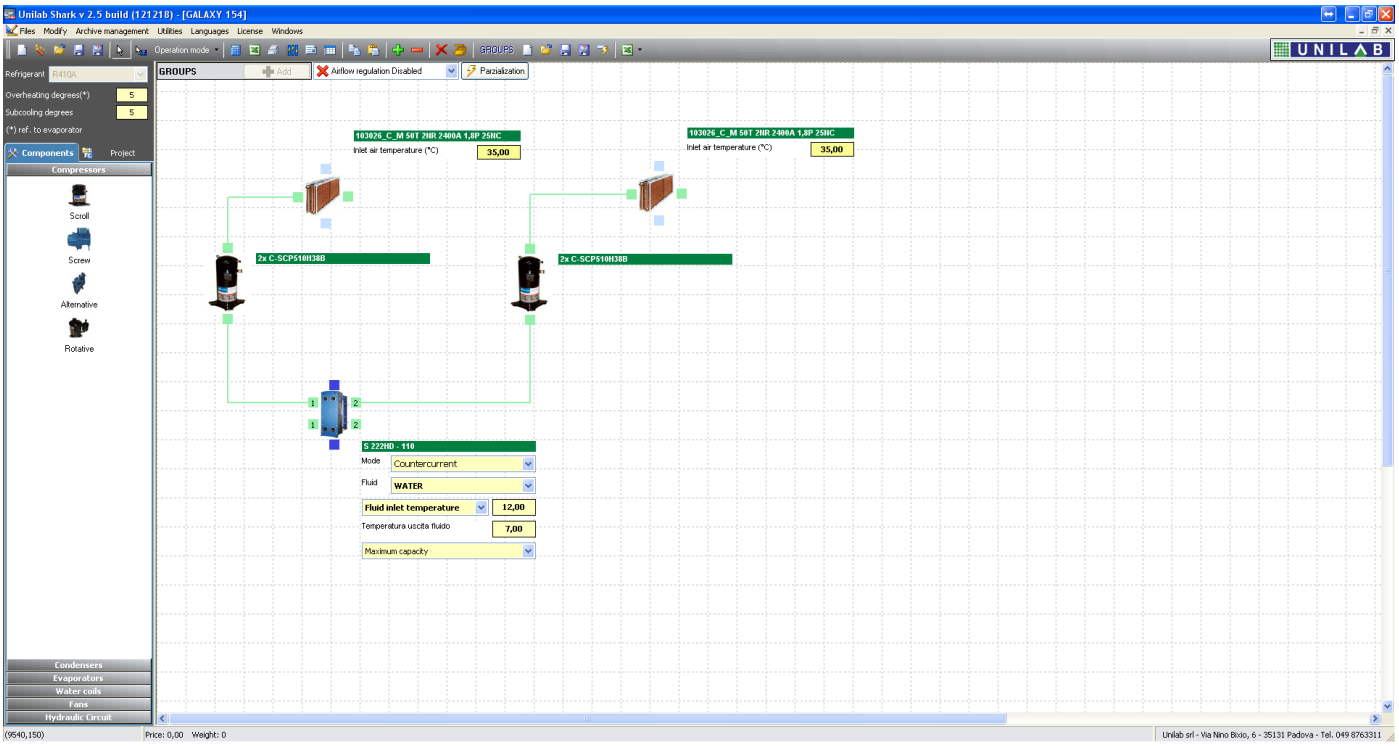
As we can see in the central part of the window contains a series of factors relative to the chosen exchanger

Each management window has its own factors that act directly on the calculation engine of SHARK.

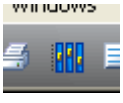
Attention: the modified factors at this level will have effect on all the projects that use the chosen exchanger. This could be an advantage, for example if it would be necessary to rate an exchanger that gives a capacity that is very diverse from what it should, on the global level, so that all projects and all designers (if the archive is shared) could benefit from it. It could instead become into a problem, when we recalculate projects of units already calculated, and rated and of which data in the catalogues has already been reported, because in such case, they would change
So the factors on the component should be used only if necessary.

Factors at unit level, relative to the component

At this point, we see the factors at the unit level, which is specific of a particular model. To access those factors, it is enough to open the project:



To click on factors button on the tool bar on the top:



The following table will appear, of which we report also the meaning. The first half refers to the unit calculated as direct cycle, the second one as inverse cycle.

CHILLER	
Evaporator Factor	1,000000
Sensible capacity factor	1,000000
Evaporator PD Factor	1,000000
Condenser Factor	1,000000
Condenser PD Factor	1,000000
Global power Factor	1,000000
Absorbed power Factor	1,000000
Abs. current factor	1,000000
Hydraulic Kv	0,000000
Air side Kv	0,000000

Evaporator Factor: acts on the capacity of the evaporator
Sensible capacity factor: acts on the sensible capacity
Evaporator Pressure drops Factor (fluid side, not Freon side)
Condenser Factor: acts on the capacity of the condenser
Pressure Drops Factor Condenser (fluid side, not Freon side)
} Global factors, discussed later
kV hydraulic factor user side
Air side kV factor fan side

HEAT PUMP	
Evaporator Factor	1,000000
Evaporator PD Factor	1,000000
Condenser Factor	1,000000
Condenser PD Factor	1,000000
Global power Factor	1,000000
Absorbed power Factor	1,000000
Abs. current factor	1,000000
Hydraulic Kv	0,000000
Air side Kv	0,000000

Evaporator Factor: acts on the capacity of the evaporator
Evaporator Pressure drops Factor (fluid side, not Freon side)
Condenser Factor: acts on the capacity of the condenser
Pressure Drops Factor Condenser (fluid side, not Freon side)
} Global factors, discussed later
kV hydraulic factor user side
Air side kV factor fan side

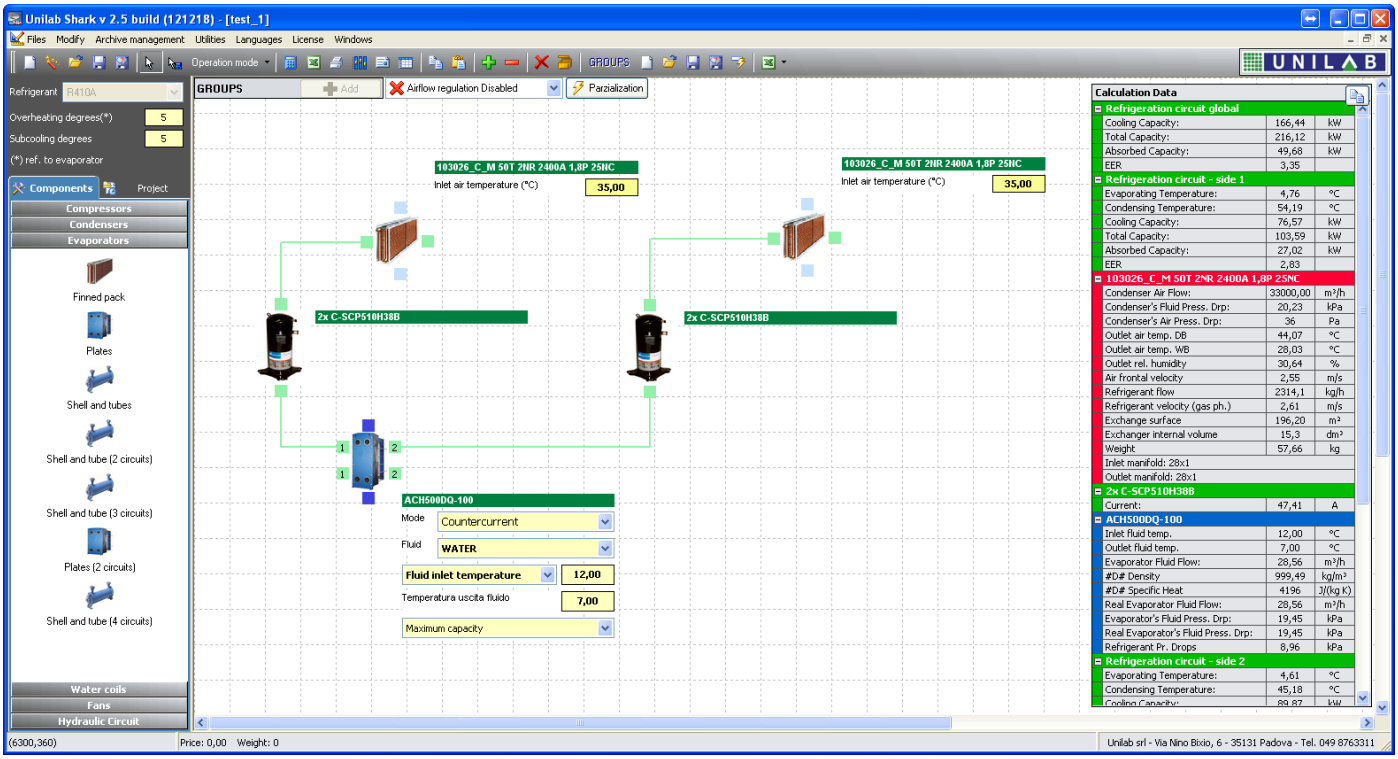
The button on the side allows accessing the factors the fouling factor:

Fouling Factors	
Evaporator	0,000000
Condenser	0,000000
Recuperator	0,000000
Heating coil	0,000000
Cooling coil	0,000000

Fouling Factor evaporator
Fouling Factor condenser
Fouling Factor recuperator
Fouling Factor heating coil
Fouling Factor cooling coil

Rating Example

Suppose we want to calculate the following unit:



These are the temperatures of the condensing and evaporating obtained:

Refrigeration circuit - side 1		
Evaporating Temperature:	4,76	°C
Condensing Temperature:	54,19	°C

Being that both circuits are made of the same components, the second circuit balances on the same values.
Suppose we want to lower the condensation. To do so, we need to increase the capacity of the condensing temperature.

We set the condensing factor as:

Condenser Factor	1,150000

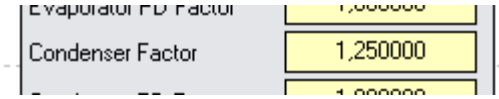
We calculate again, and we see that the condensing temperature has lowered of 1 °:

Refrigeration circuit - side 1		
Evaporating Temperature:	4,74	°C
Condensing Temperature:	53,02	°C

The capacity has changed obviously:

Refrigeration circuit global		
Cooling Capacity:	168,08	kW
Total Capacity:	217,14	kW
Absorbed Capacity:	49,06	kW
EER	3,43	

We want to get 52 °C, so we touch once more the factor:



At this point we calculate again and we see the result:

Refrigeration circuit - side 1		
Evaporating Temperature:	4,73	°C
Condensing Temperature:	52,39	°C

The value is nearer to 52 ° c... The results of the capacities are:

Calculation Data		
Refrigeration circuit global		
Cooling Capacity:	168,97	kW
Total Capacity:	217,70	kW
Absorbed Capacity:	48,74	kW
EER	3,47	

At this point it is a question only to find the correct factor to center the result on the desired value. This procedure is valid also for all other factors.

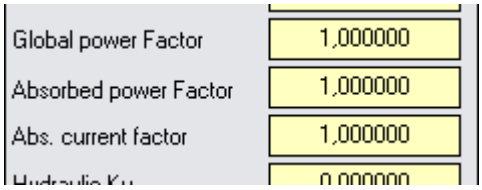
Attention: the rating factor is not proportional; they act on specific equations in the calculation engine.

Global Factors

Let's see the global factors. These factors refer to the unit, but they adjust the cooling capacity of the unit at the global level, the same is valid for the absorbed capacity and absorbed current.

To access these factors, the procedure is the same. It is enough to click on the factors button on the tool bar:

The factors table will appear. At the center of each factors group, we find:



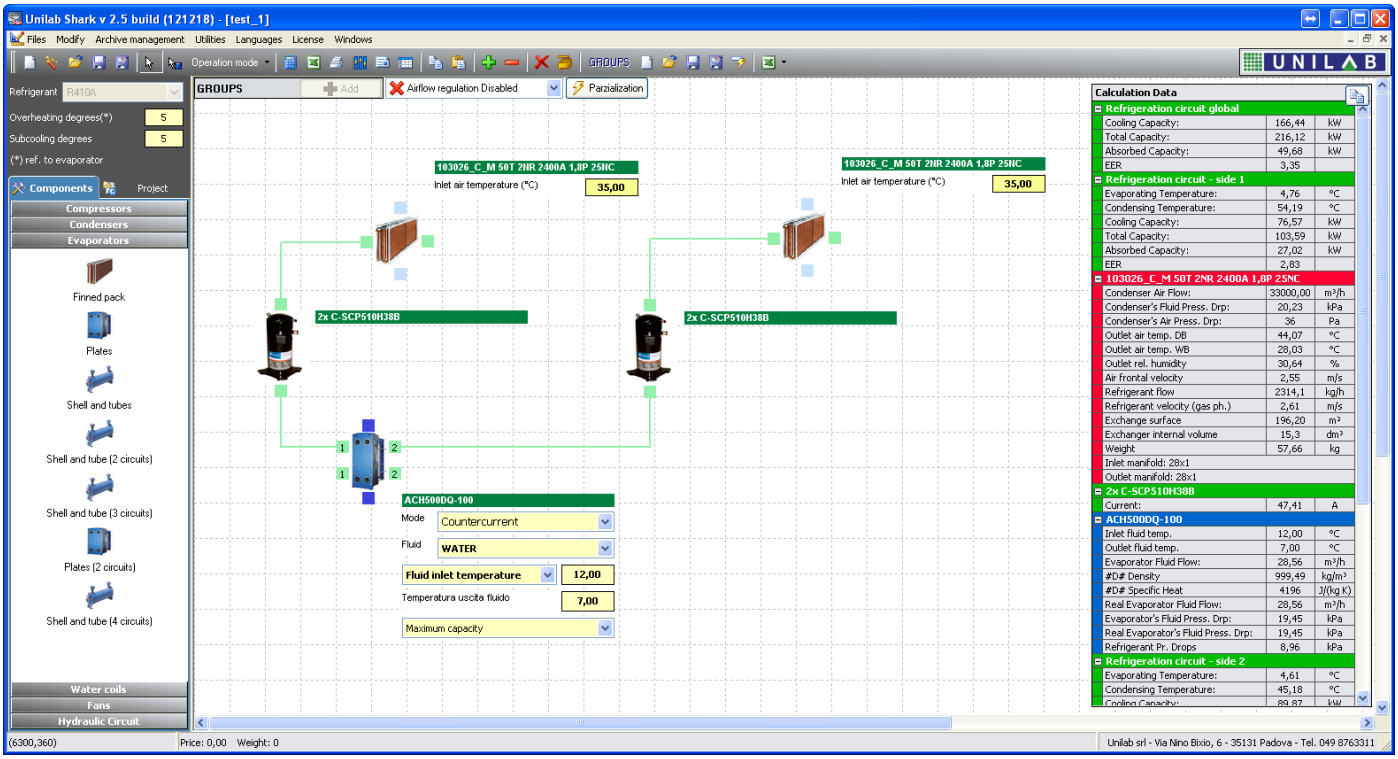
Global power Factor

Absorbed power Factor

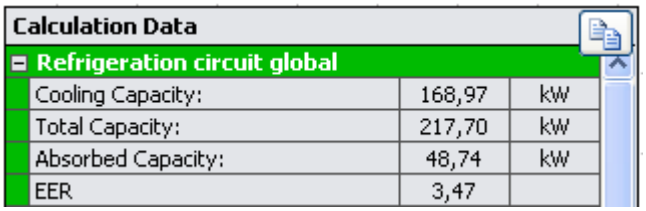
Absorbed current factor

Rating Example

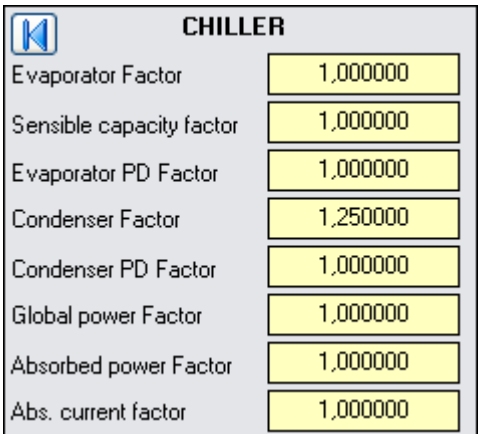
Suppose we calculate the same previous unit, after rating the condensing and evaporating temperatures:



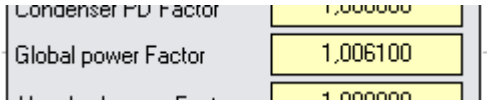
The results of the calculation:



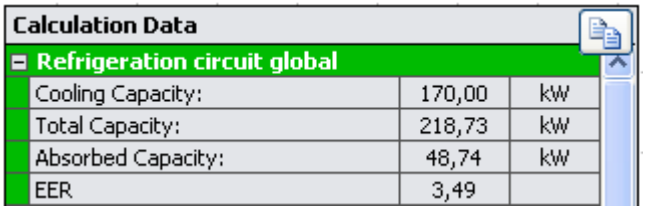
We open again the table of the factors:



At this point, we act on the global factor on the cooling capacity. This factor is proportional, so to obtain 170 kW we need to insert this factor:

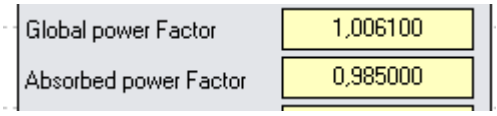


Calculating again, we see the capacity is now 170 kW:

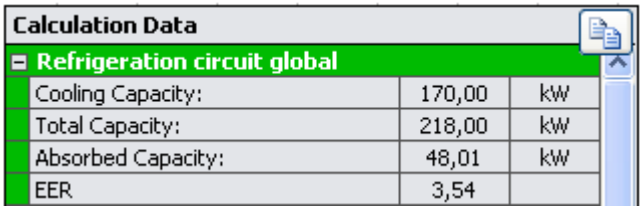


Calculation Data		
Refrigeration circuit global		
Cooling Capacity:	170,00	kW
Total Capacity:	218,73	kW
Absorbed Capacity:	48,74	kW
EER	3,49	

We repeat the operation with the absorbed power, inserting the following value:



We have rated the unit:



Calculation Data		
Refrigeration circuit global		
Cooling Capacity:	170,00	kW
Total Capacity:	218,00	kW
Absorbed Capacity:	48,01	kW
EER	3,54	

Archive management

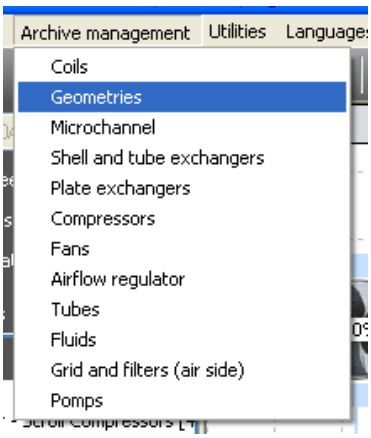
The two database archive of SHARK

Before we can show how to insert any type of data in SHARK, it is important to state that the archives are divided in two parts:

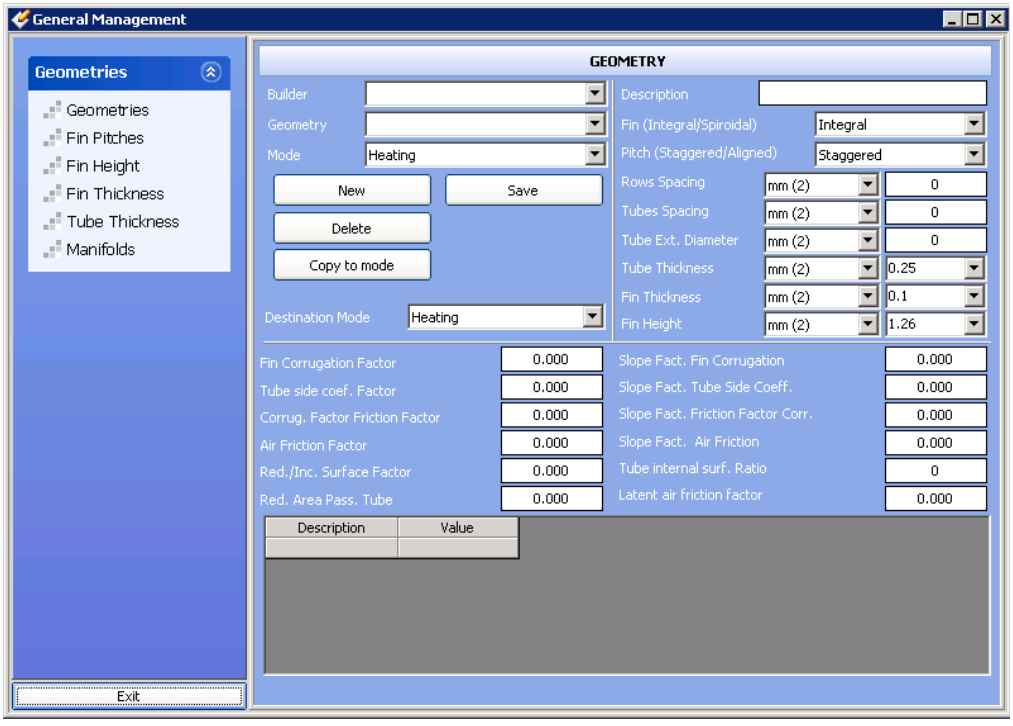
- Standard: are standard archives given by Unilab and are periodically updated. No components should be inserted in this archive because it could be removed by one of our updates.
- Customer: is the archive where to insert new components, which can be shared with the users of the Shark in the technical office.

How to insert a geometry

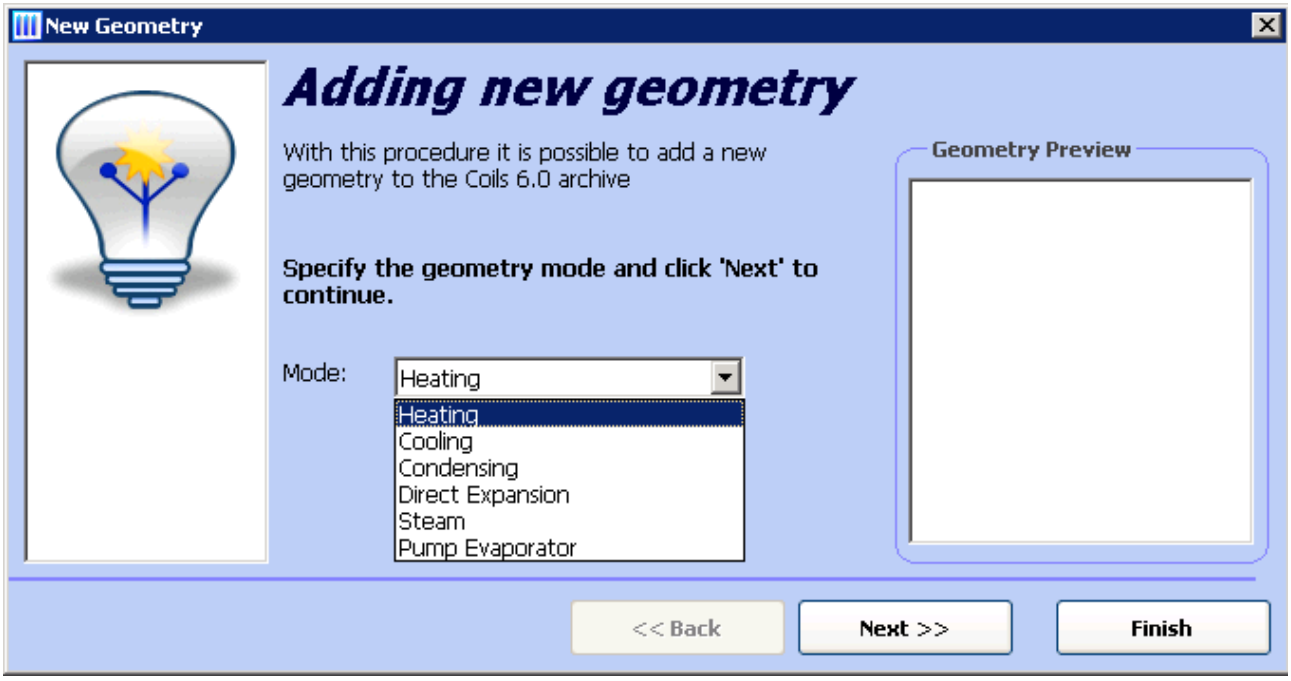
To insert geometry in Shark, we click on "Archive Management", then "Geometries":



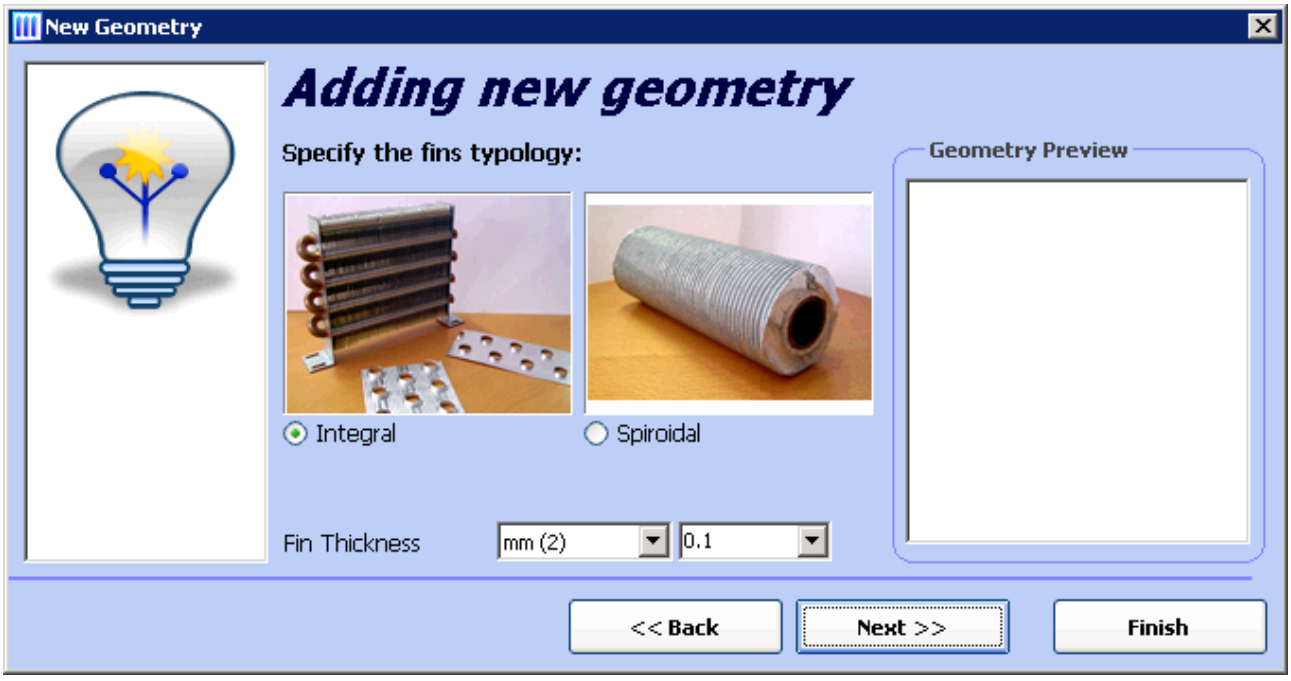
We click on "New" to start the insertion:



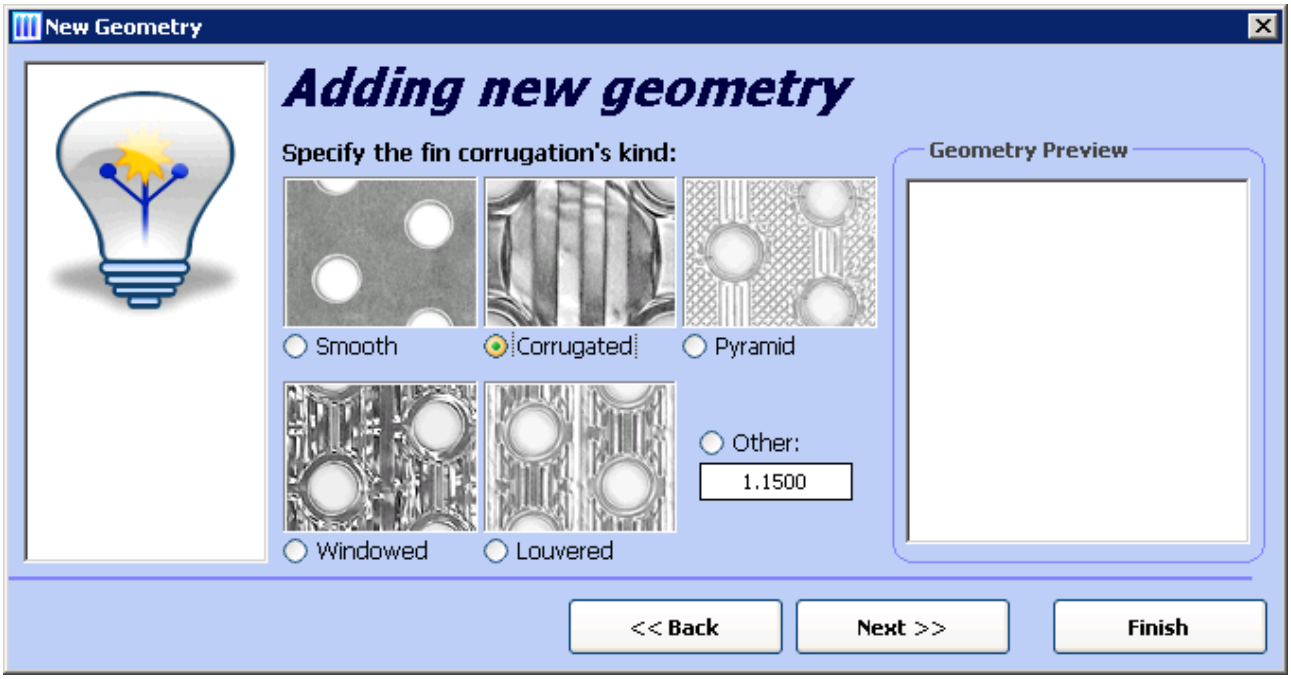
We can choose the modality of the geometry:



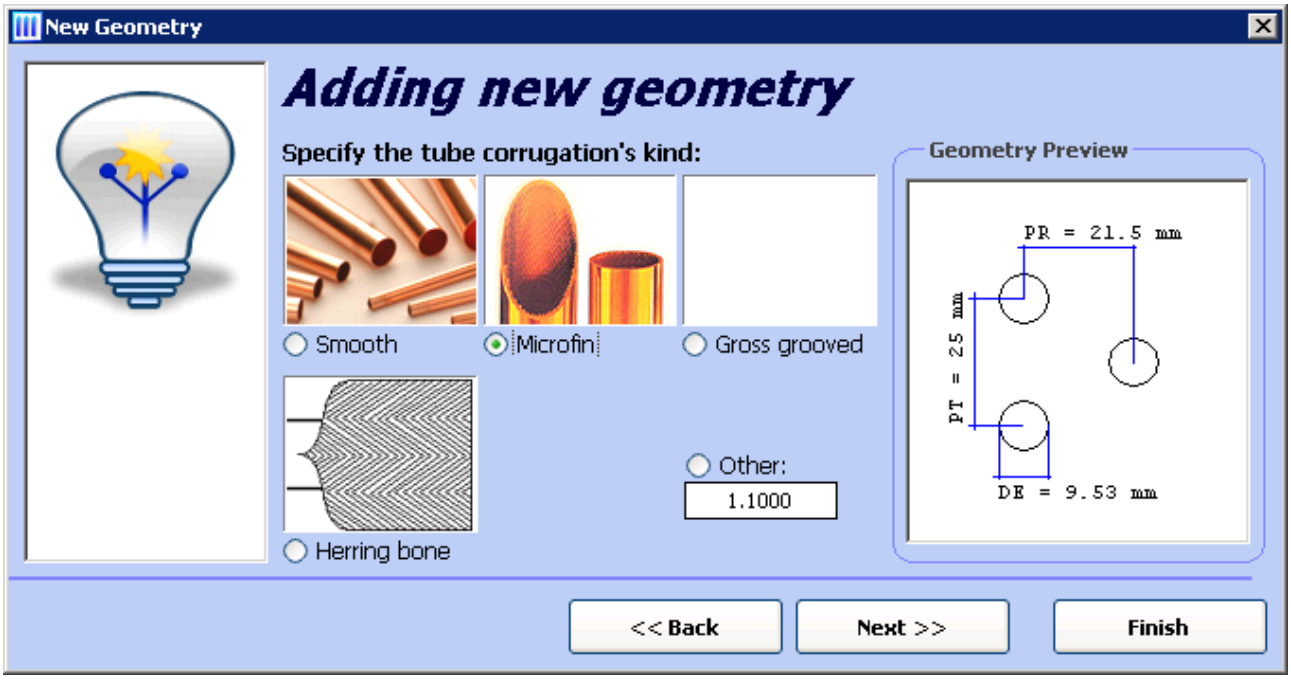
Then we click on "Next" and insert the builder, then we click on Next again and we can now choose the type of fin, either integral or spiroidal and choose the fin thickness and click on Next:



Then you can specify the type of fin corrugation, and see the relative corrugation factor on the field "Other" and we click on "Next":

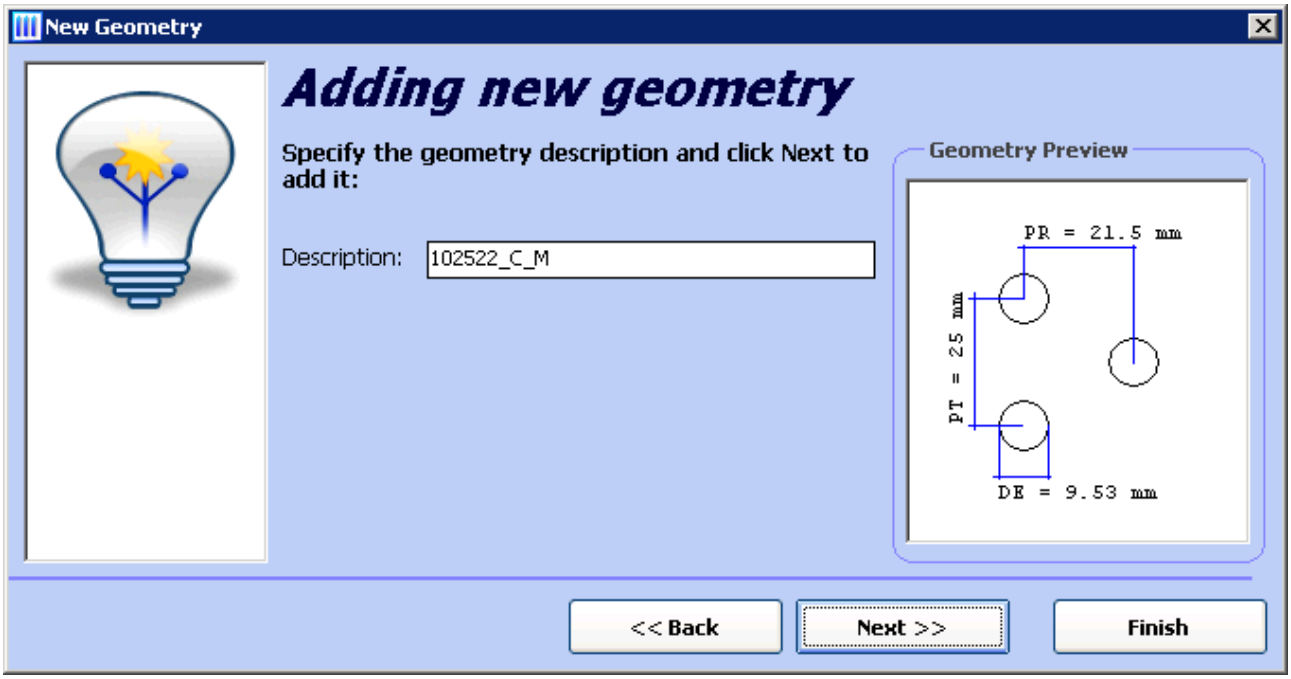


We can then specify the tube alignment -> Staggered or Aligned, and insert the tube external diameter, tube thickness, rows spacing, and tubes spacing, then we click on Next:

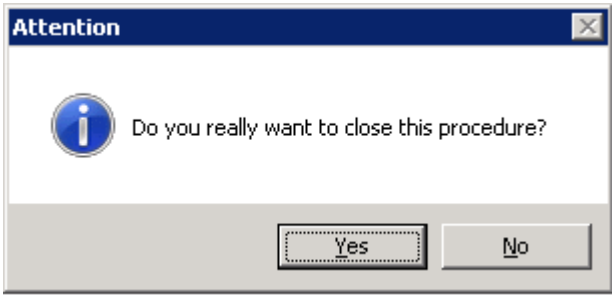


And then we specify the tube corrugation and check the relative factor on the field "Other"

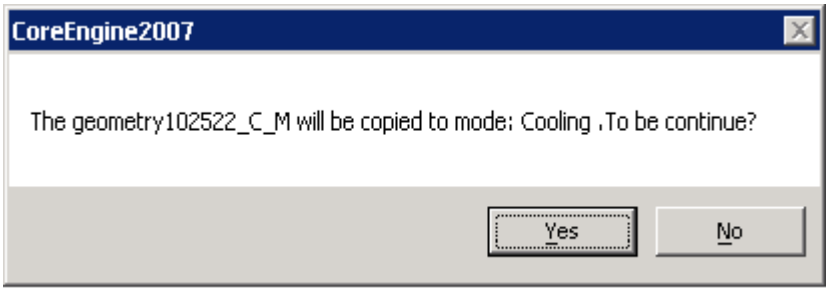
Then we can see the description of the same and click on Next.



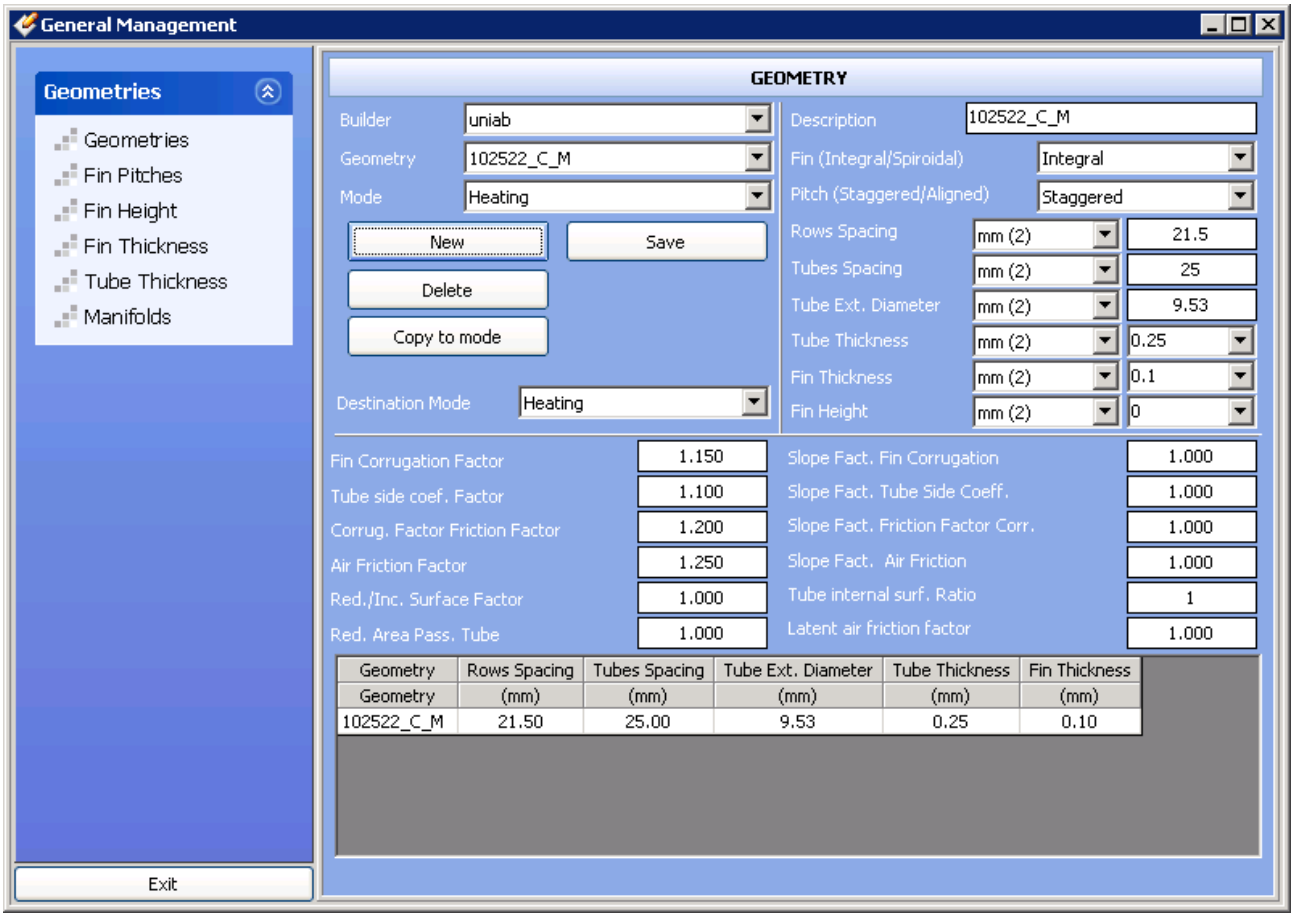
You will see a warning "The Geometry was added correctly. Do you want to add another one in the archive?" We click on "Yes" if we want to Add, or No, if we do not need.



Then we click On Finish, then "Do you really want to close this procedure?" We can click on Yes, if we are done.



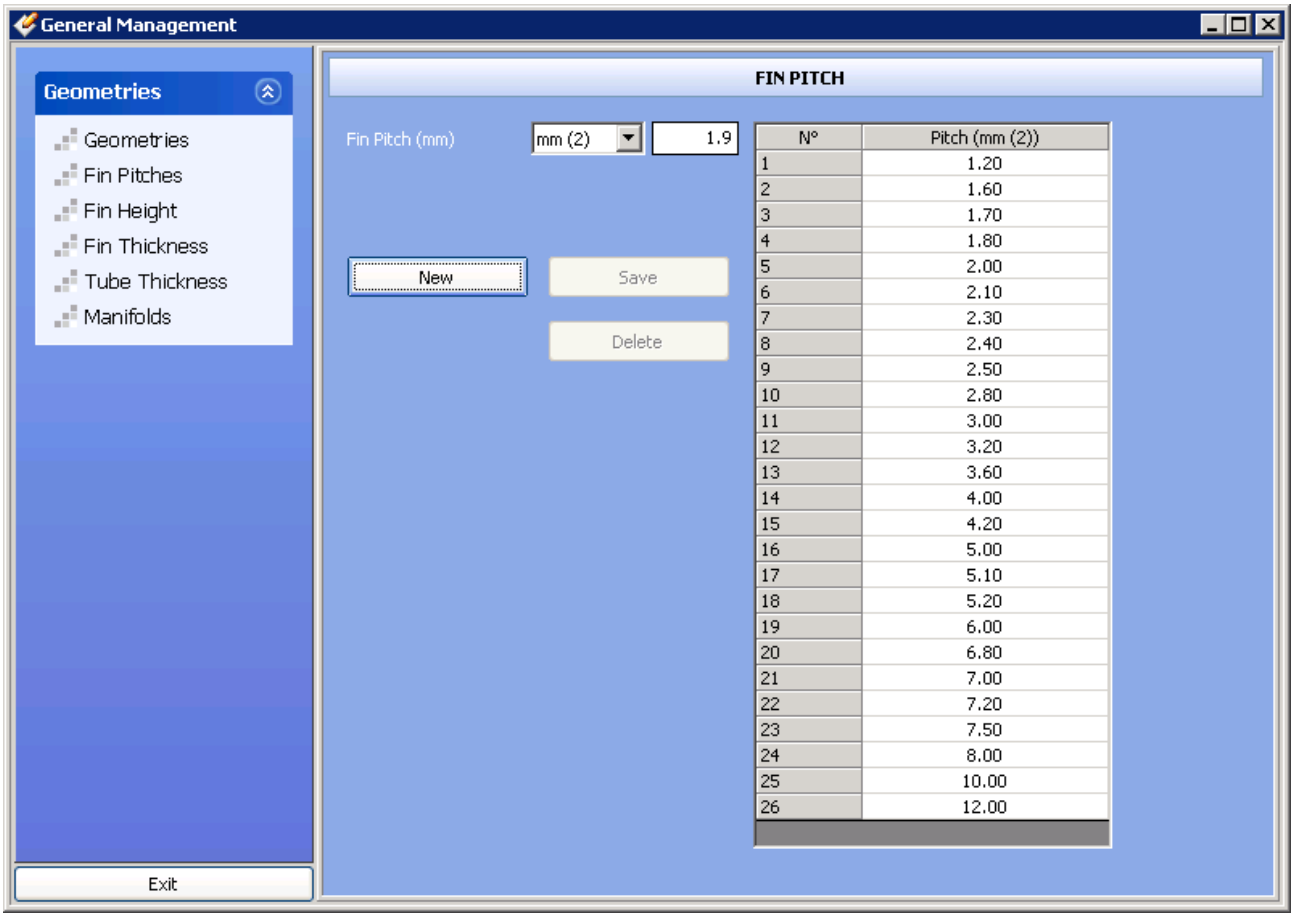
We can decide to Copy the geometry that we inserted in the Heating mode, into another modality like cooling. By clicking on the copy to mode:



The geometry 102522_C_M will be copied to mode: Cooling. To continue we click on Yes and the geometry will be copied.

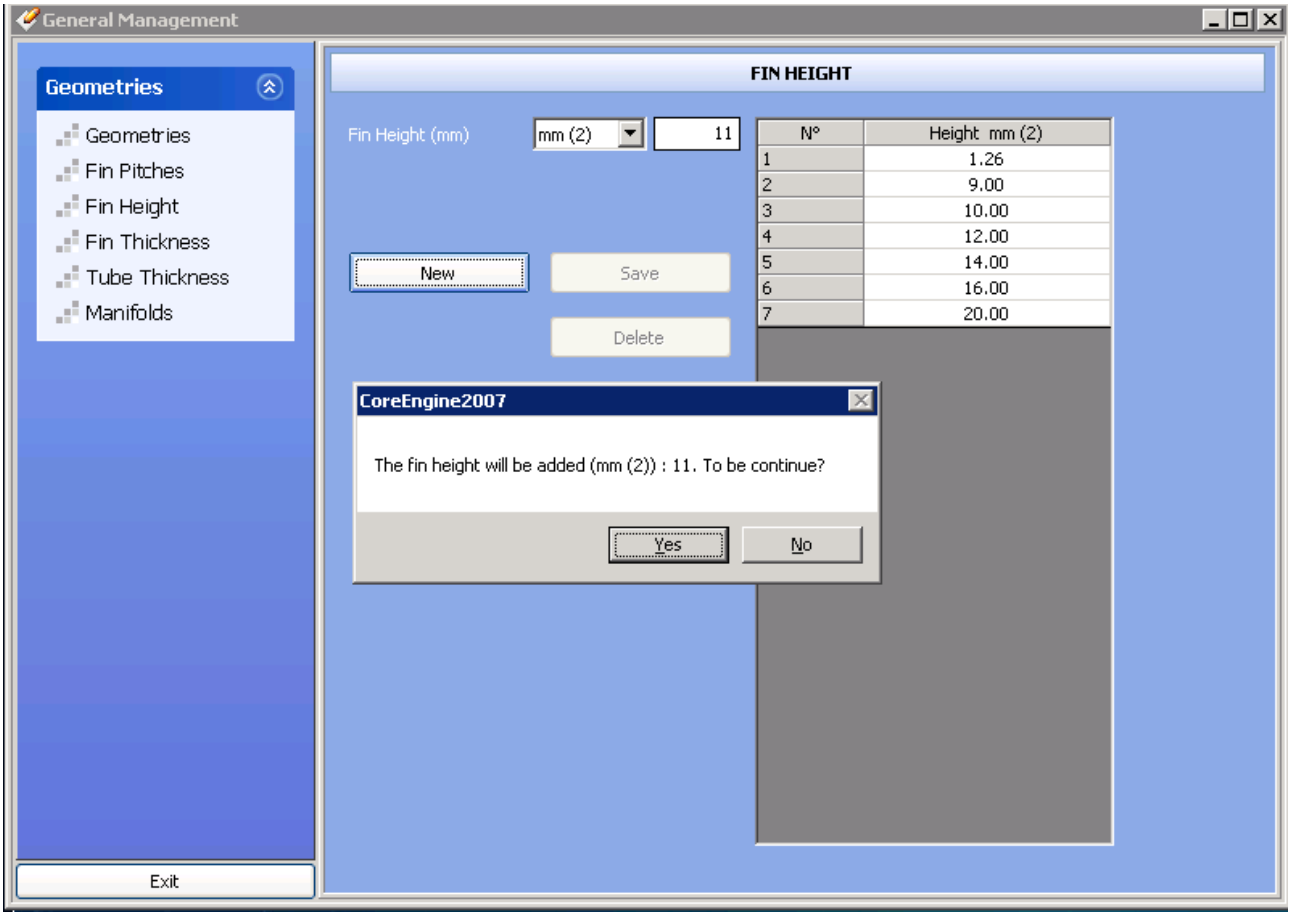
On the same widow, we can manage the fin pitches, height thickness, tube thickness and manifolds.

For example we can click on Fin Pitches and see the list:

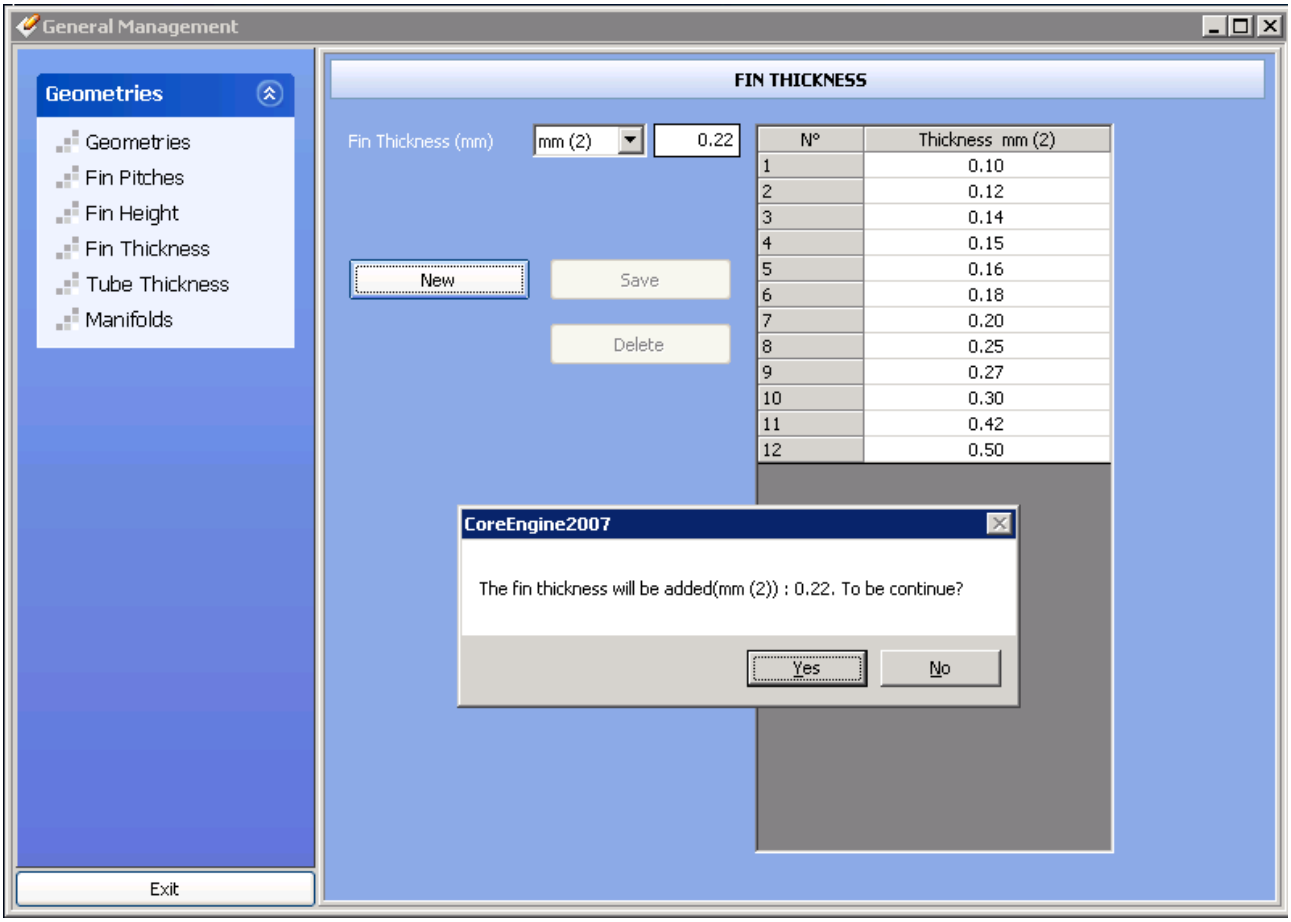


Suppose we want o add a fin pitch of 1.90 mm, so we can write the value "1.90" like in the figure, and click on "New" and you will see a message "The fin pitch will be added", we click on "Yes" to confirm.

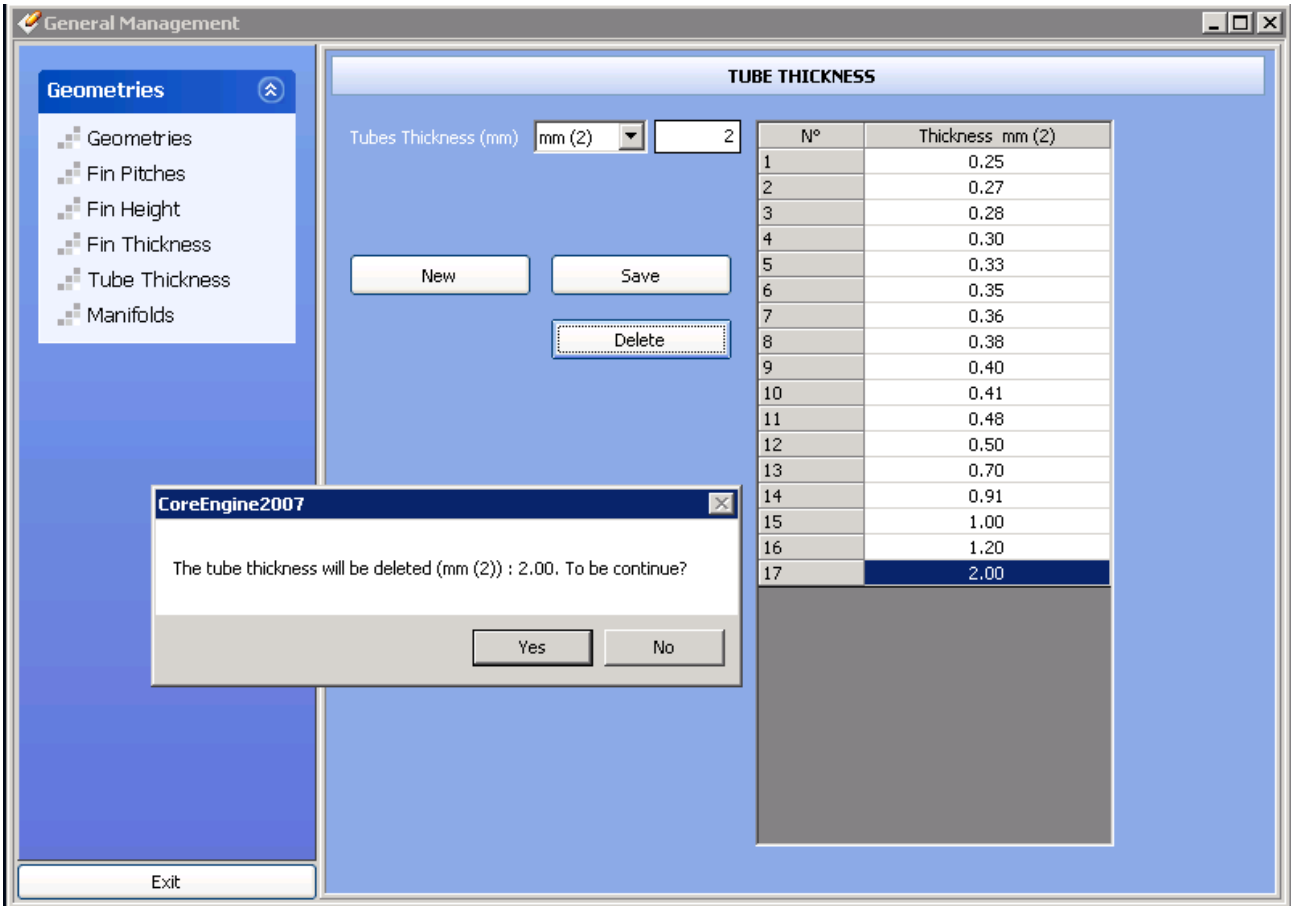
Similarly we can add a new fin height value (for example 11.00 mm)



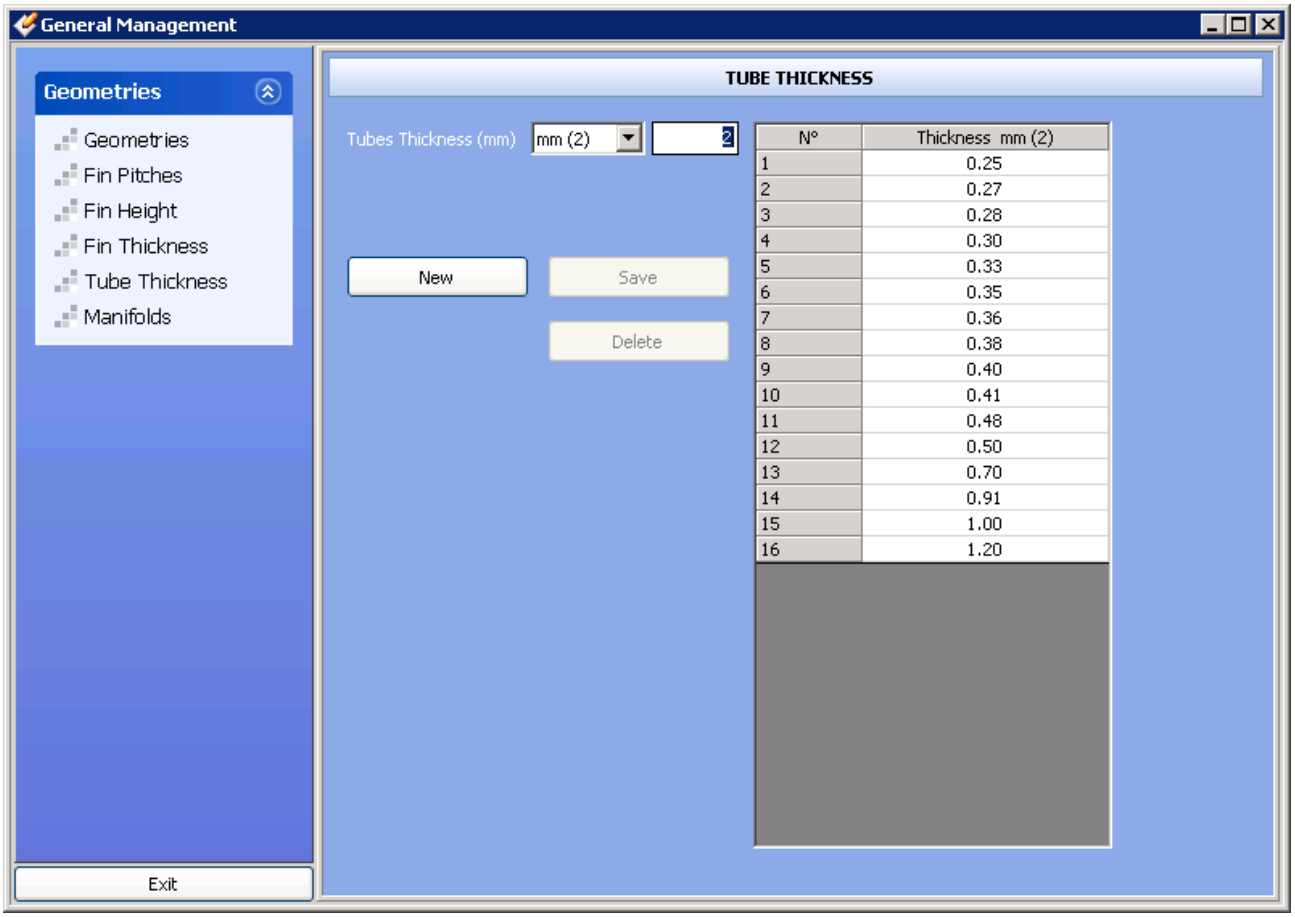
Similarly we can add a fin thickness value (example 0.22 mm)



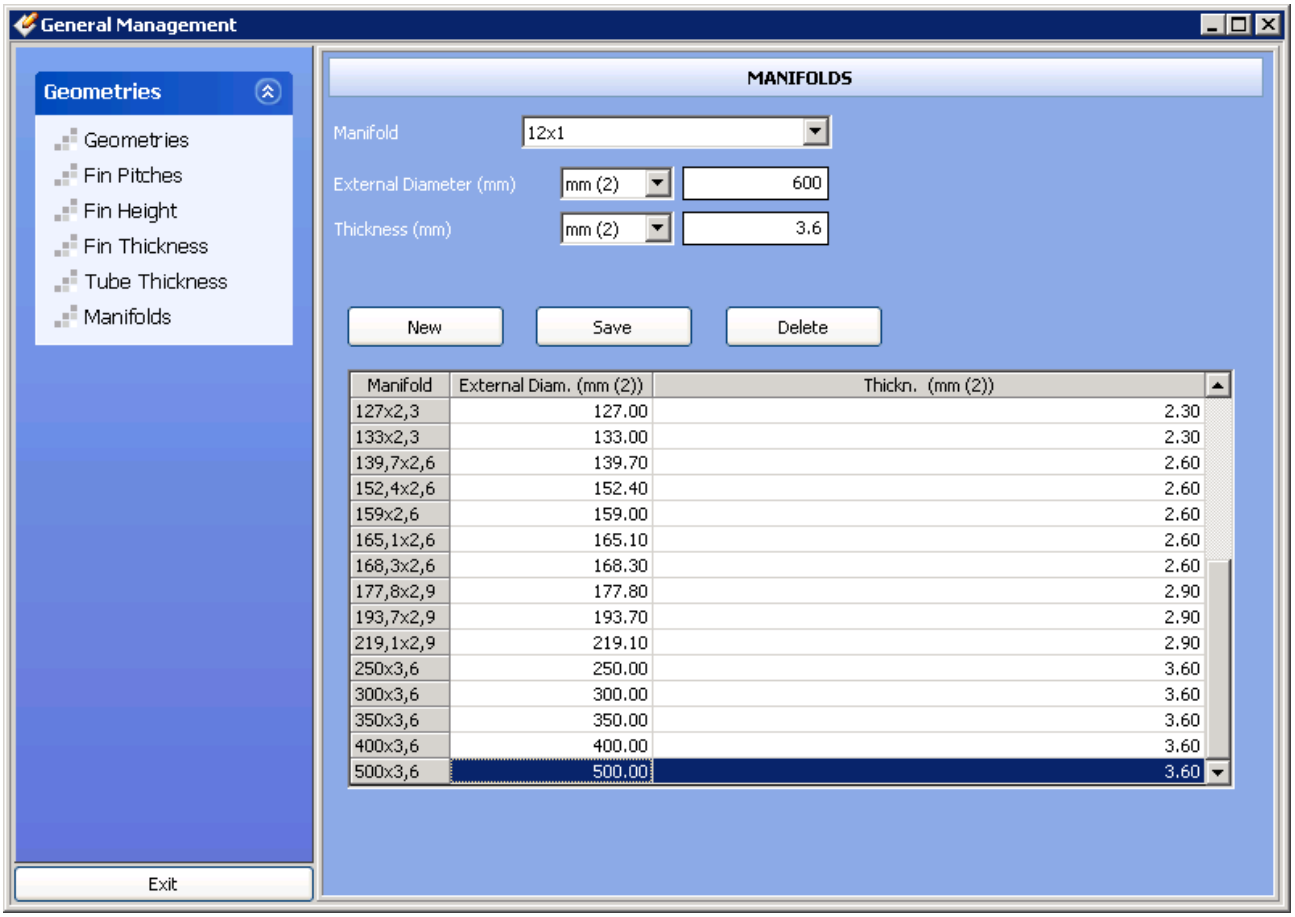
We can also delete and or modify values in these tables (example deleting 2.00 tube thickness)



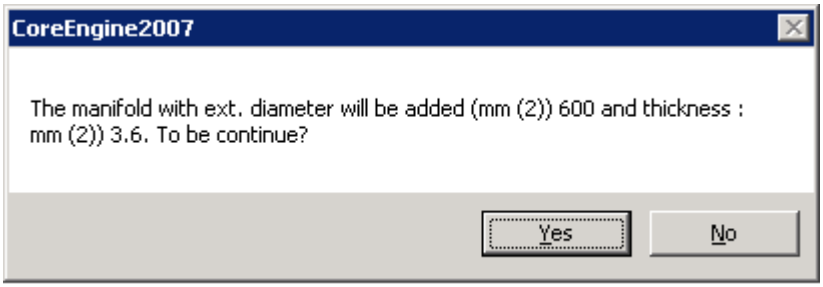
We click on the value we want to delete and we click on the "delete" button.



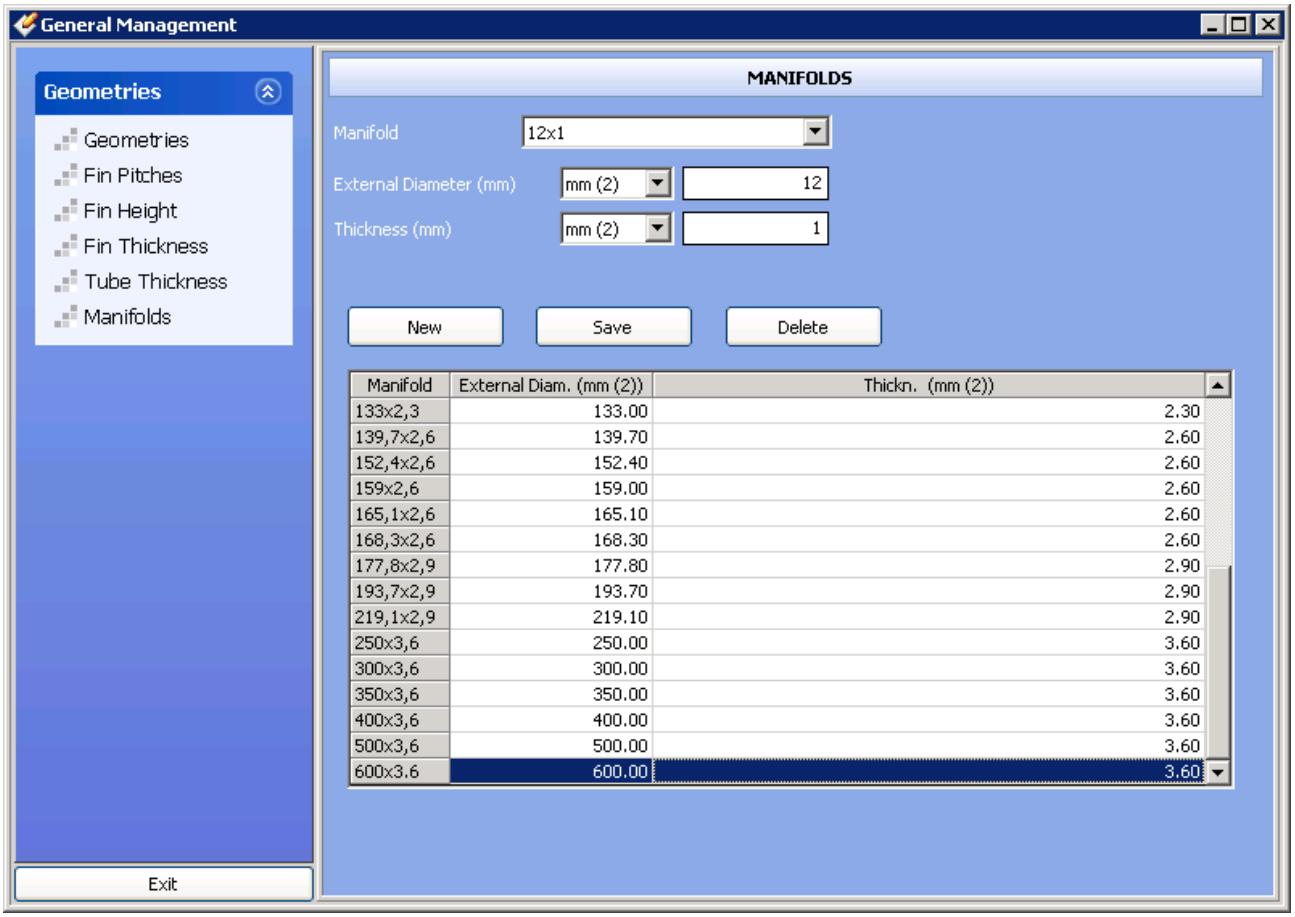
As last point let us insert a new manifold



We click on Manifolds, and we insert the external diameter and the thickness, then we click on New. We click on "Yes"

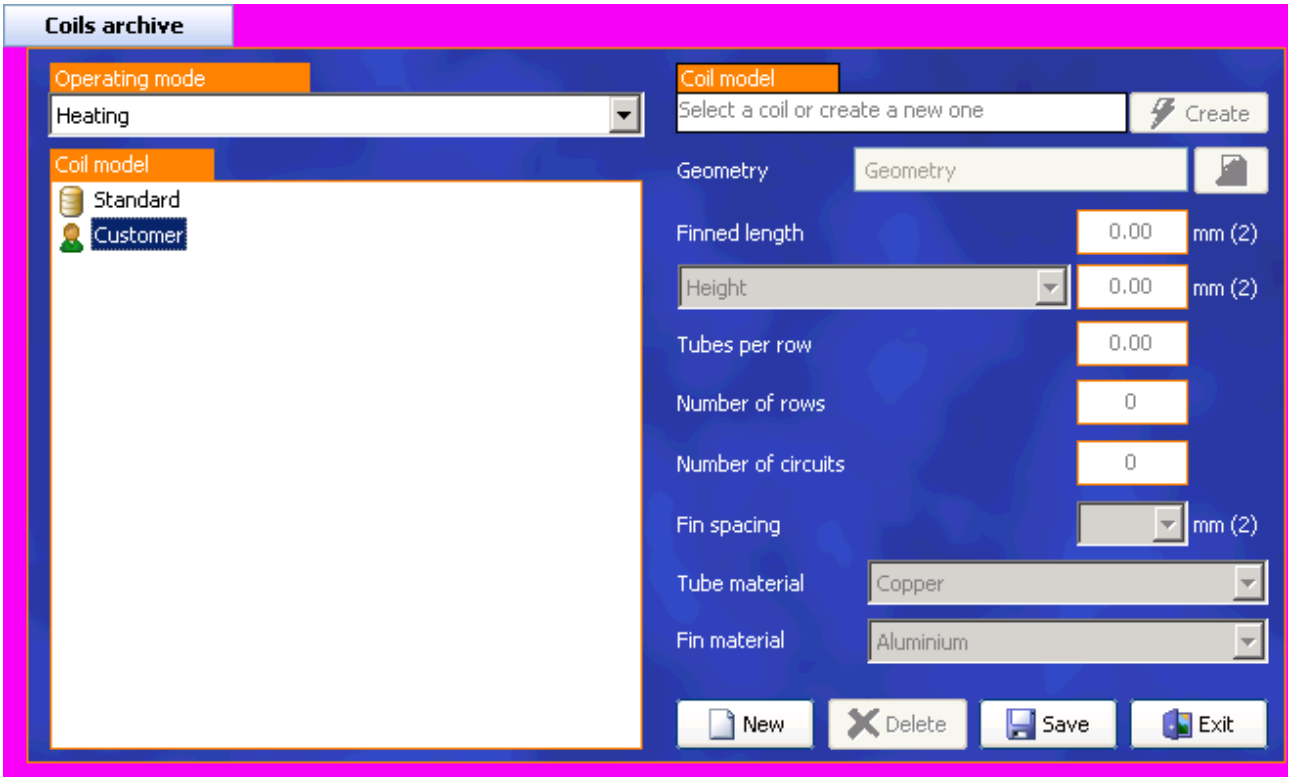


As we can see from the figure in the bottom

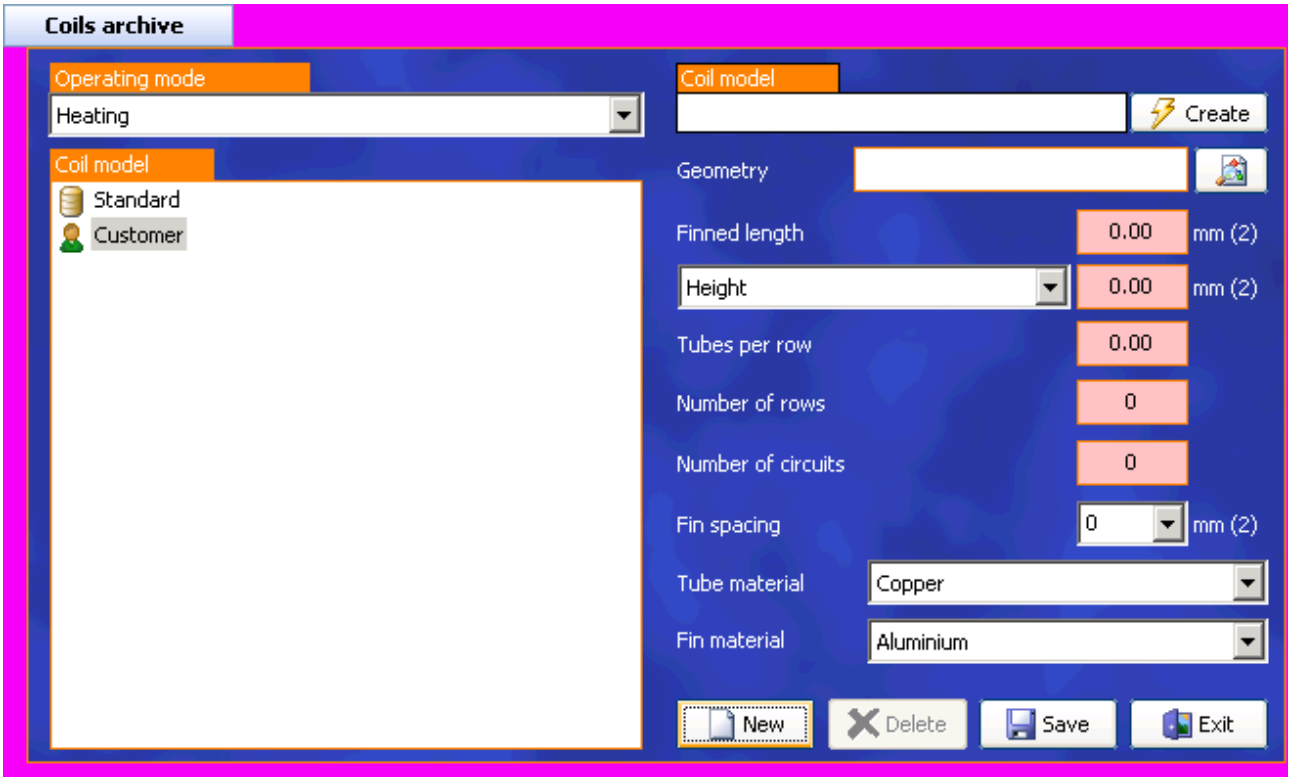

General Management
Geometries
Geometries
Fin Pitches
Fin Height
Fin Thickness
Tube Thickness
Manifolds
Exit
MANIFOLDS
Manifold
12x1
External Diameter (mm)
mm (2)
12
Thickness (mm)
mm (2)
1
New
Save
Delete
Manifold | External Diam. (mm (2)) | Thickn. (mm (2))
133x2,3 | 133.00 | 2.30
139,7x2,6 | 139.70 | 2.60
152,4x2,6 | 152.40 | 2.60
159x2,6 | 159.00 | 2.60
165,1x2,6 | 165.10 | 2.60
168,3x2,6 | 168.30 | 2.60
177,8x2,9 | 177.80 | 2.90
193,7x2,9 | 193.70 | 2.90
219,1x2,9 | 219.10 | 2.90
250x3,6 | 250.00 | 3.60
300x3,6 | 300.00 | 3.60
350x3,6 | 350.00 | 3.60
400x3,6 | 400.00 | 3.60
500x3,6 | 500.00 | 3.60
600x3.6 | 600.00 | 3.60

How to insert a coil

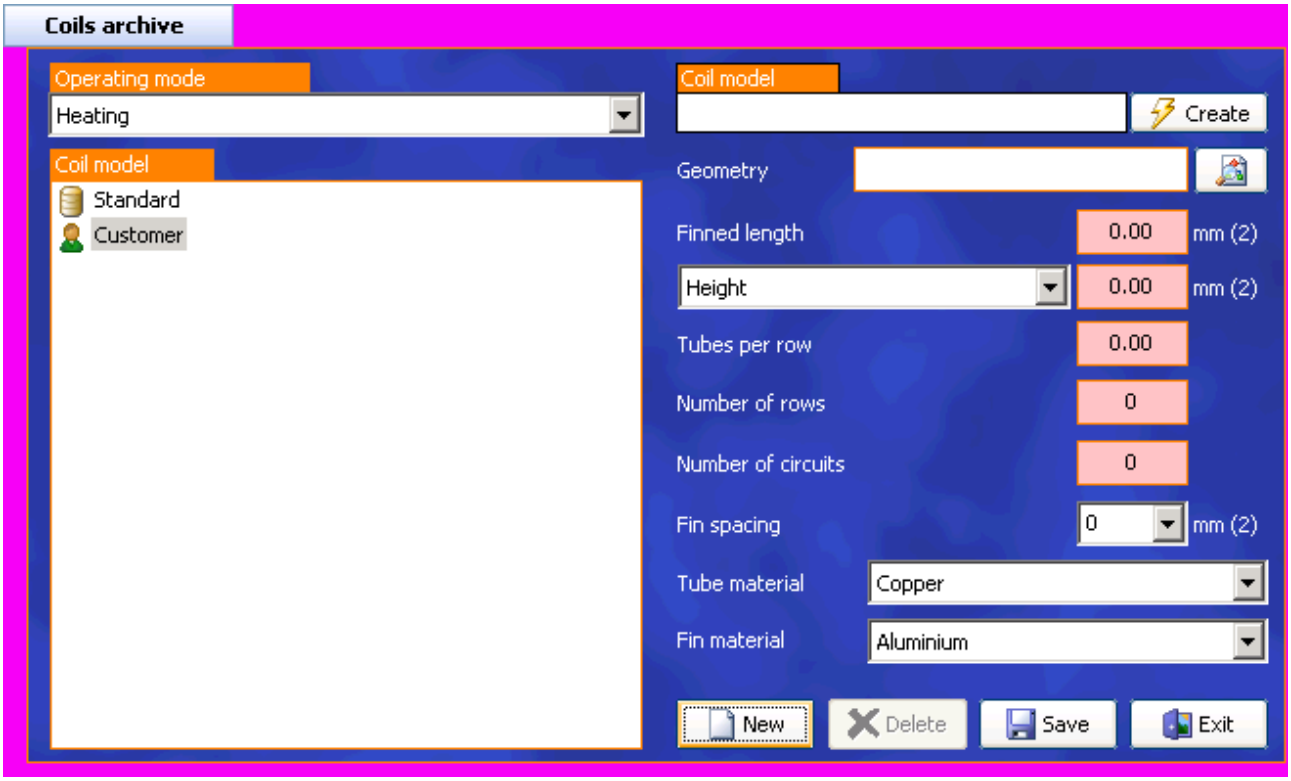
We click on Archive Management, and then on Coils, we will see:



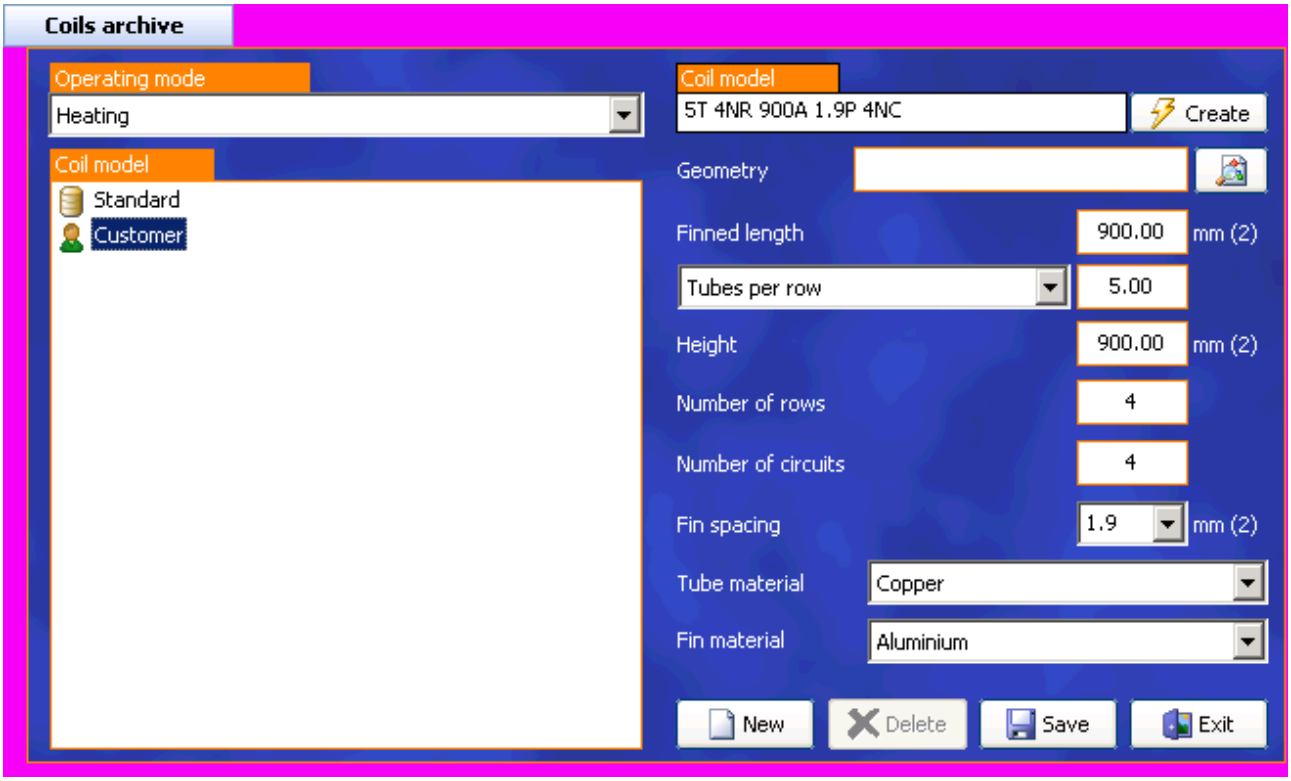
We choose the operating mode in which we heating, then we click on Customer on the left tree:



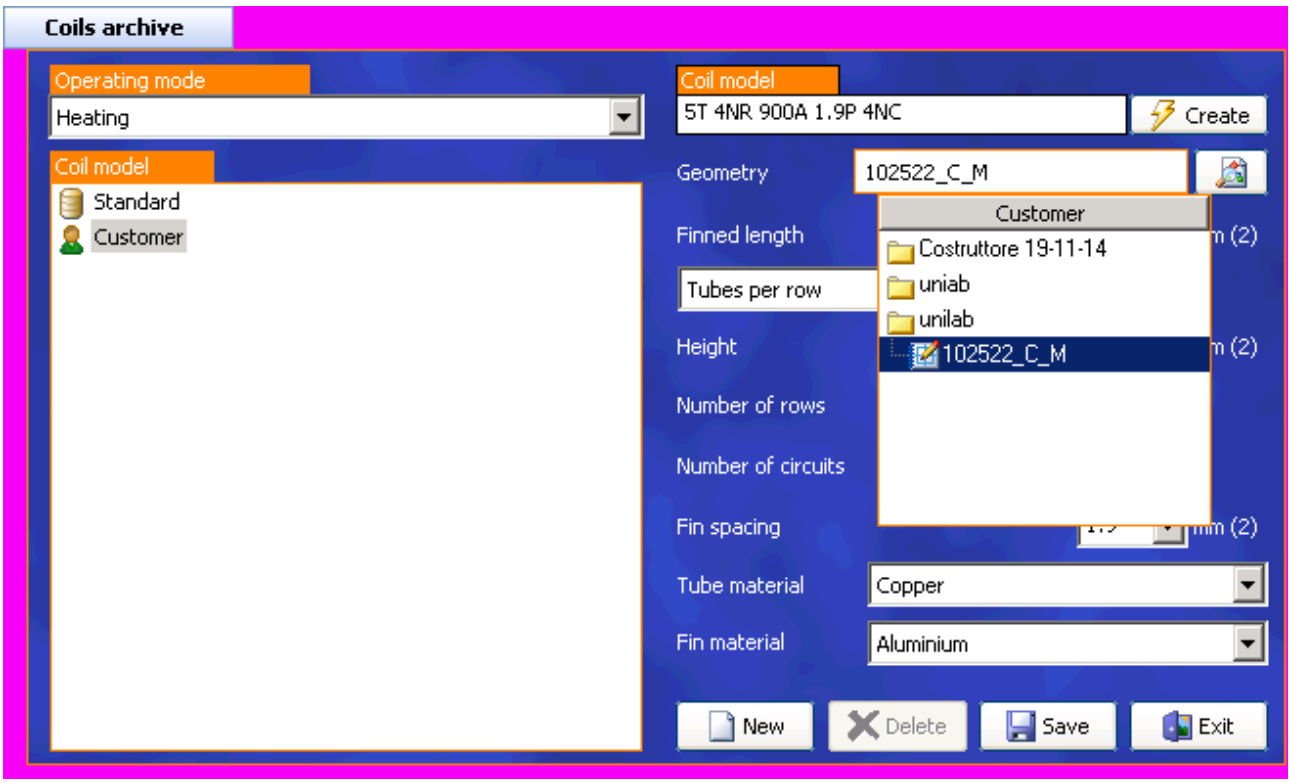
Then we click on New and get:



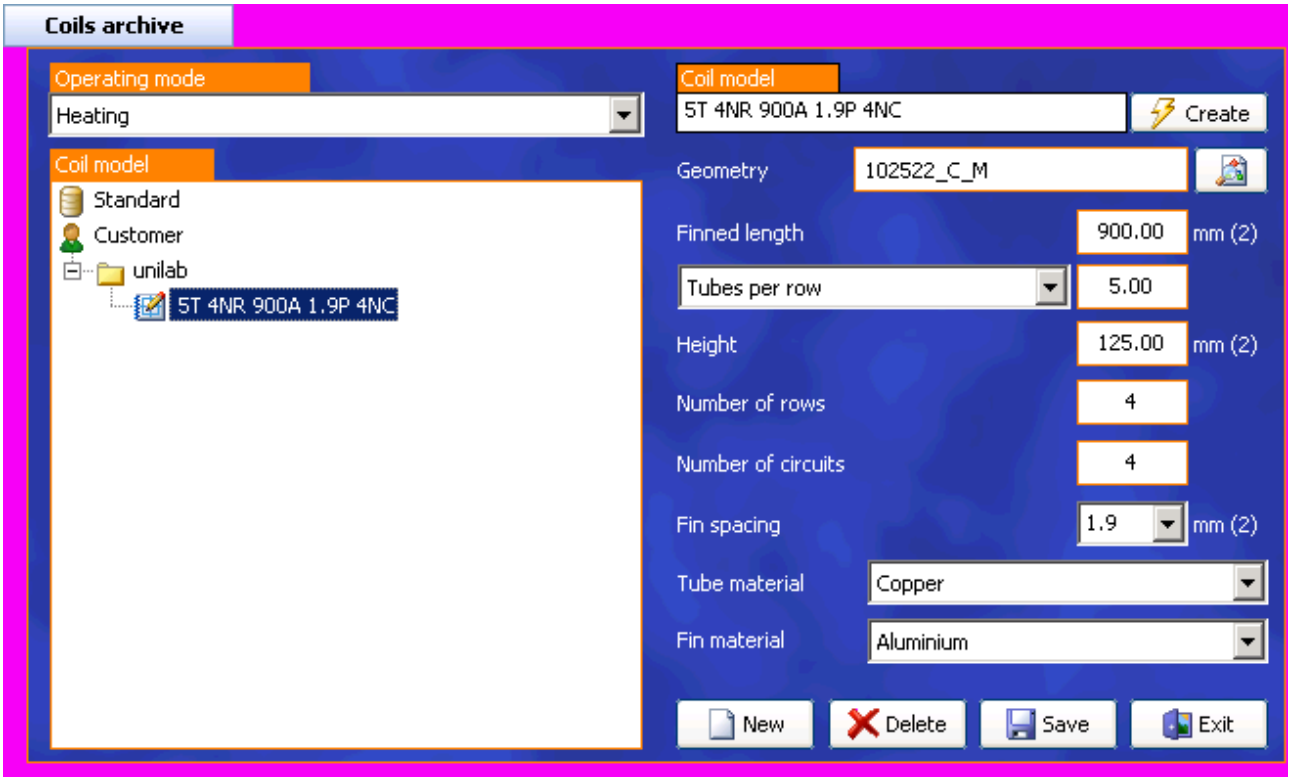
We insert the dimensions on the coils:



Then we add the geometry that we saved previously by double clicking on the Geometry empty field, then we can choose the model from the "Customer" database:



Then we see this, we can click on save and thus we have inserted the coil that we can use in our calculations.



How to insert Axial Fans, single tension or EC type

SHARK 2.5 allows the insertion of various types of axial fans, including EC and AC in the archive. To do that it is necessary to have the extracted curves from the catalogue or from the selection software that will have different forms according to the manufacturer.

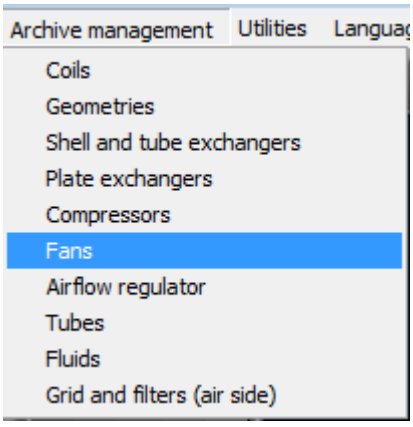
SHARK supports the following types of fans:

Typologies	Description	Field	Inlet Variable	Outlet Variable
Single Phase	Fan with a defined number "N" of curves	Discrete	Voltage	Flow
Three Phase	Fan with two curves, "Delta" or "Star"	Continuous	"Delta" or "Star" link	Flow
EC multicurve on RPM	Multicurve fan with air flow regulator	Continuous	Flow, ESP	RPM
EC multicurve on voltage. 0-10V	Multicurve fan with air flow regulator	Continuous	Flow, ESP	Voltage. 0-10V
AC with auto transformer	Multicurve fan with auto	Discrete	Flow, ESP, priority	Voltage and Flow or ESP

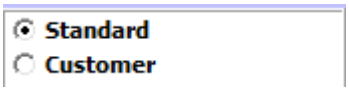
Given that what is important to SHARK is not the fan typology "from the manufacturer catalogue", but how it is used in the unit and driven from the controller.

Single Tension Fan Insertion

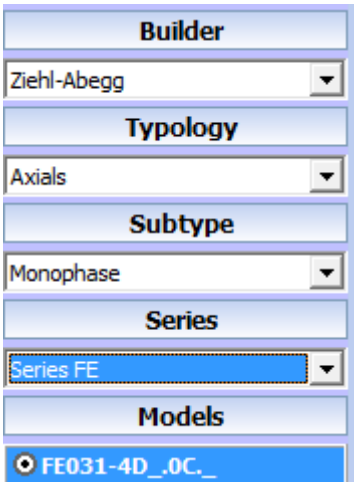
To insert a new fan in "Archive Management" on the option "Fan"



Choose the "Customer" archive:

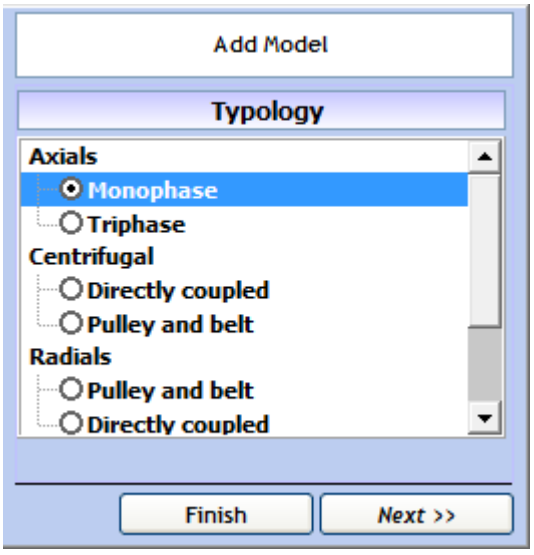


At this point the software will present, if any, fans in the Customer archive.

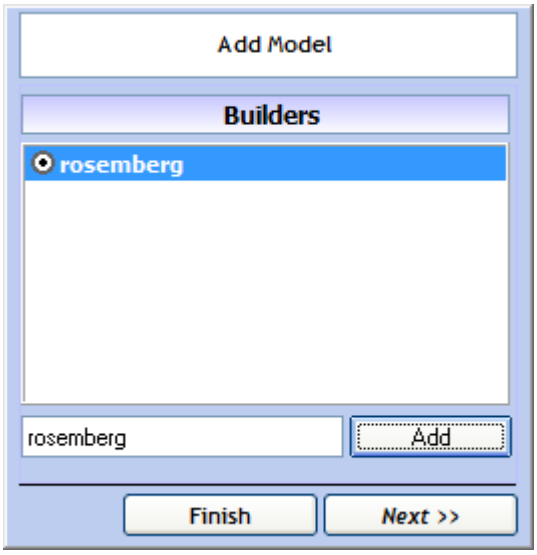


In our case we need to add a new fan, so we click on "Add":

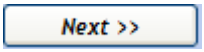
We set the typology of the fan on Single Phase:



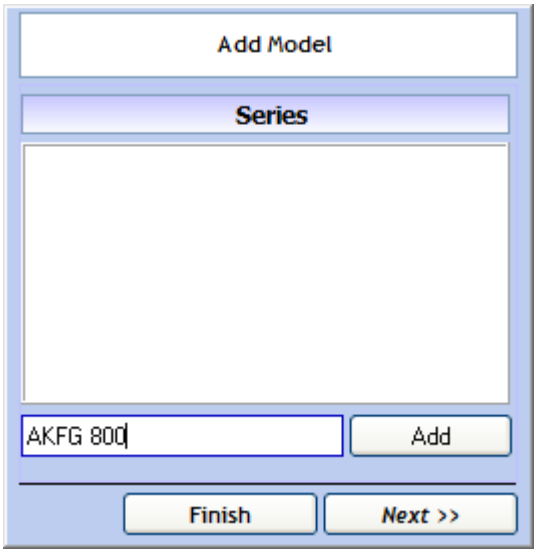
We click on Next to specify the manufacturer:



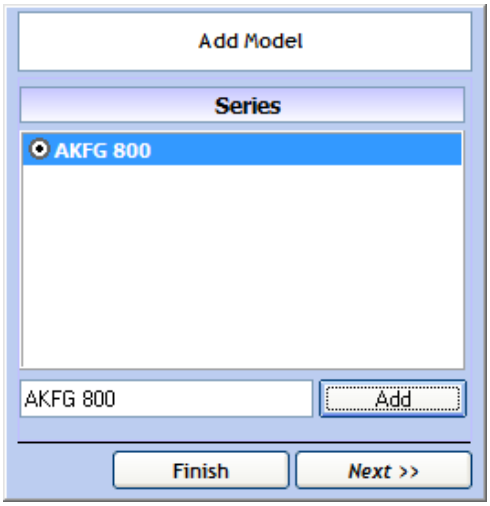
If necessary, add the name in the box below the list and we click on "Add":



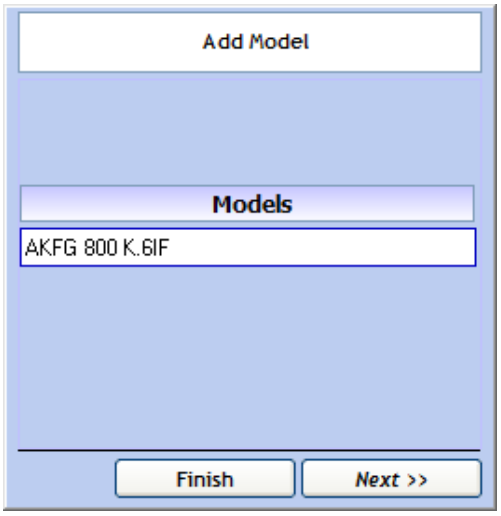
Click on next and specify the fan series:



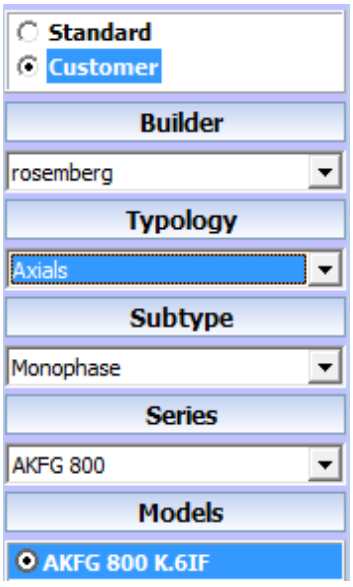
If it is necessary, like in this case, to add the series, write the name in the box below the list, and click on "Add":



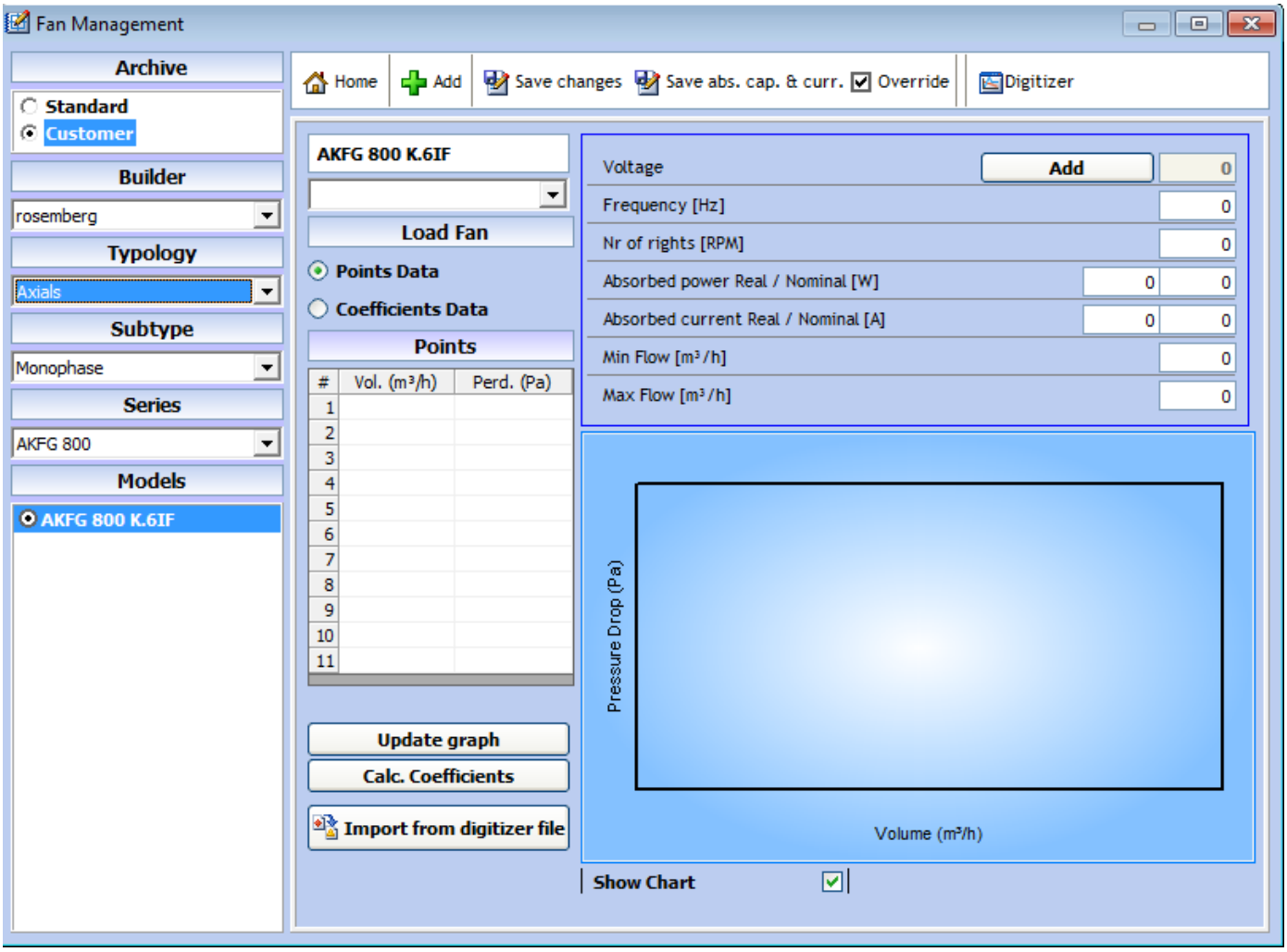
Let's click on "Next" and specify the model name:



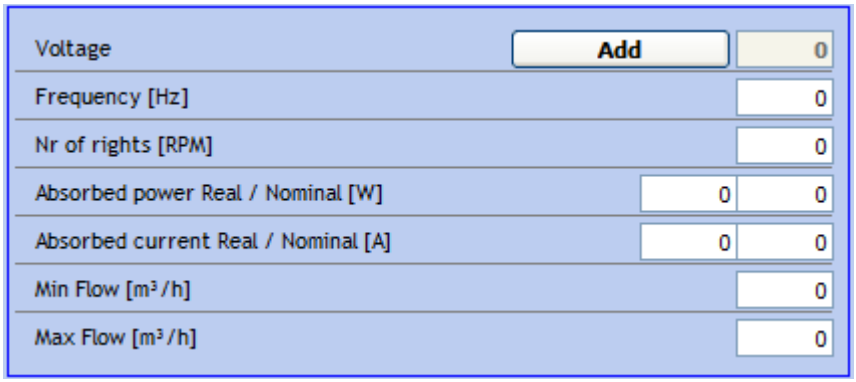
At this point the new fan is inserted in the archive, but all its data are not specified:

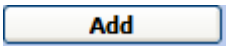


We will see the following:

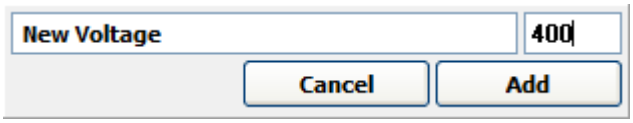


The parameters shown in the following image are very important, as they refer to the chosen voltage curve:



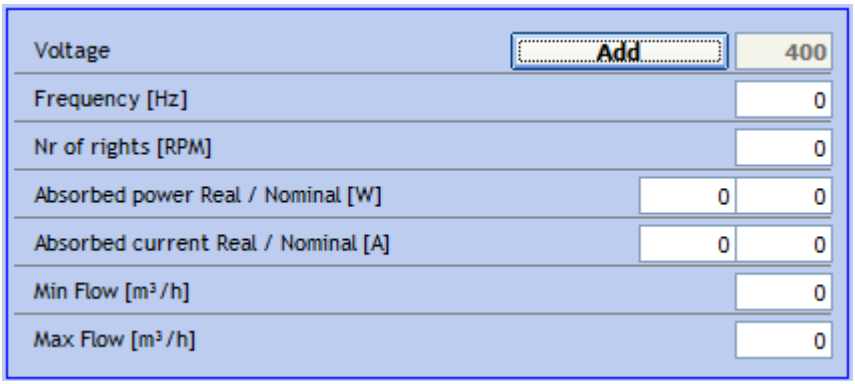
Currently, no curves have been inserted, so we click on "Add" 

The following will be shown, where we can insert the new voltage:

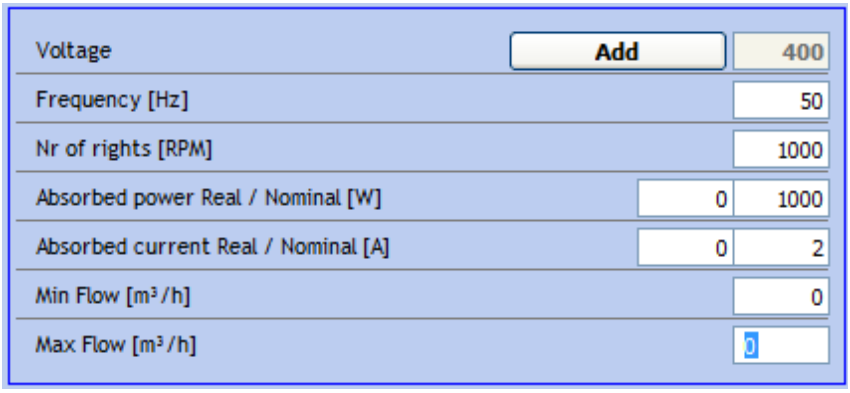


Once it is specified we click on "Add" 

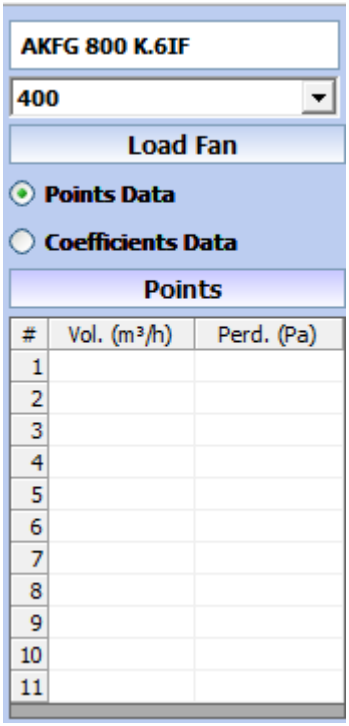
Now the voltage is shown:



Now we set the nominal data in the window:



At the end we need to insert the curve in the dedicated area. Here we can decide if of the curve we know the point's data or the coefficients:



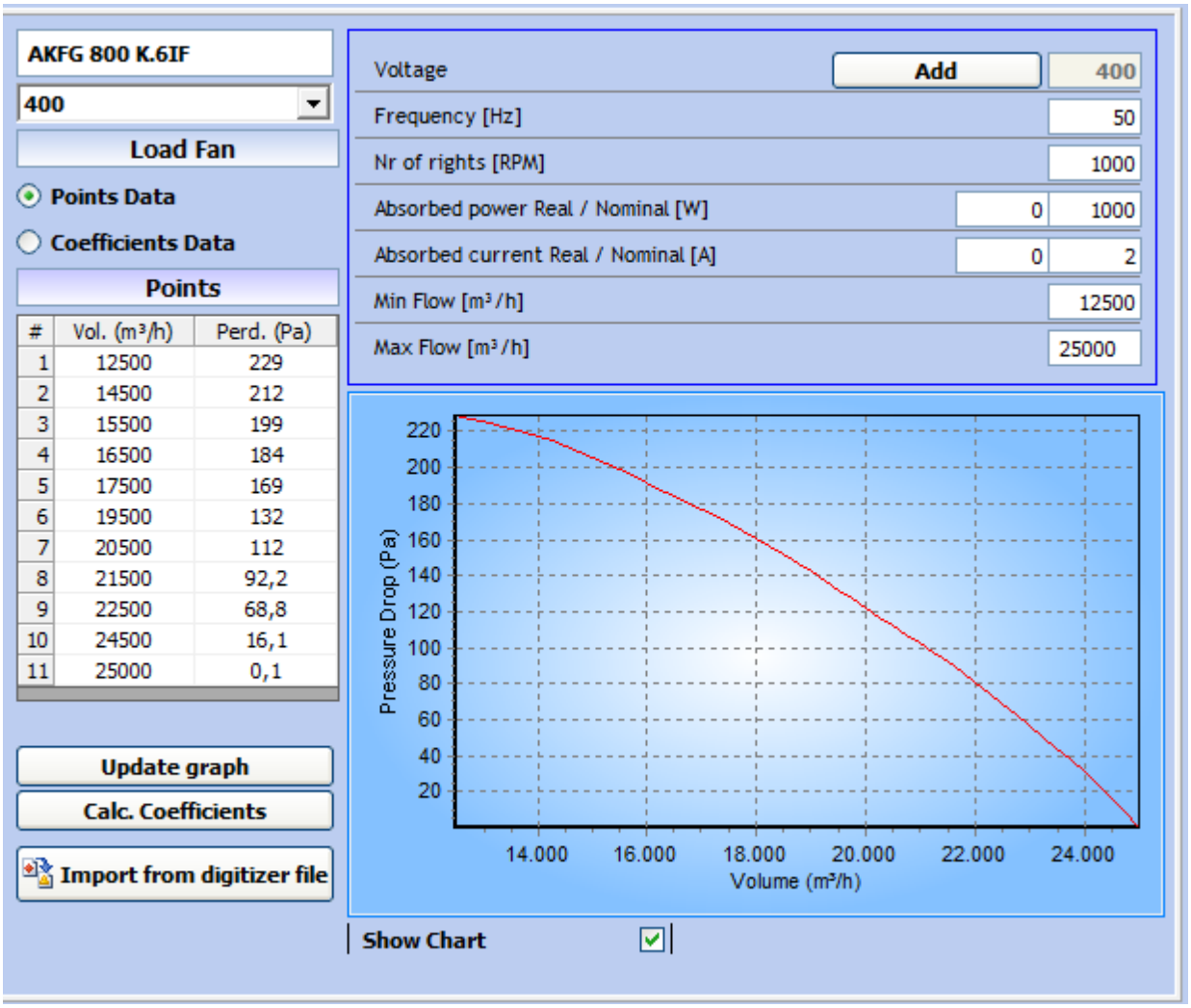
In our case, we will insert the data like in the following case:

#	Vol. (m³/h)	Perd. (Pa)
1	12500	229
2	14500	212
3	15500	199
4	16500	184
5	17500	169
6	19500	132
7	20500	112
8	21500	92,2
9	22500	68,8
10	24500	16,1
11	25000	0,1

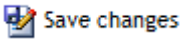
We specify the minimum and maximum flows for the chosen curve:

We click on "Update Chart":

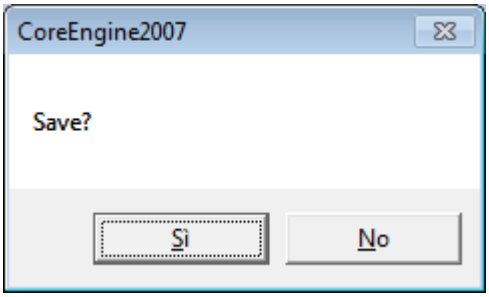
We obtain the following:



Let's click on "Save modifications" to save the data in the archive:



We will see the confirmation message:



We click on "Yes".

Repeat the insertion procedure of the voltages for each available curve.

Insertion of a EC fan

Suppose, we need to insert the same fan as EC voltage 0-10V. We have extracted a table as the following from the manufacturer selection software:

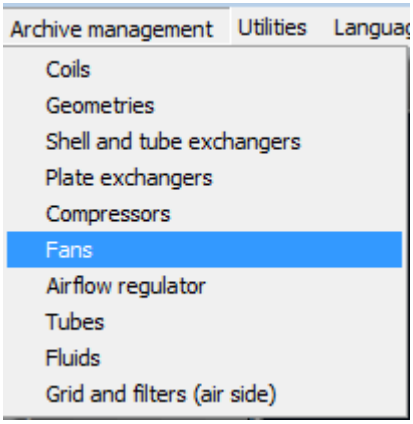
TuC	10 V		9 V		8 V		7 V		6 V		5 V	
	400 V		360 V		320 V		280 V		240 V		200 V	
	1000 min^{-1}		900 min^{-1}		800 min^{-1}		706 min^{-1}		604 min^{-1}		504 min^{-1}	
	m^3/h	Pa	m^3/h	Pa	m^3/h	Pa	m^3/h	Pa	m^3/h	Pa	m^3/h	Pa
1	12500	229	11200	183	10000	142	8700	110	7500	81,5	6300	56,7
2	13500	223	12200	177	11000	138	9700	109	8500	76,2	7300	52,8
3	14500	212	13200	167	12000	129	10700	99	9500	68,3	8300	46,6
4	15500	199	14200	154	13000	118	11700	90	10500	60,4	9300	38,6
5	16500	184	15200	140	14000	107	12700	79,8	11500	49,8	10300	28,1
6	17500	169	16200	128	15000	93,7	13700	64,6	12500	38,6	11300	16,4
7	18500	153	17200	110	16000	75,7	14700	49,8	13500	25,9	12300	3,7
8	19500	132	18200	93,5	17000	60,4	15700	34,9	14500	7,4	12500	0
9	20500	112	19200	76,2	18000	40,2	16700	16,3	15000	0		
10	21500	92,2	20200	55,6	19000	19,6	17500	0				
11	22500	68,8	21200	31,2	20000	0						
12	23500	40,8	22200	9								
13	24500	16,1	22500	0								
14	25000	0										

NB: The above table, cannot be inserted inside SHARK as it is, its content needs to organized in precise way that will be explained later on.

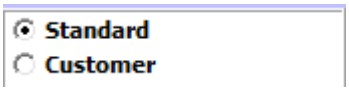
In the first rows, we can notice the association with the regulation voltage:

TuC	10 V	9 V	8 V	7 V	6 V	5 V
	400 V	360 V	320 V	280 V	240 V	200 V
	1000 min^{-1}	900 min^{-1}	800 min^{-1}	706 min^{-1}	604 min^{-1}	504 min^{-1}

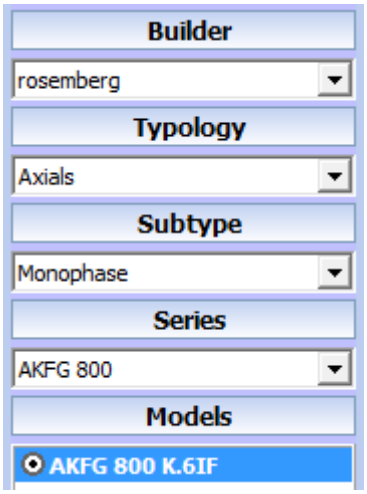
To insert a fan, we follow the same procedure, we have just seen. We click on "Archive Management" on "Fan":



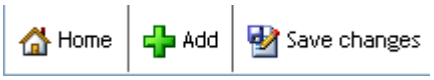
Choose the "Customer" archive:



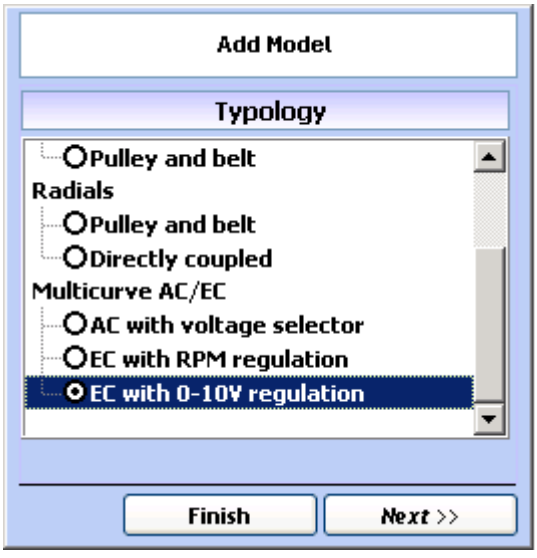
At this point, the software will show, if there are any, fans in the "Customer" archive.



Since we need to add a new fan, so we click on "Add":

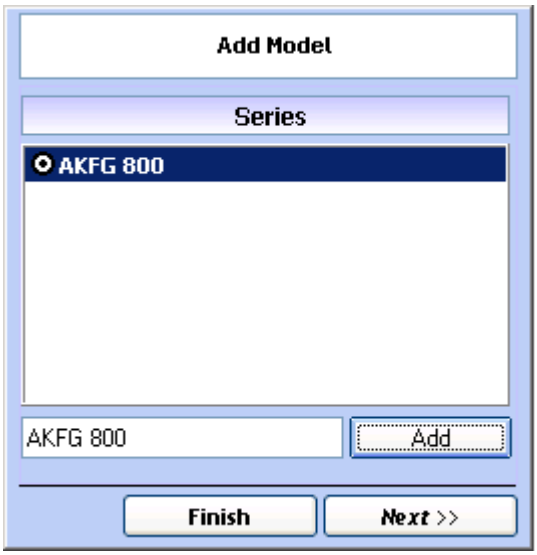


In this case, we need to choose "EC with 0-10V regulation" as fan typology:

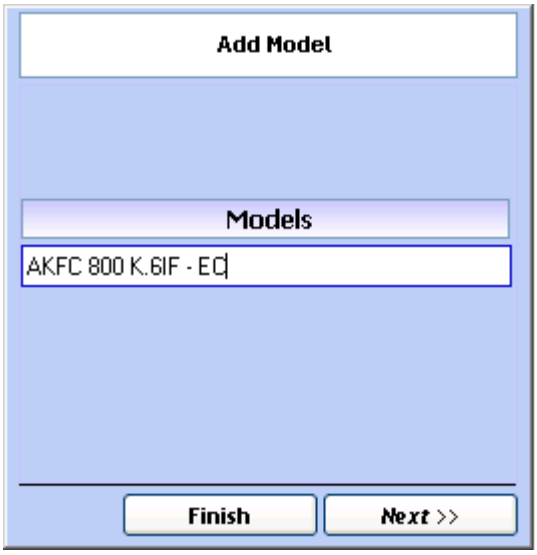


We click on "Next" to specify the manufacturer:

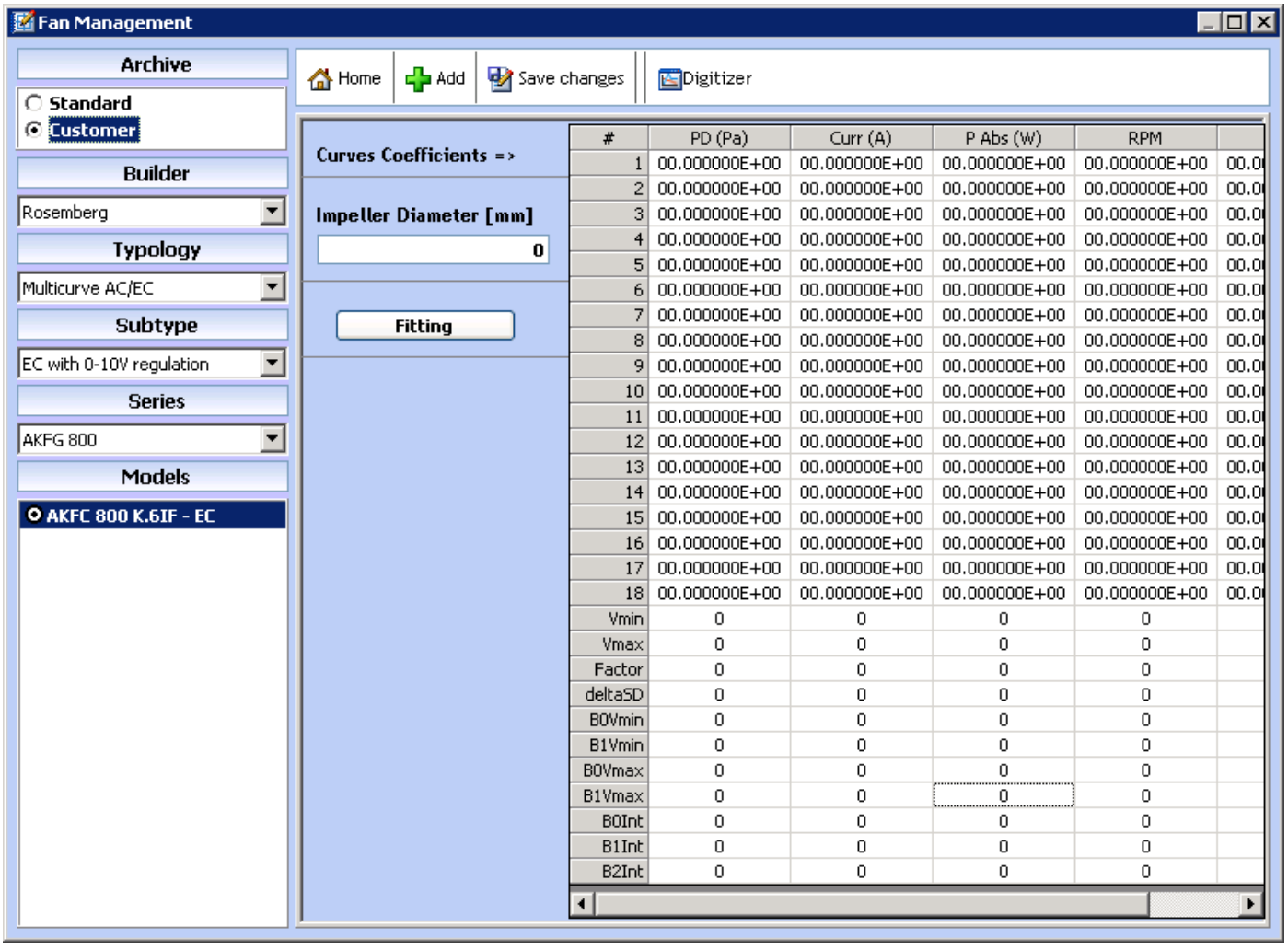
It should be already present in the archive, but in case we would need to add it, we would need to add its name under the list and click on "Add". We click on next to specify the series of the fan:



In this case, too, the series should be, already present in the archive, but if we need to add it; we need to write the name below the list and click on "Add". Specify also the name of the model as well:

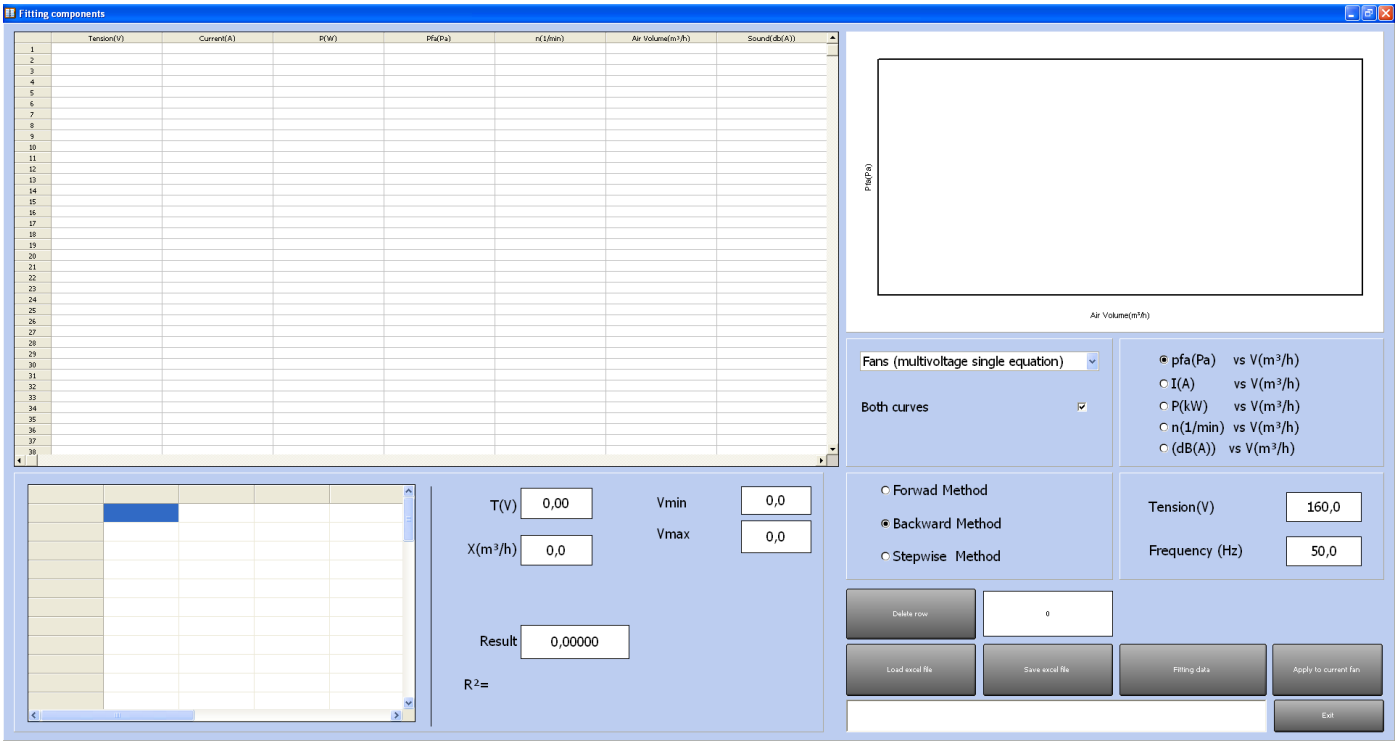


NB: since a fan already exists, even if in a different category, we need to set a different name.
Once it is done, we click on "Next", the following will appear:

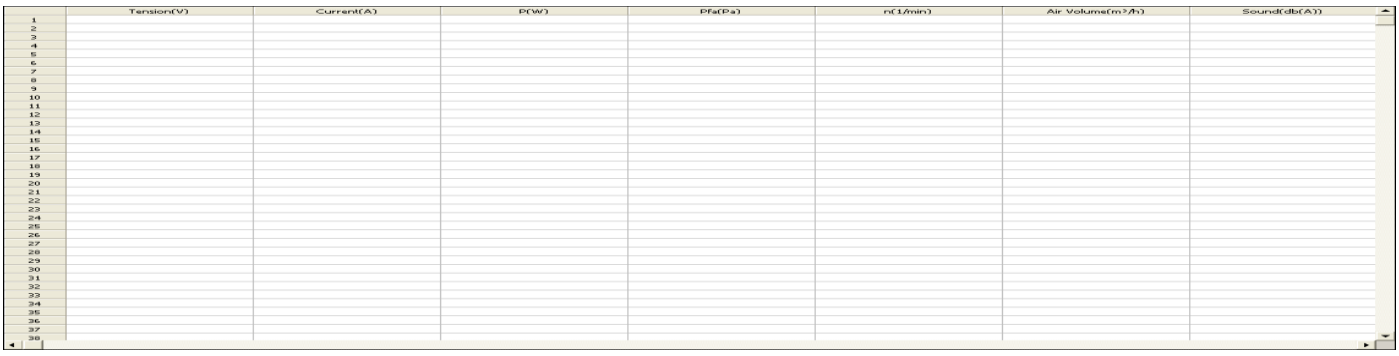


You'll see in the central part of the window the coefficients of the fan. To extract those coefficients, click on "Fitting":

The following window will come up:



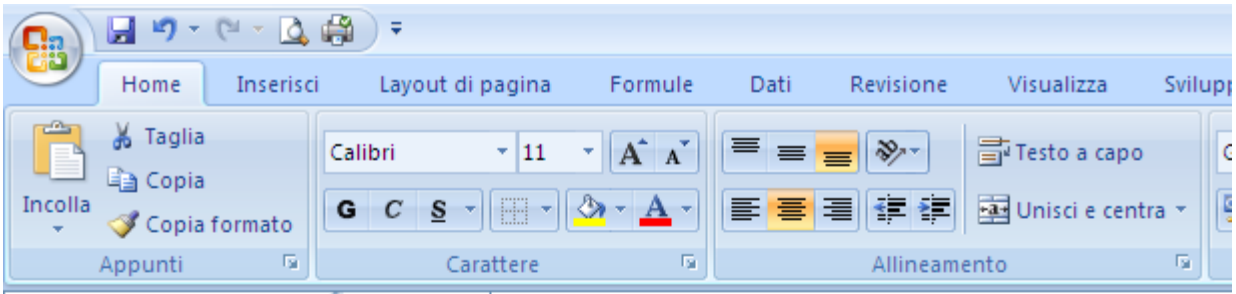
In the center, we see the format of the excel file we need to import:



The excel file needs to have as columns:

- Voltage (V) => in this case the 0-10 V tension
- Current (A)
- Absorbed Power (W)
- Prevalence (Pa)
- RPM
- Flow(m³/h)
- Noise (db(A))

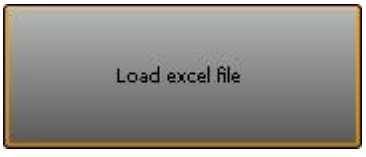
So the excel file will be as the following:



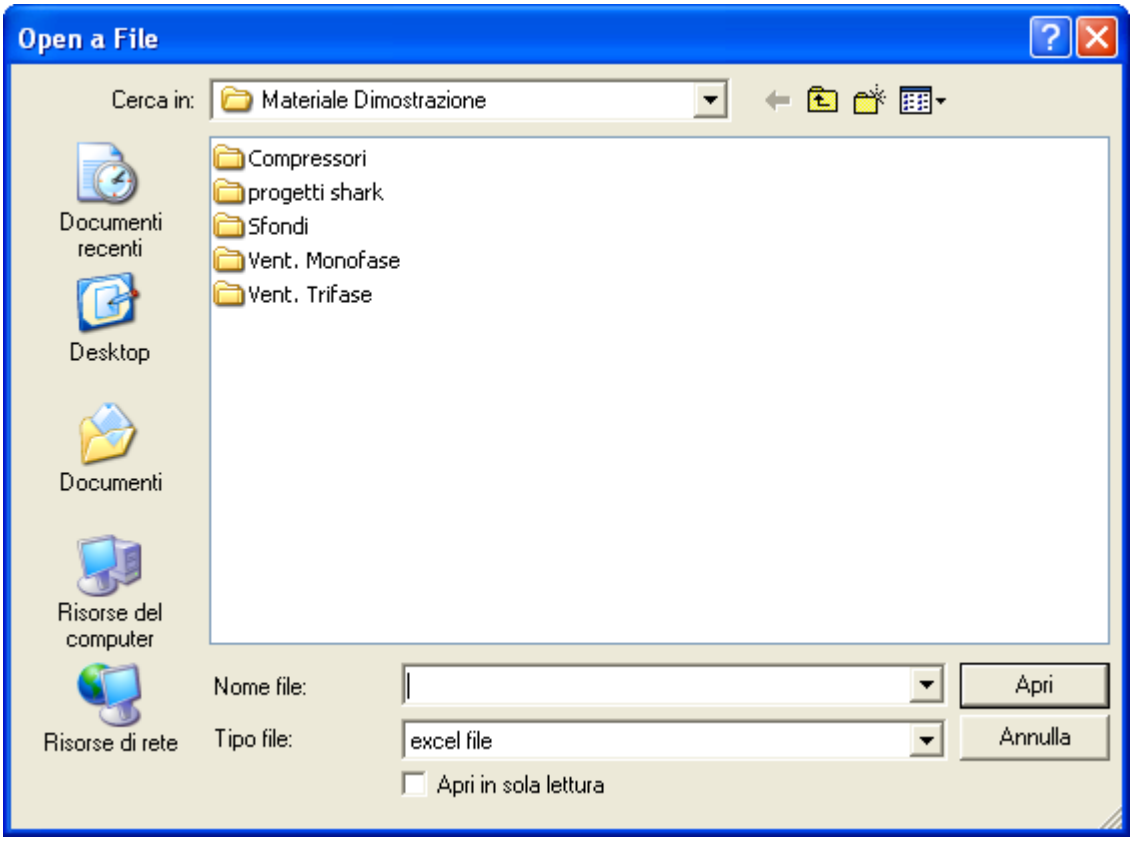
	A	B	C	D	E	F	G	H	I
1	10	0	0	229	1000	12500	0		
2	10	0	0	223	1000	13500	0		
3	10	0	0	212	1000	14500	0		
4	10	0	0	199	1000	15500	0		
5	10	0	0	184	1000	16500	0		
6	10	0	0	169	1000	17500	0		
7	10	0	0	153	1000	18500	0		
8	10	0	0	132	1000	19500	0		
9	10	0	0	112	1000	20500	0		
10	10	0	0	92,2	1000	21500	0		
11	10	0	0	68,8	1000	22500	0		
12	10	0	0	40,8	1000	23500	0		
13	10	0	0	16,1	1000	24500	0		
14	10	0	0	0	1000	25000	0		
15	9	0	0	183	1000	11200	0		
16	9	0	0	177	1000	12200	0		
17	9	0	0	167	1000	13200	0		
18	9	0	0	154	1000	14200	0		
19	9	0	0	140	1000	15200	0		
20	9	0	0	128	1000	16200	0		
21	9	0	0	110	1000	17200	0		
22	9	0	0	93,5	1000	18200	0		
23	9	0	0	76,2	1000	19200	0		
24	9	0	0	55,6	1000	20200	0		
25	9	0	0	31,2	1000	21200	0		

Etc.

At this point, we click on "Load Excel File" to open the excel file just generated.



Choose the file:

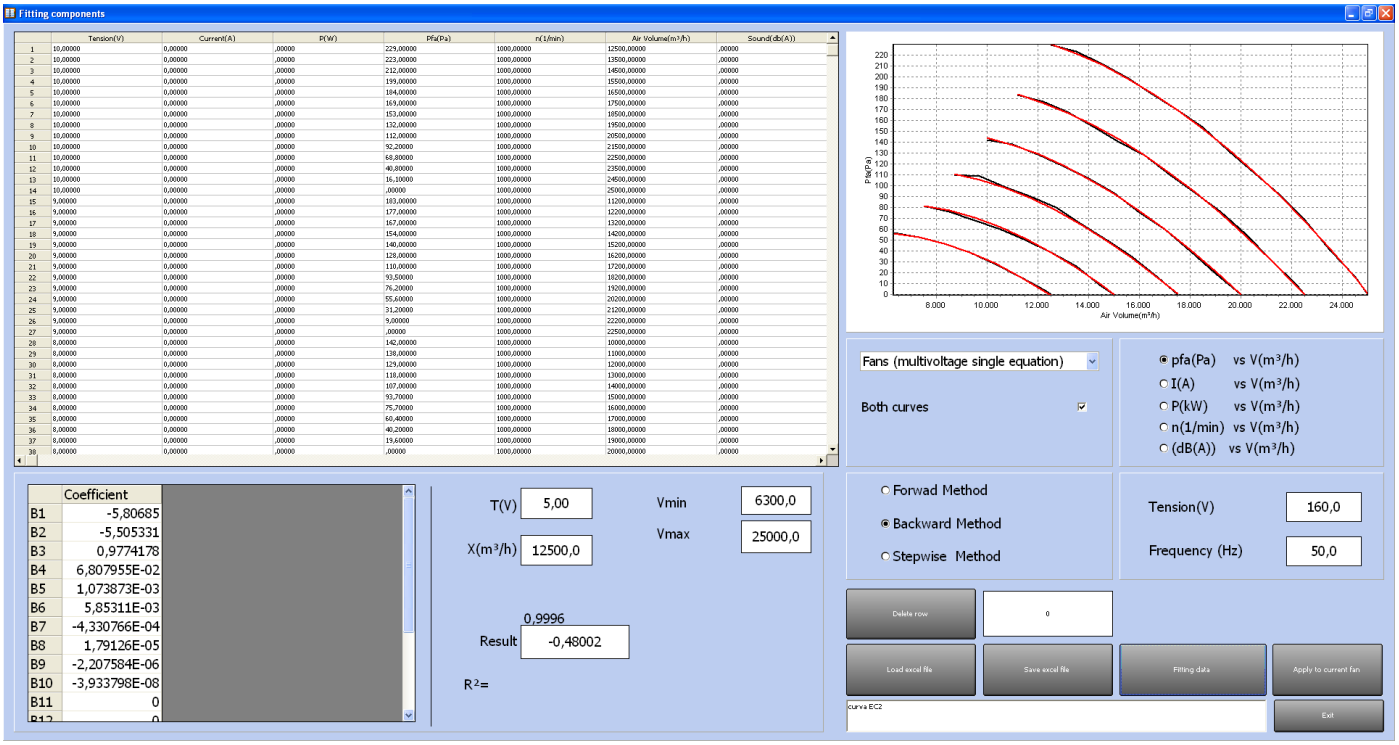


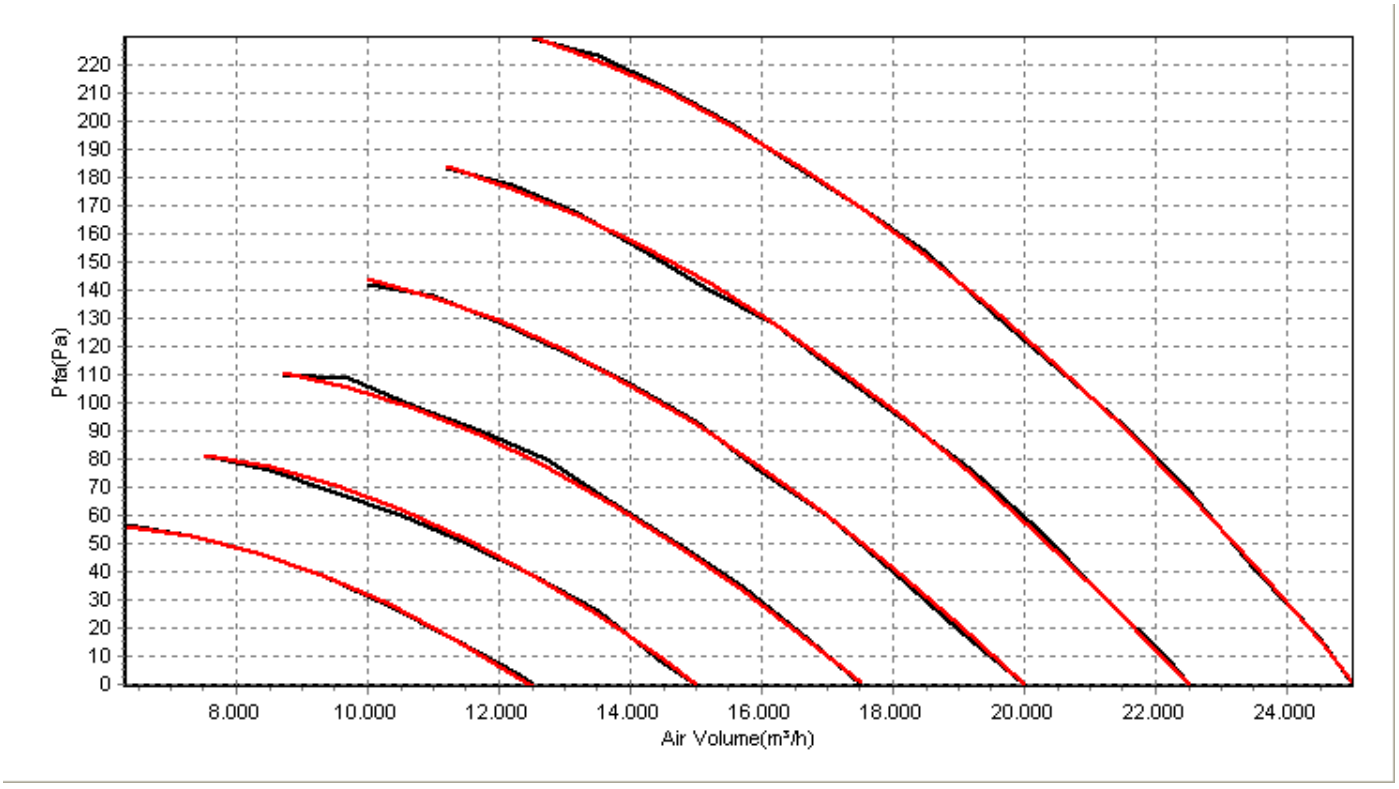
The content of the file is shown in the table:

	Tension(V)	Current(A)	P(W)	Pfa(Pa)	n(1/min)	Air Volume(m³/h)	Sound(db(A))
1	10,00000	0,00000	,00000	229,00000	1000,00000	12500,00000	,00000
2	10,00000	0,00000	,00000	223,00000	1000,00000	13500,00000	,00000
3	10,00000	0,00000	,00000	212,00000	1000,00000	14500,00000	,00000
4	10,00000	0,00000	,00000	199,00000	1000,00000	15500,00000	,00000
5	10,00000	0,00000	,00000	184,00000	1000,00000	16500,00000	,00000
6	10,00000	0,00000	,00000	169,00000	1000,00000	17500,00000	,00000
7	10,00000	0,00000	,00000	153,00000	1000,00000	18500,00000	,00000
8	10,00000	0,00000	,00000	132,00000	1000,00000	19500,00000	,00000
9	10,00000	0,00000	,00000	112,00000	1000,00000	20500,00000	,00000
10	10,00000	0,00000	,00000	92,20000	1000,00000	21500,00000	,00000
11	10,00000	0,00000	,00000	68,80000	1000,00000	22500,00000	,00000
12	10,00000	0,00000	,00000	40,80000	1000,00000	23500,00000	,00000
13	10,00000	0,00000	,00000	16,10000	1000,00000	24500,00000	,00000
14	10,00000	0,00000	,00000	,00000	1000,00000	25000,00000	,00000
15	9,00000	0,00000	,00000	183,00000	1000,00000	11200,00000	,00000
16	9,00000	0,00000	,00000	177,00000	1000,00000	12200,00000	,00000
17	9,00000	0,00000	,00000	167,00000	1000,00000	13200,00000	,00000
18	9,00000	0,00000	,00000	154,00000	1000,00000	14200,00000	,00000
19	9,00000	0,00000	,00000	140,00000	1000,00000	15200,00000	,00000
20	9,00000	0,00000	,00000	128,00000	1000,00000	16200,00000	,00000
21	9,00000	0,00000	,00000	110,00000	1000,00000	17200,00000	,00000
22	9,00000	0,00000	,00000	93,50000	1000,00000	18200,00000	,00000
23	9,00000	0,00000	,00000	76,20000	1000,00000	19200,00000	,00000
24	9,00000	0,00000	,00000	55,60000	1000,00000	20200,00000	,00000
25	9,00000	0,00000	,00000	31,20000	1000,00000	21200,00000	,00000
26	9,00000	0,00000	,00000	9,00000	1000,00000	22200,00000	,00000
27	9,00000	0,00000	,00000	,00000	1000,00000	22500,00000	,00000
28	8,00000	0,00000	,00000	142,00000	1000,00000	10000,00000	,00000
29	8,00000	0,00000	,00000	138,00000	1000,00000	11000,00000	,00000
30	8,00000	0,00000	,00000	129,00000	1000,00000	12000,00000	,00000
31	8,00000	0,00000	,00000	118,00000	1000,00000	13000,00000	,00000
32	8,00000	0,00000	,00000	107,00000	1000,00000	14000,00000	,00000
33	8,00000	0,00000	,00000	93,70000	1000,00000	15000,00000	,00000
34	8,00000	0,00000	,00000	75,70000	1000,00000	16000,00000	,00000
35	8,00000	0,00000	,00000	60,40000	1000,00000	17000,00000	,00000
36	8,00000	0,00000	,00000	40,20000	1000,00000	18000,00000	,00000
37	8,00000	0,00000	,00000	19,60000	1000,00000	19000,00000	,00000
38	8,00000	0,00000	,00000	,00000	1000,00000	20000,00000	,00000

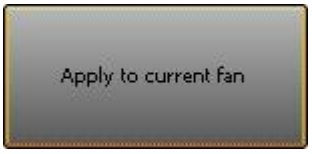
Click on "Fitting Data:"

Below we can see the result of the fitting, of the perfect curves:





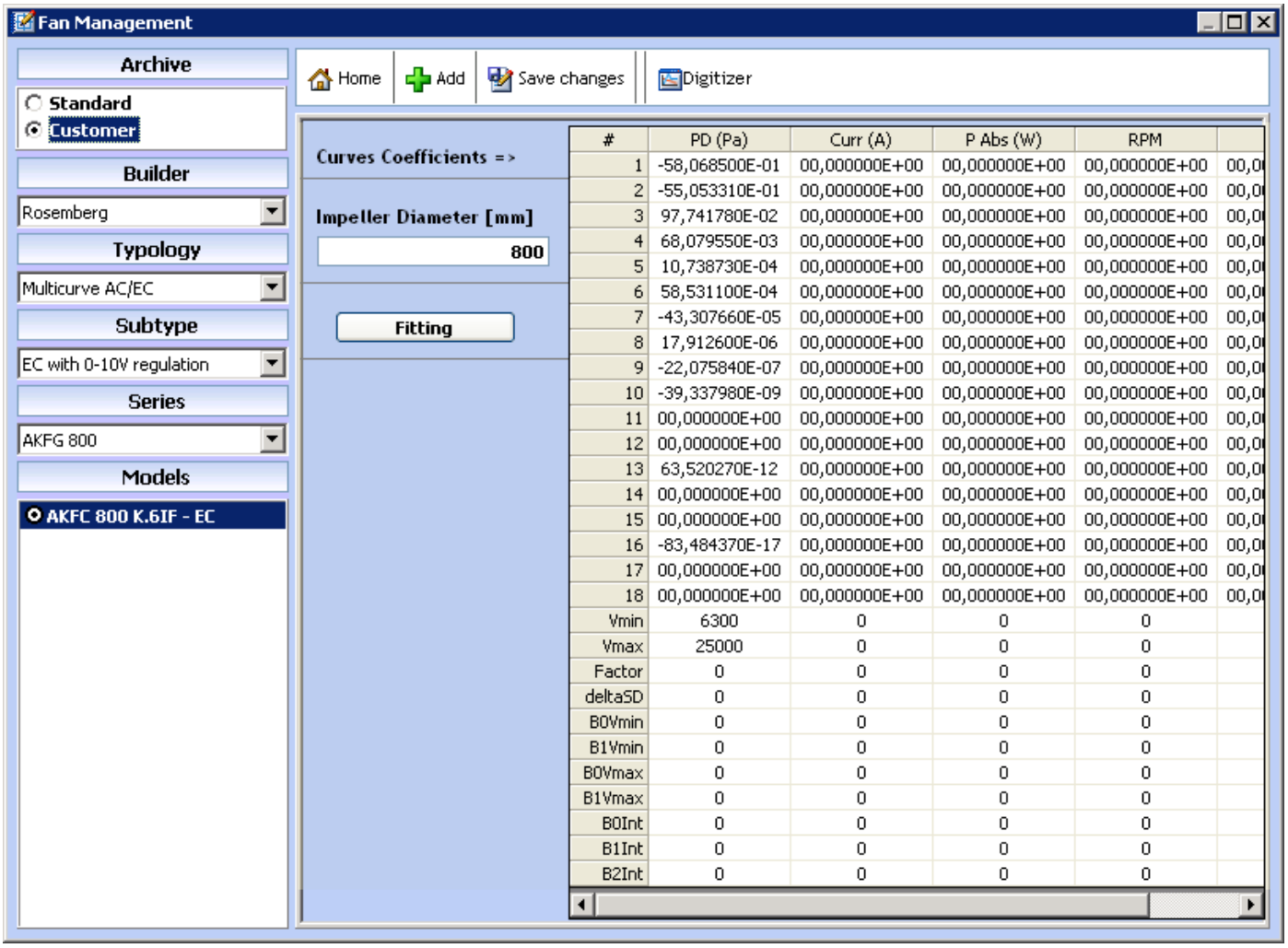
Now to save the data, please click on "Apply to Current fan":



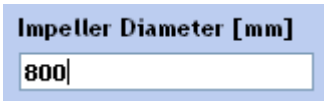
If we had the absorbed current curves, absorbed power, and noise, we would have had to repeat the procedure "Fitting data" and then "Apply to current fan", for each available curve. Before doing the fitting, change the parameter:

Once the fitting has been done for all the curves, let's click on "Exit":

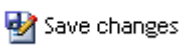
The following window will appear:



Let us set the Impeller Diameter:

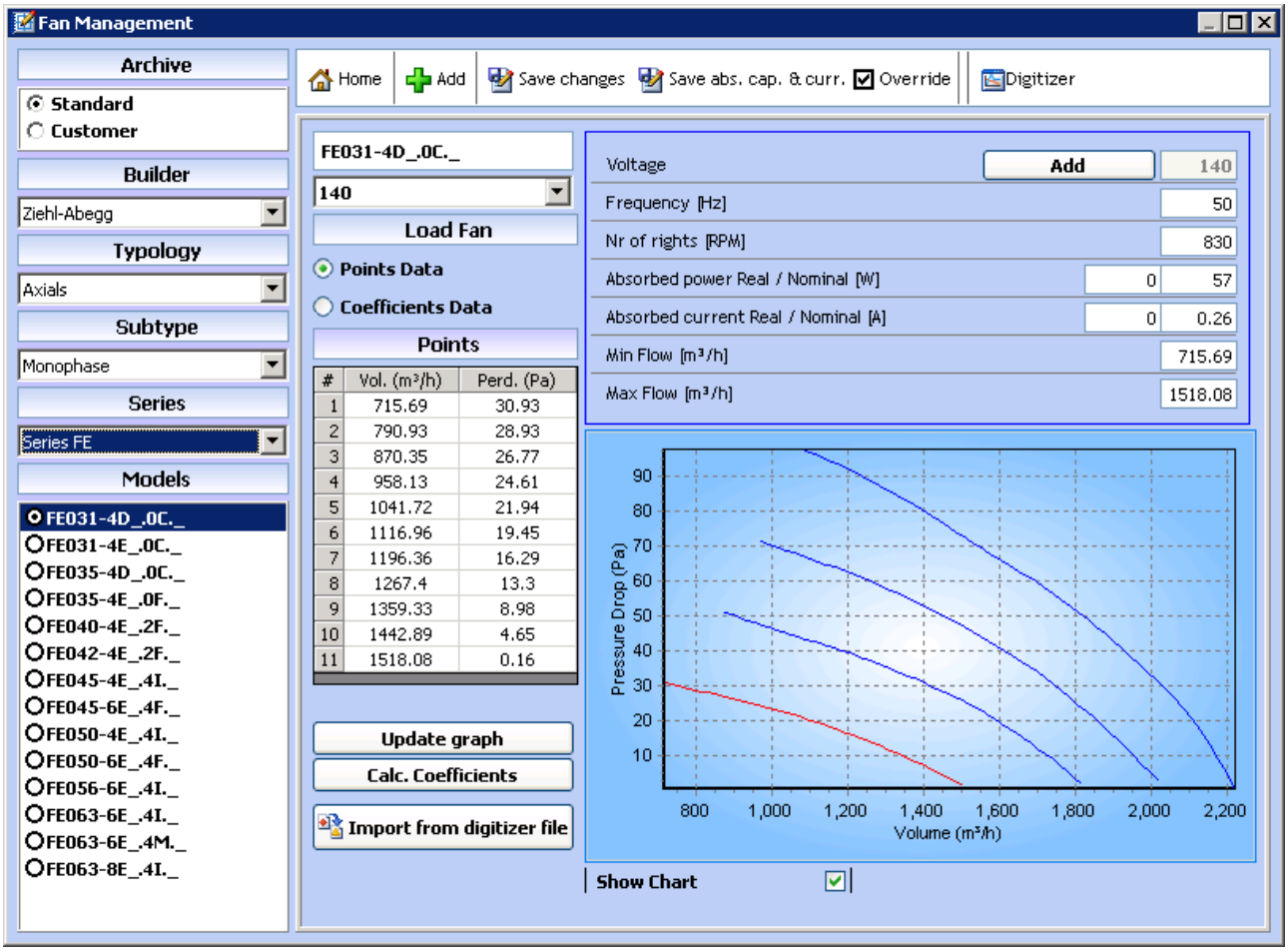


And we click on Save:



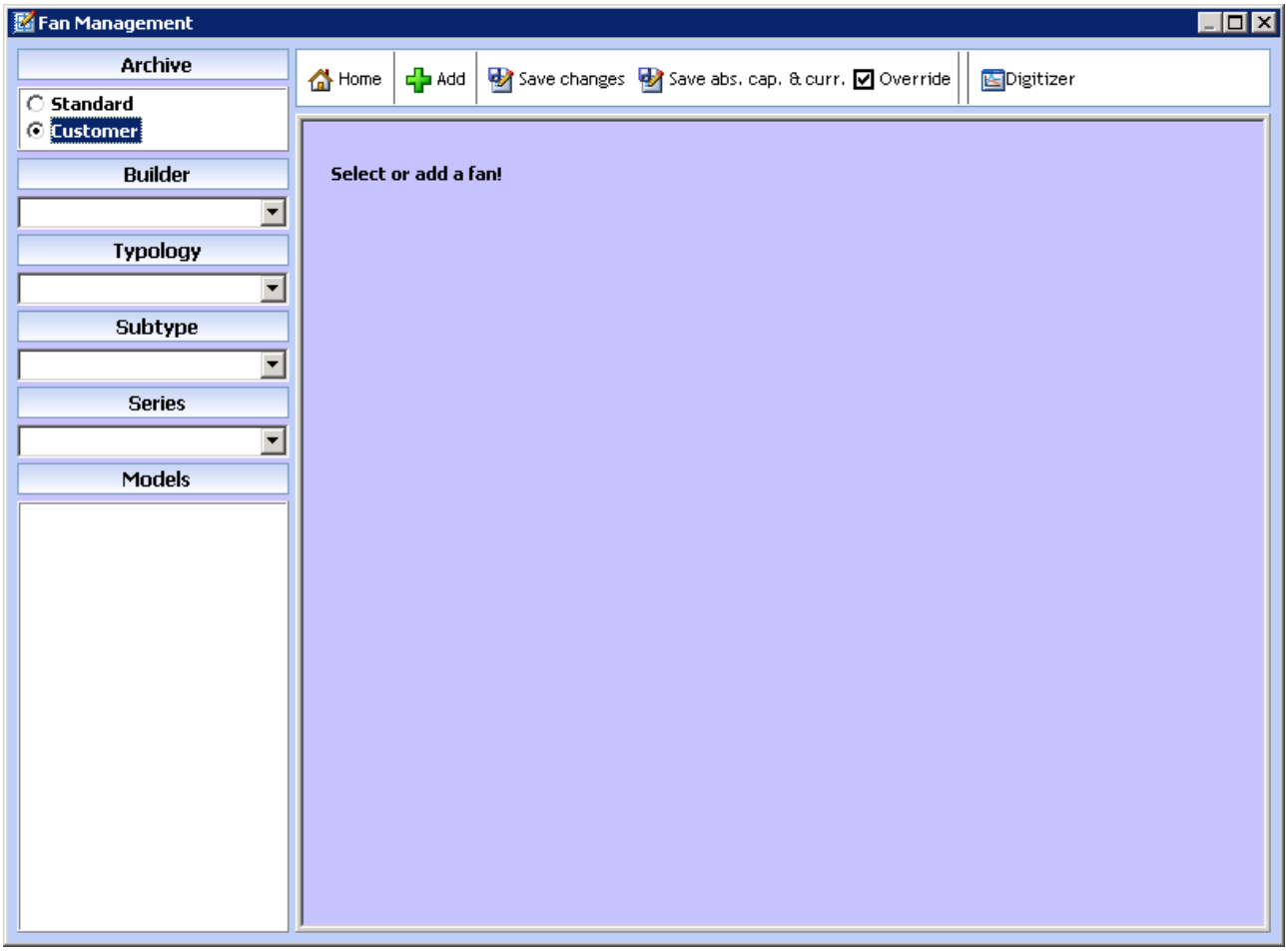
How to insert a Centrifugal Fan

To insert a new fan, we click Archive management, and then on we get:

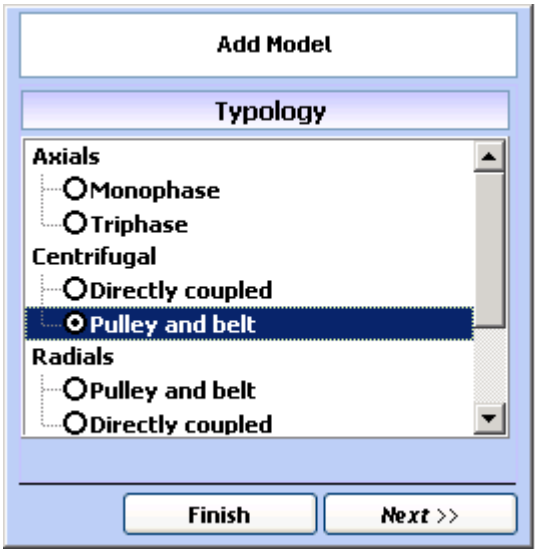


We then click on Customer, Add button, we can add the builder, the typology, the subtype, the series and the model.

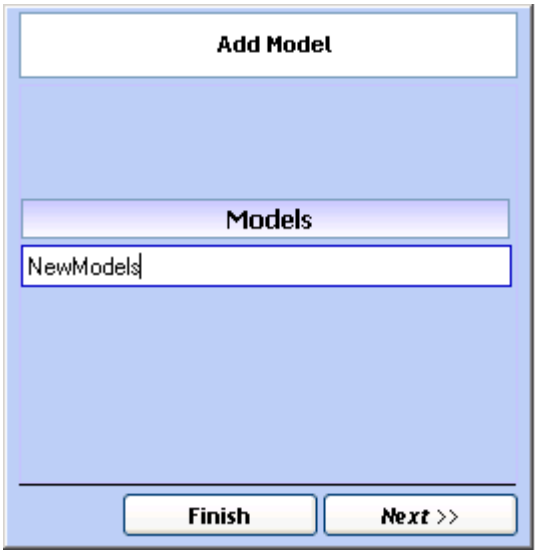
We choose "Archive", and click on "Customer" and then when we click on "Add" we get:



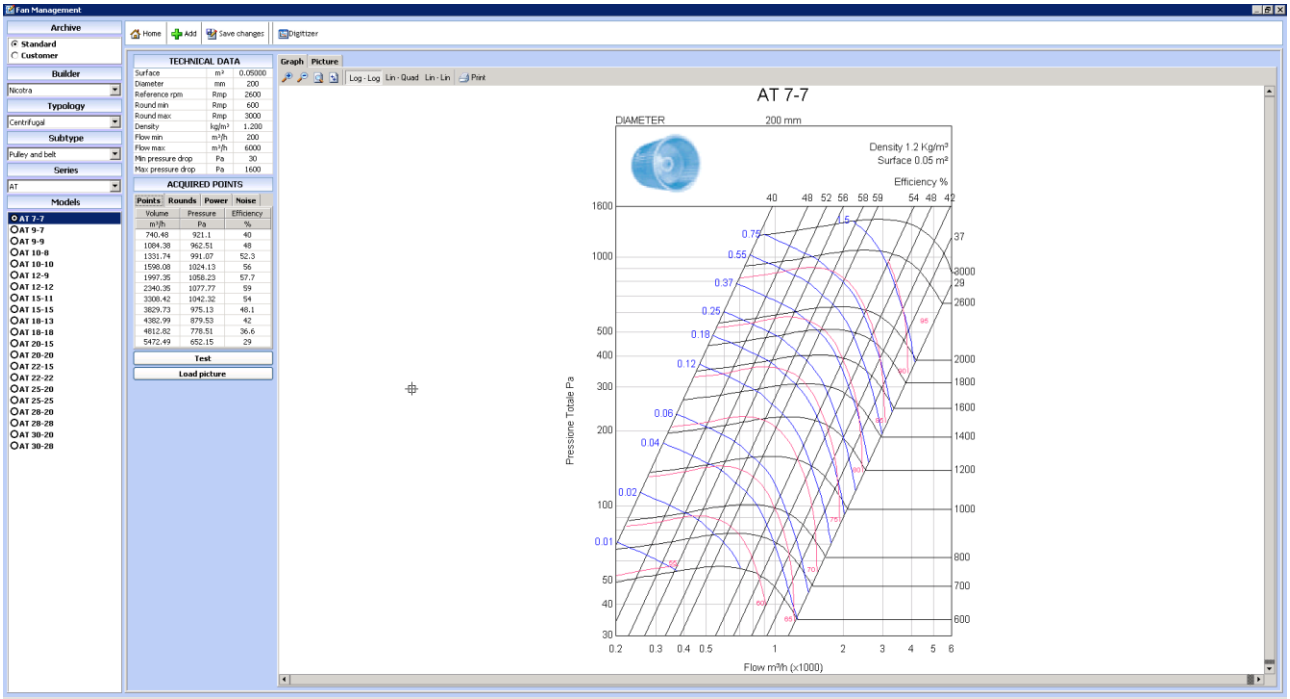
Then we can insert the typology:



Then the model:

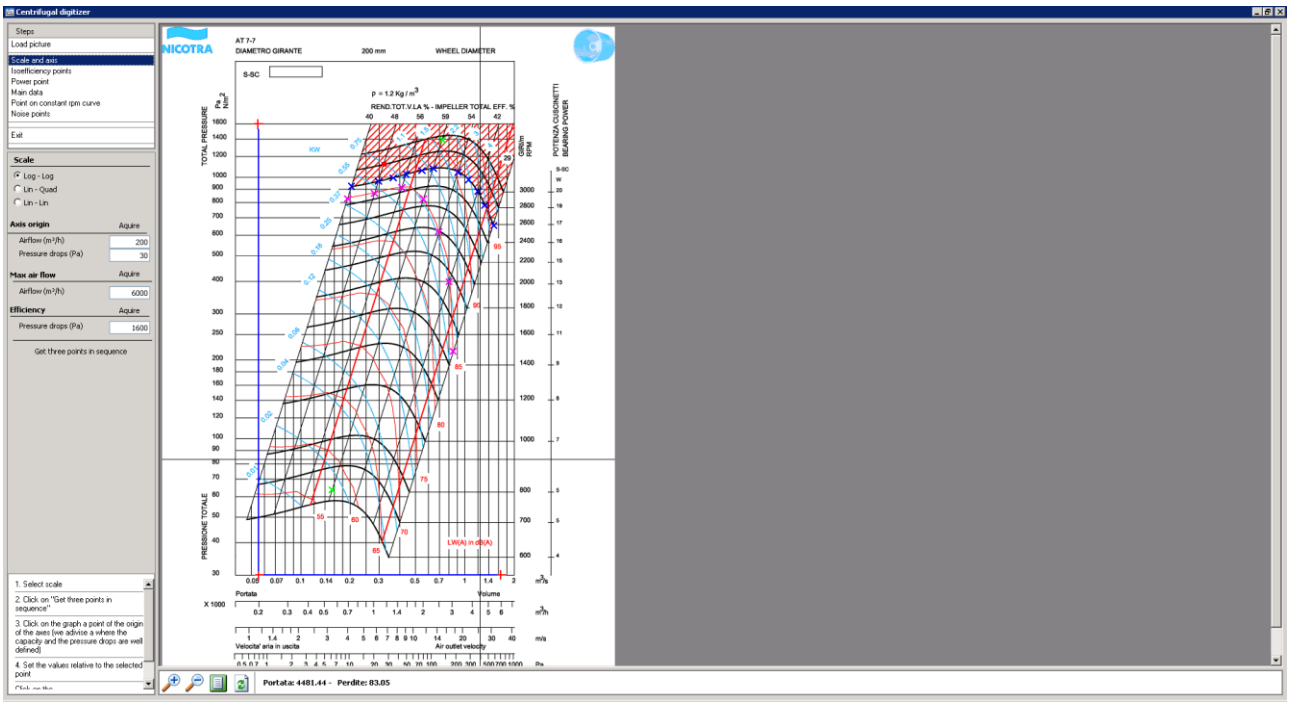


Then we proceed with Digitizer and get the image of the fan:



We choose the type of fan to be inserted and we click on "Next".

We click on "Load Picture" and open the image of the fan we want to insert

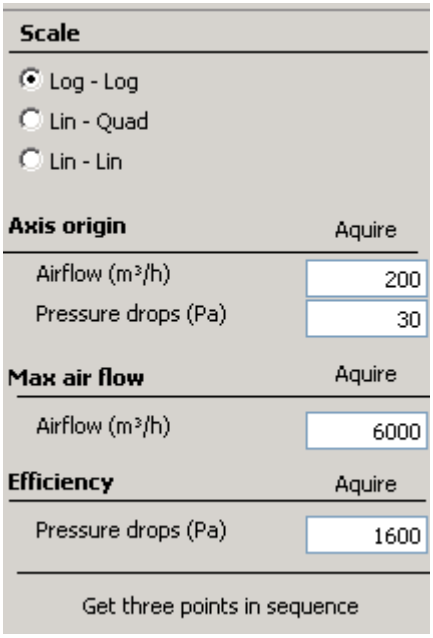


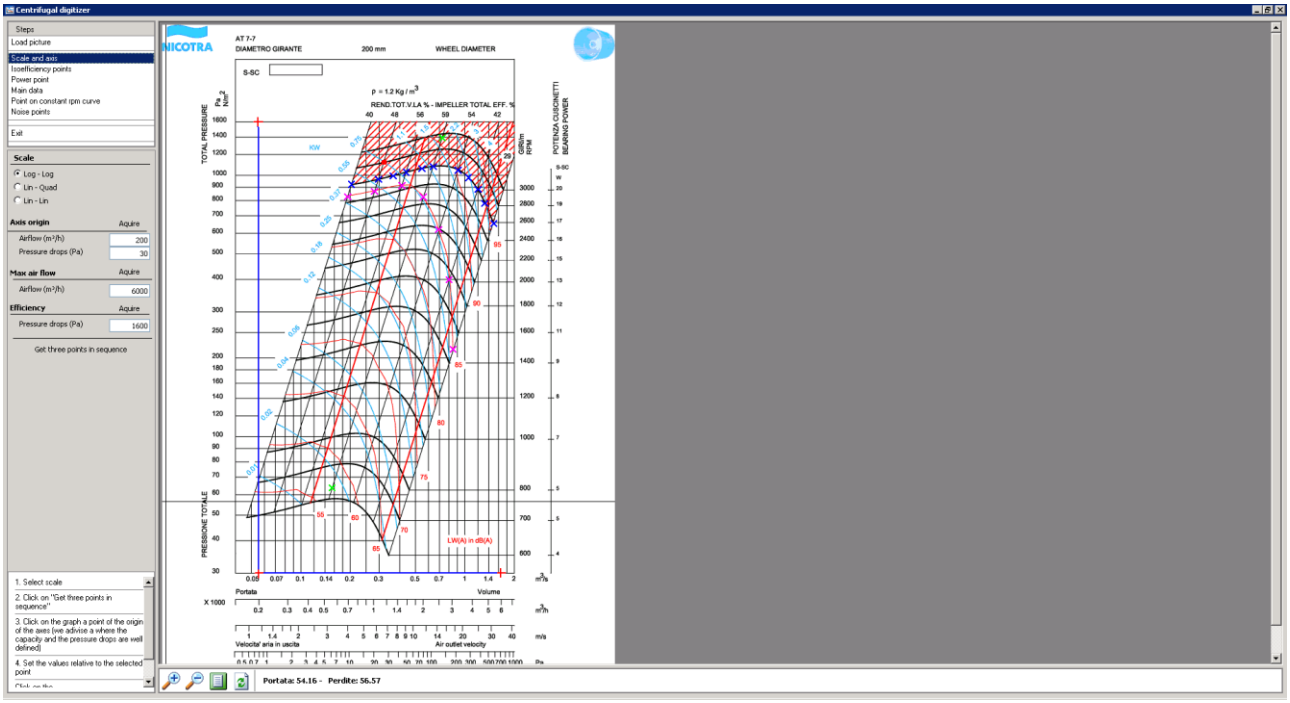
We click on "Scale and Axes". The types of scales are Logarithm-logarithm, Linear- quadratic and linear / linear.

We click on "Acquire" (Axes Origin) to indicate the origin of the axes and to insert the relative values.

We do the same for "Max Airflow".

We click on "Efficiency"

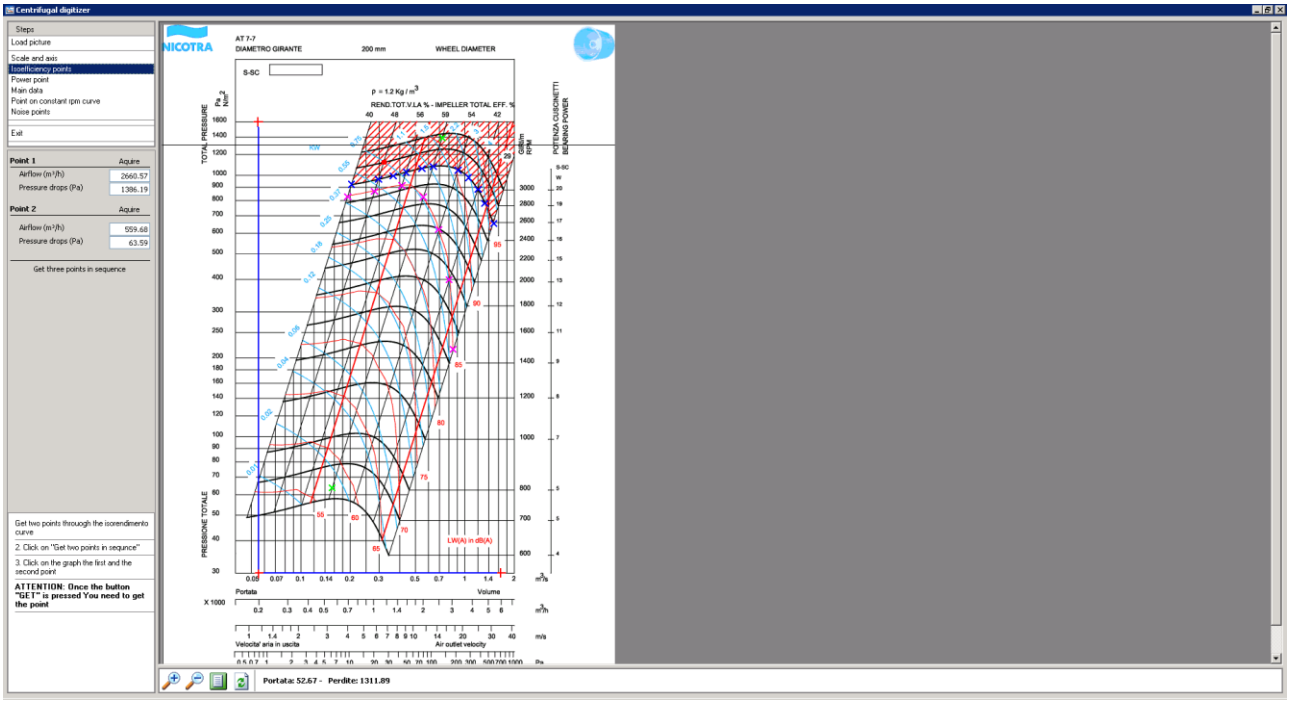




We need to get two points that are on the same oblique line called constant efficiency "Isoefficiency points".

Like in the given guide we click on the "get" button to get the points.

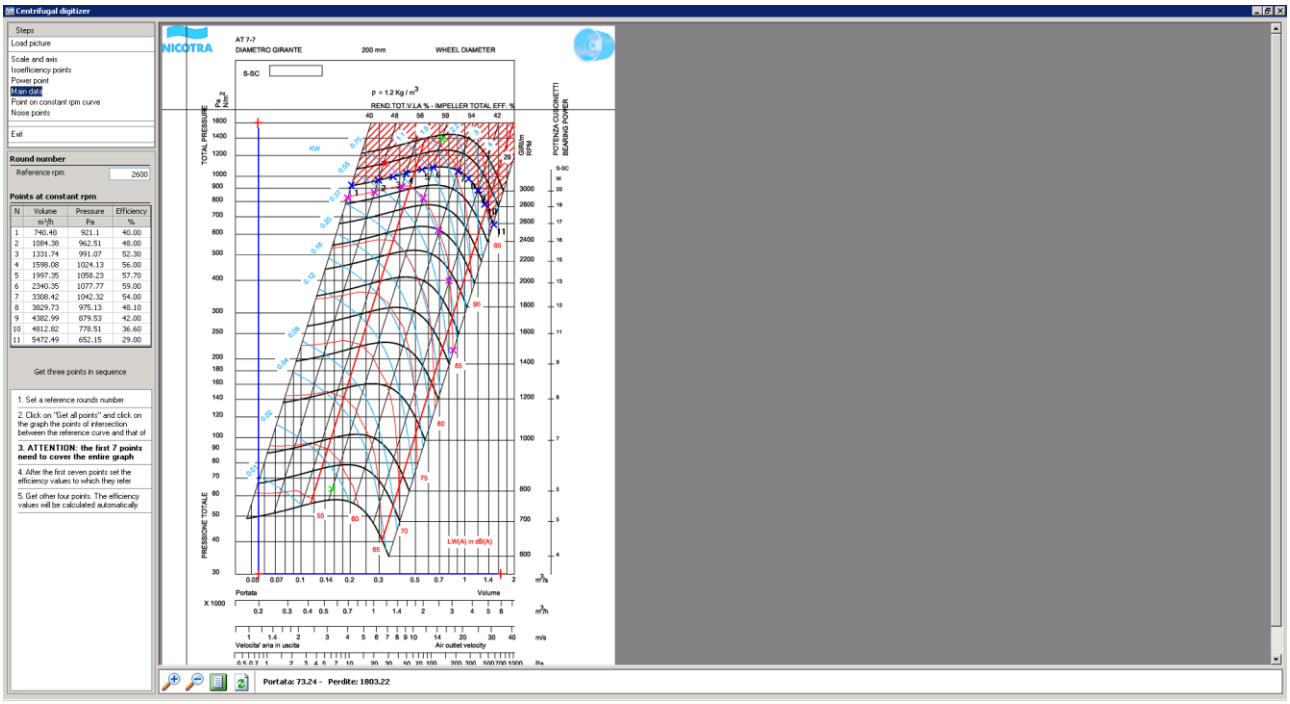
We click on "Power Point"



From the small guide we click on "Acquire" and we click on an intersection point between the constant efficiency curve and the power curve.

After that we click on the corresponding spaces the power values and the efficiency of the chosen curves.

We click on "Main Data":



We insert the diameter of the impeller that in this case is at the top of the graph.

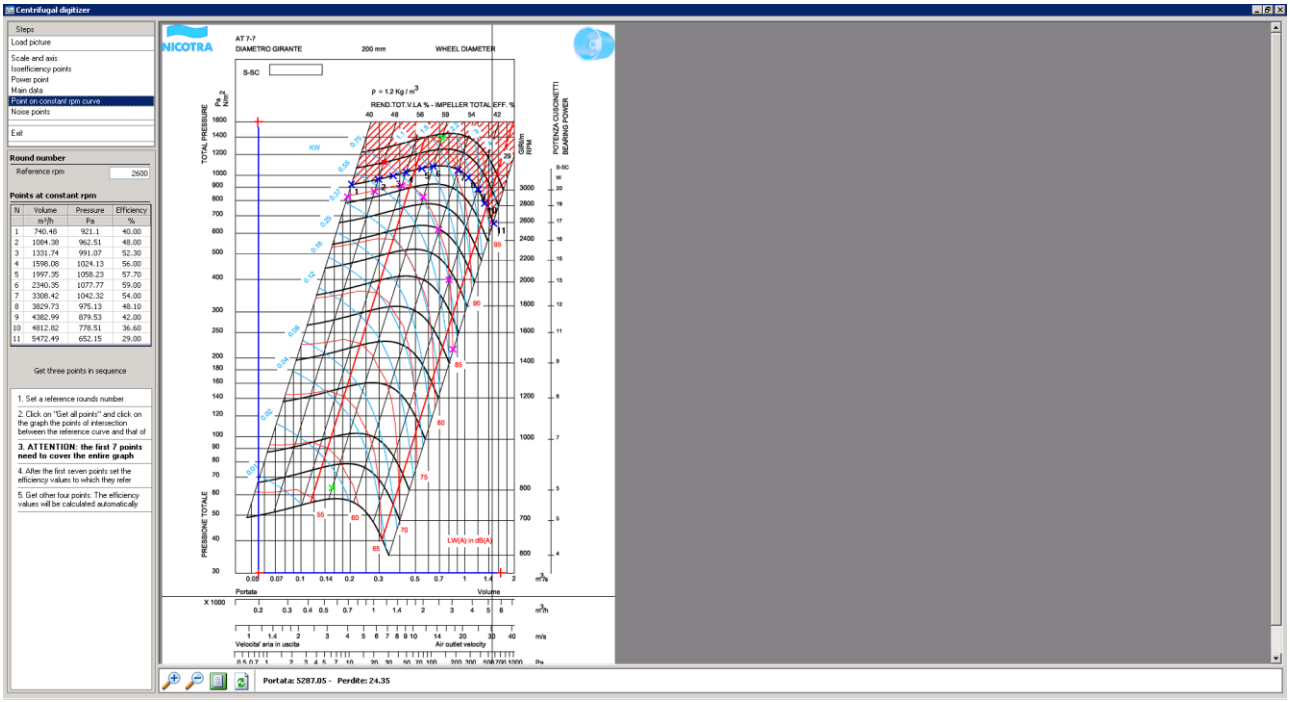
The same for the air density.

In case the air to the fan outlet is known we just insert the value , otherwise we click on "Get"(Fan Outlet) and we click on the on a point of the graph at a certain speed ; we have a field where we can enter the chosen air velocity and automatically the fan outlet will be calculated.

Next, in the section "RPM" we put the minimum and maximum values.

If we click on "rpm" we can insert the relative data.
We do the same for "Power" and "Noise"

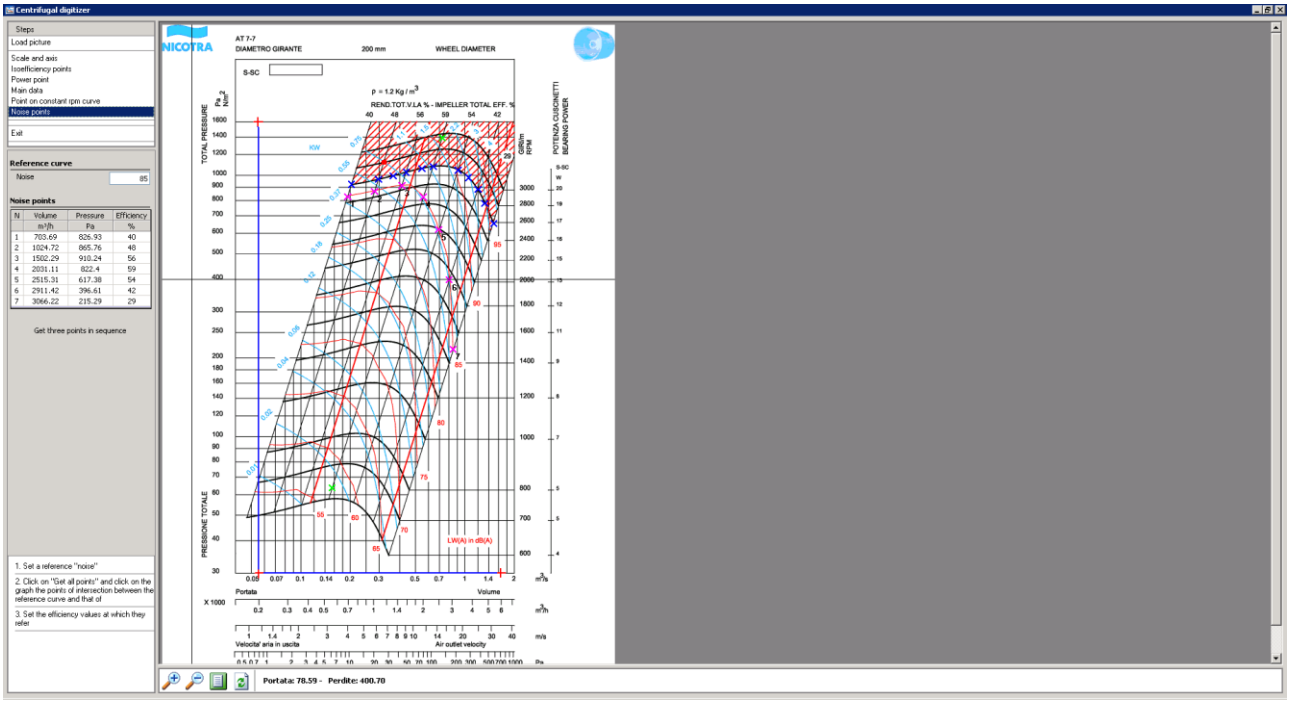
We click on "Point on constant rpm curve" and get:



For example let's take an rpm of "2600"

We click on "Get all points" and we follow the instructions that are given in the small guide paying attention to point 3. That says that the first seven points taken in the graph need to be the ones of the intersection between the curves of constant efficiency and the chosen curve.

We click on "Noise Points" and we get

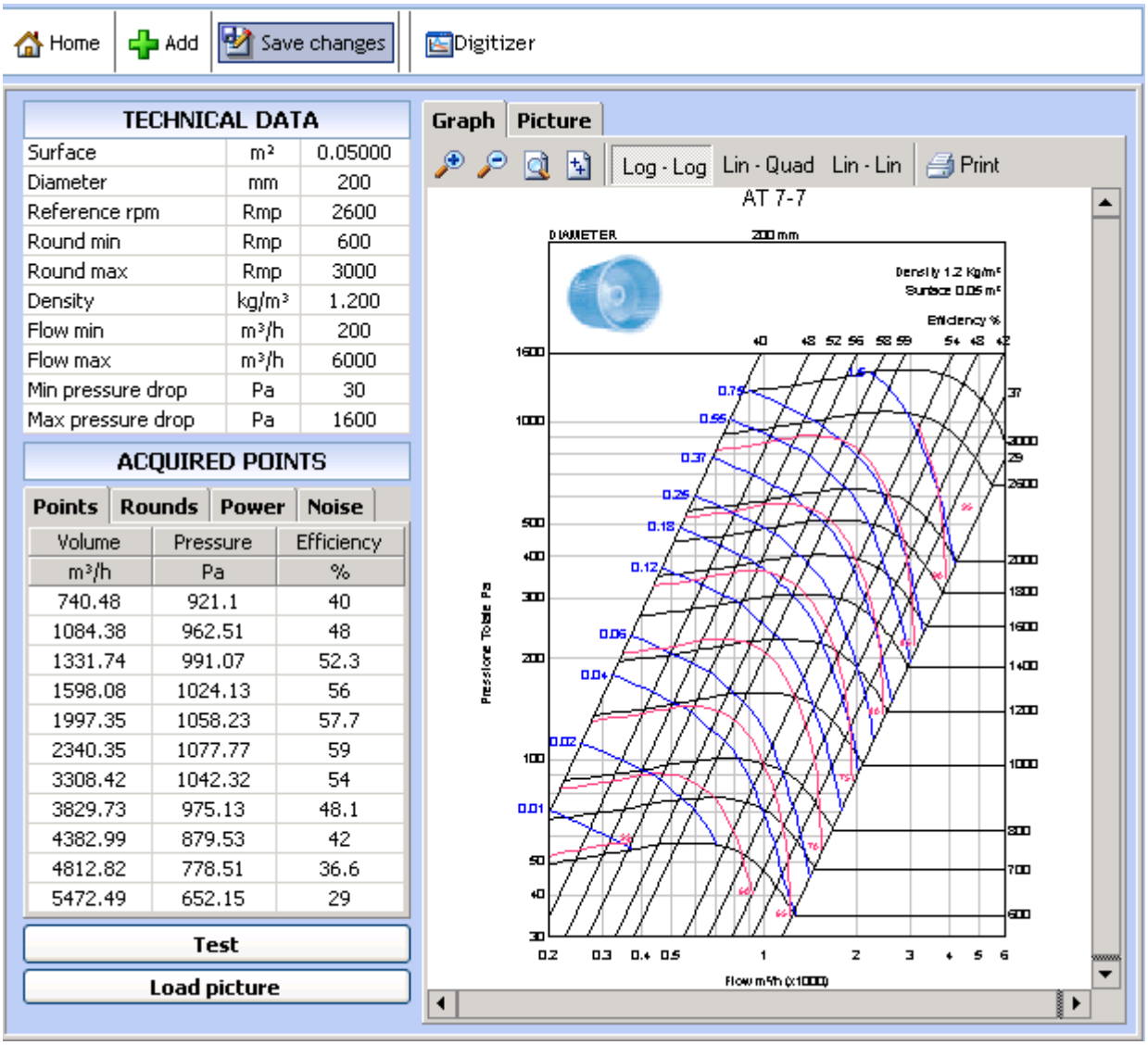


We follow the same procedure as for "Point on constant rpm curve"

We can follow the mini guide below.

1. Set a reference "noise"
2. Click on "Get all points" and click on the graph the points of intersection between the reference curve and that of
3. Set the efficiency values at which they refer

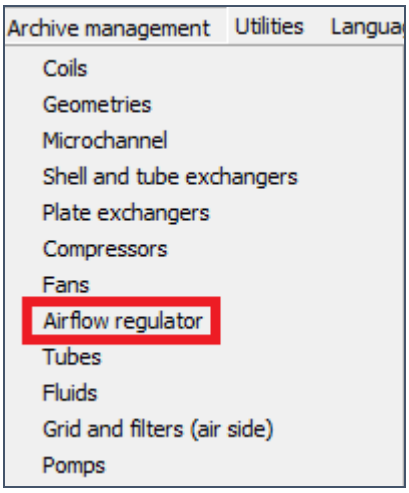
We click on "Exit" and on save changes



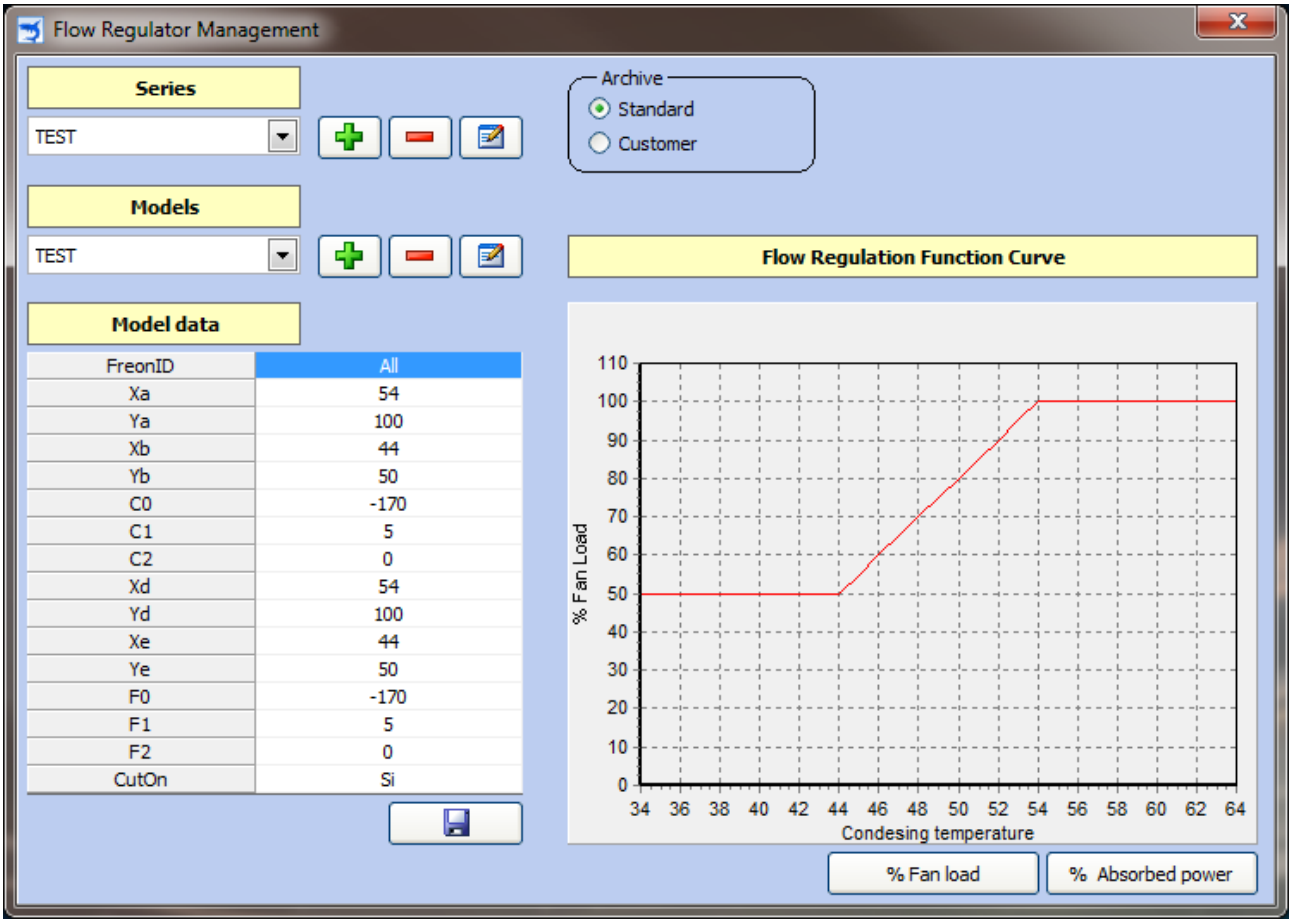
How to insert an Airflow regulator

Airflow regulators are used to scale the fan air flow in regards to the unit condensing temperature (it can be applied only to air/water chiller).

Click on "Archive Management" -> Airflow regulator:



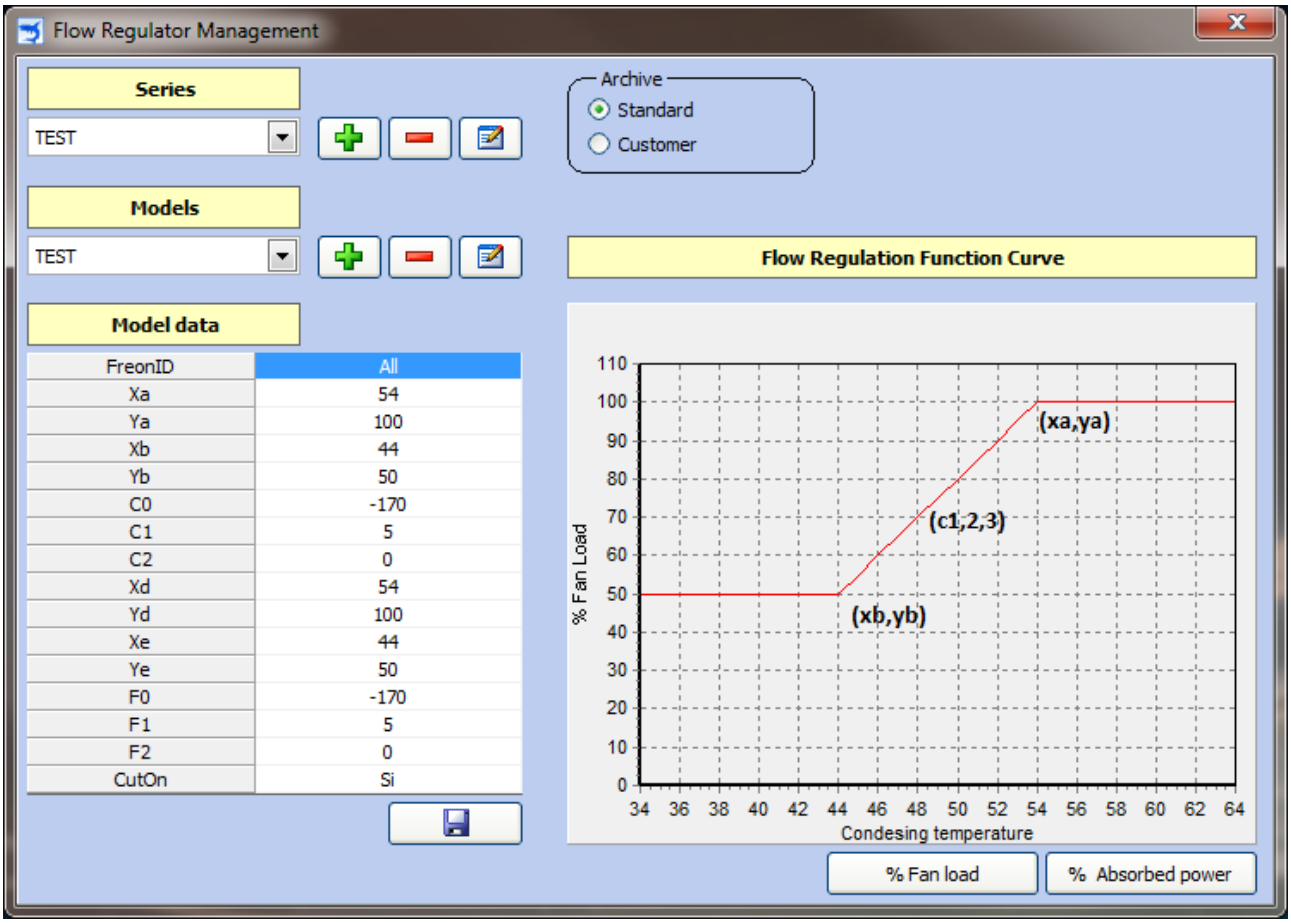
You will see the mask below with an example:



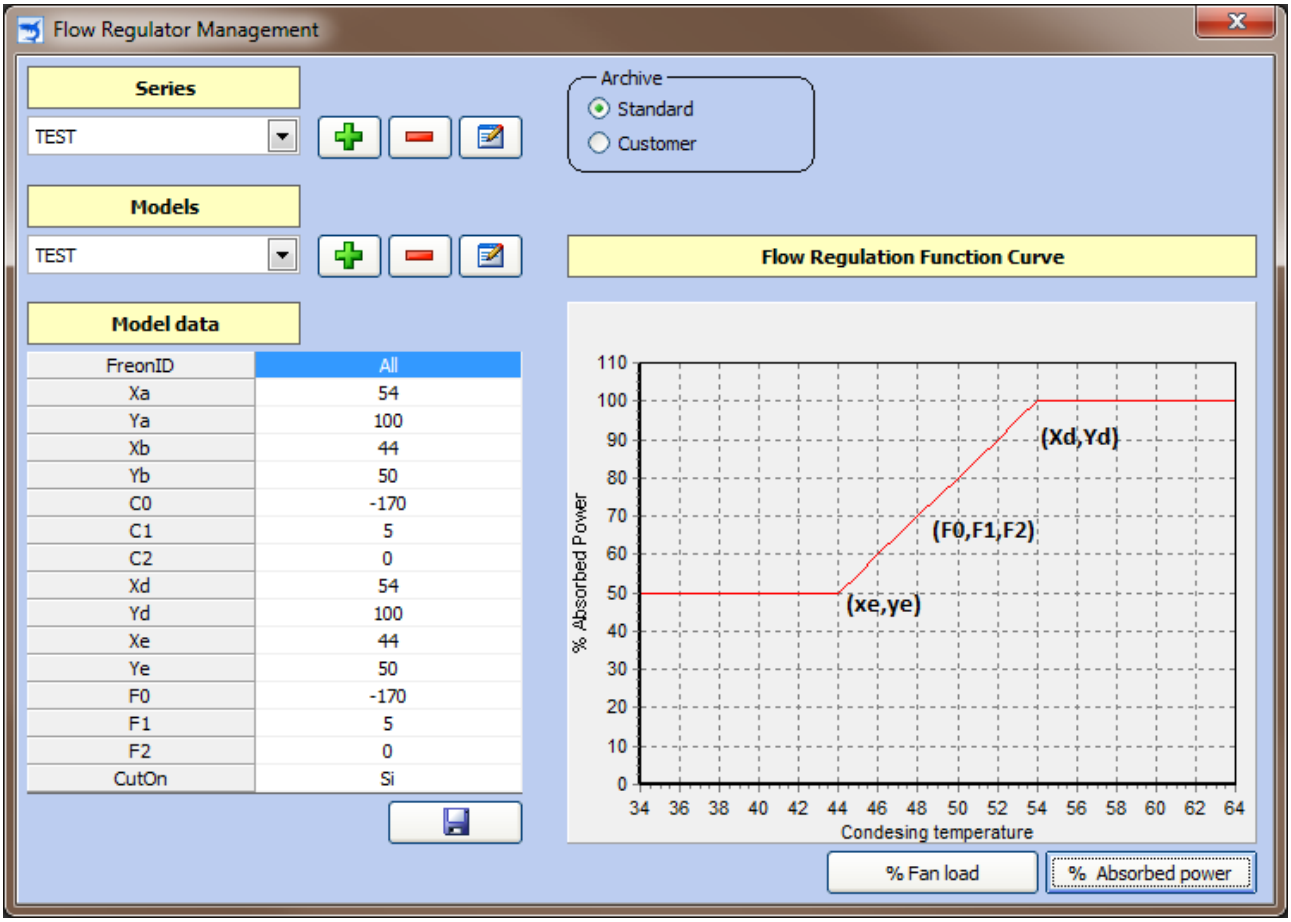
On the chart, you can see on the axis "y", %Fan or % absorbed power clicking on the buttons

% Fan load Or % Absorbed power

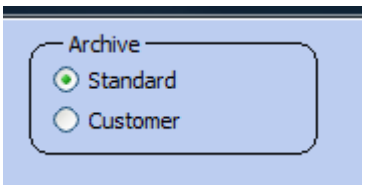
The coordinates (xa,ya),(xb,yb), and the known terms (c0,c1,c2) refers to chart Condensing Temperature/% Fan Load.



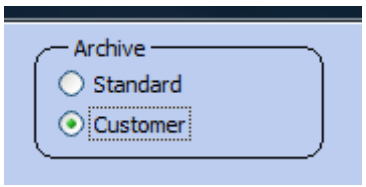
The coordinates (xd,yd),(xe,ye) and the known terms (F0,F1,F2) refers to chart Condensing Temperature/% Absorbed Power.



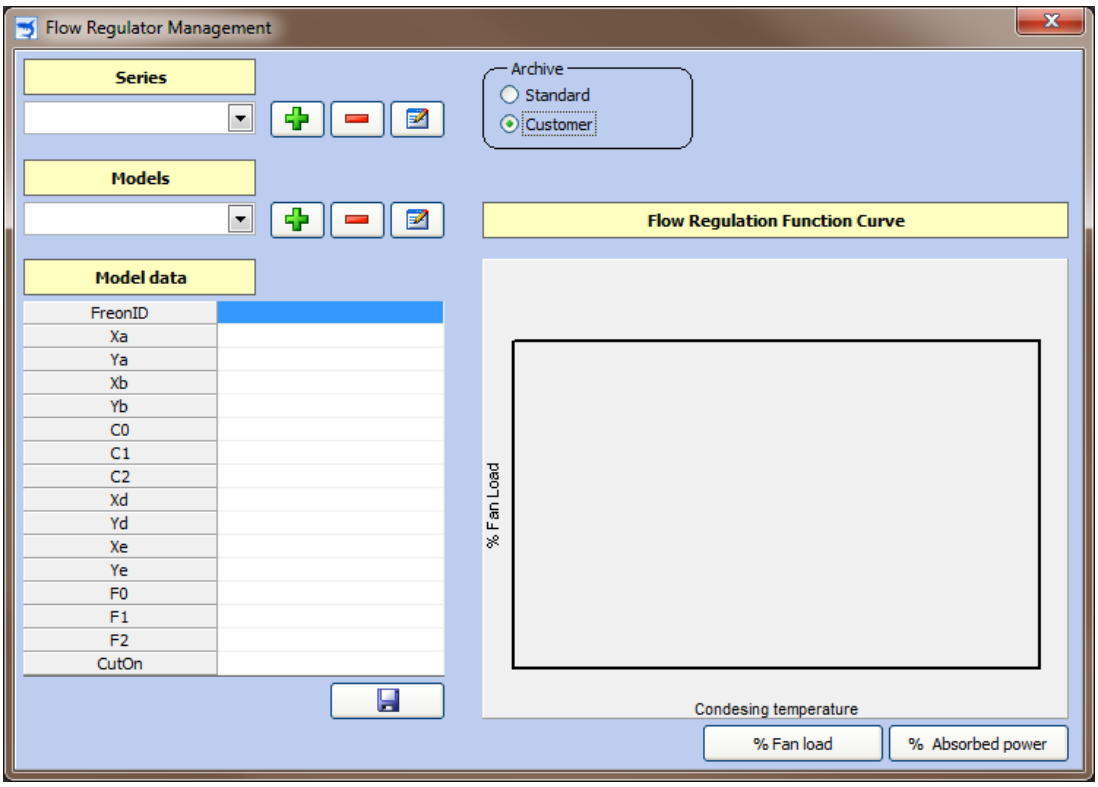
To insert a new series and a new regulator, it is possible to insert the data in the Customer Archive.



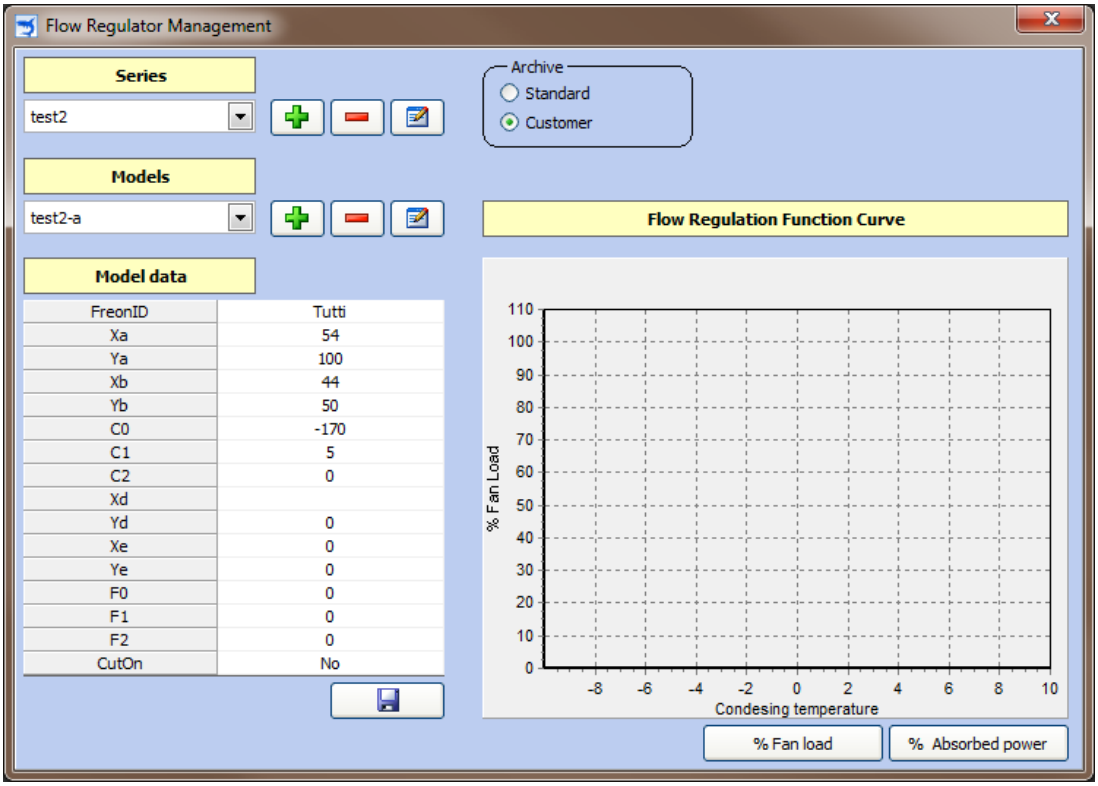
→



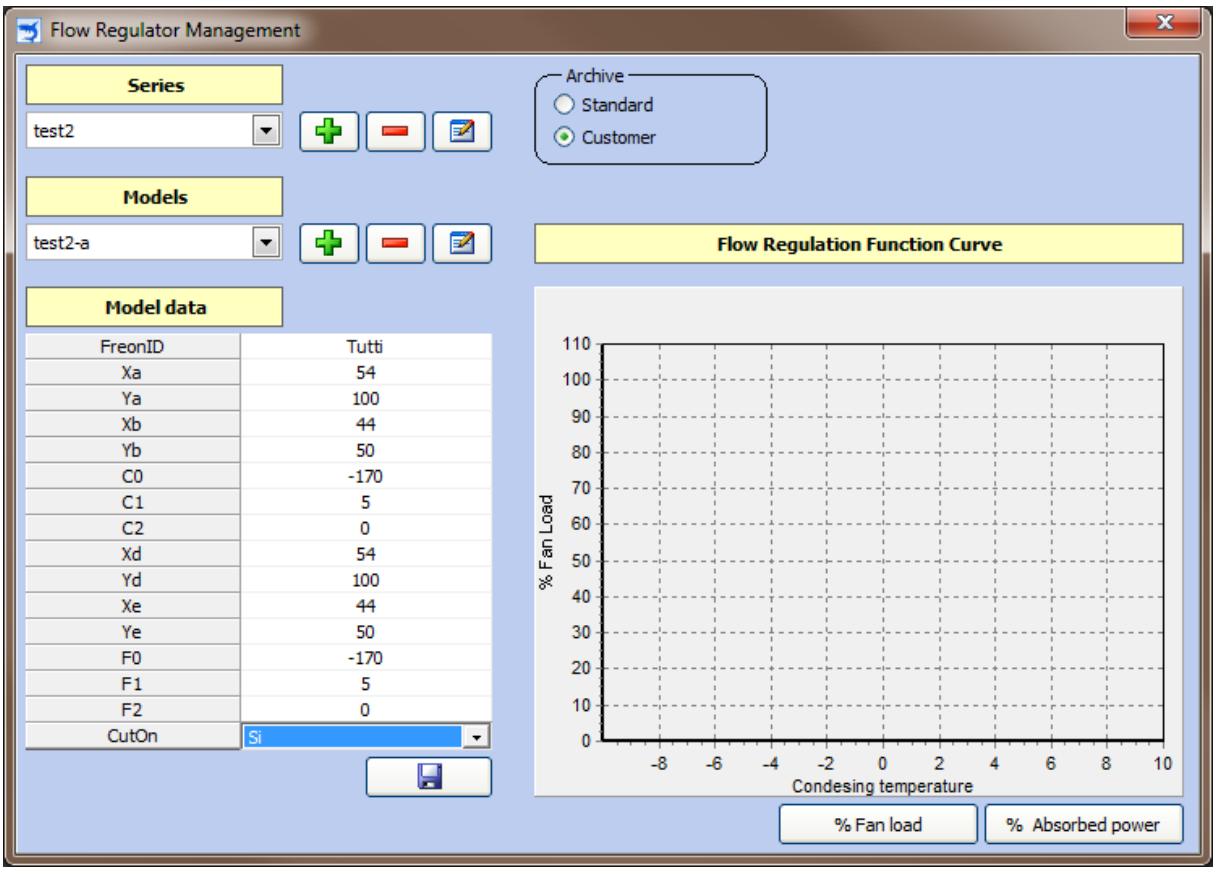
How to insert the points in the chart

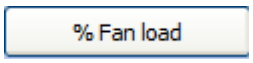


Click on the buttons  to insert SERIES and MODELS. Besides, to insert the variables "a, b, C", like the example below.

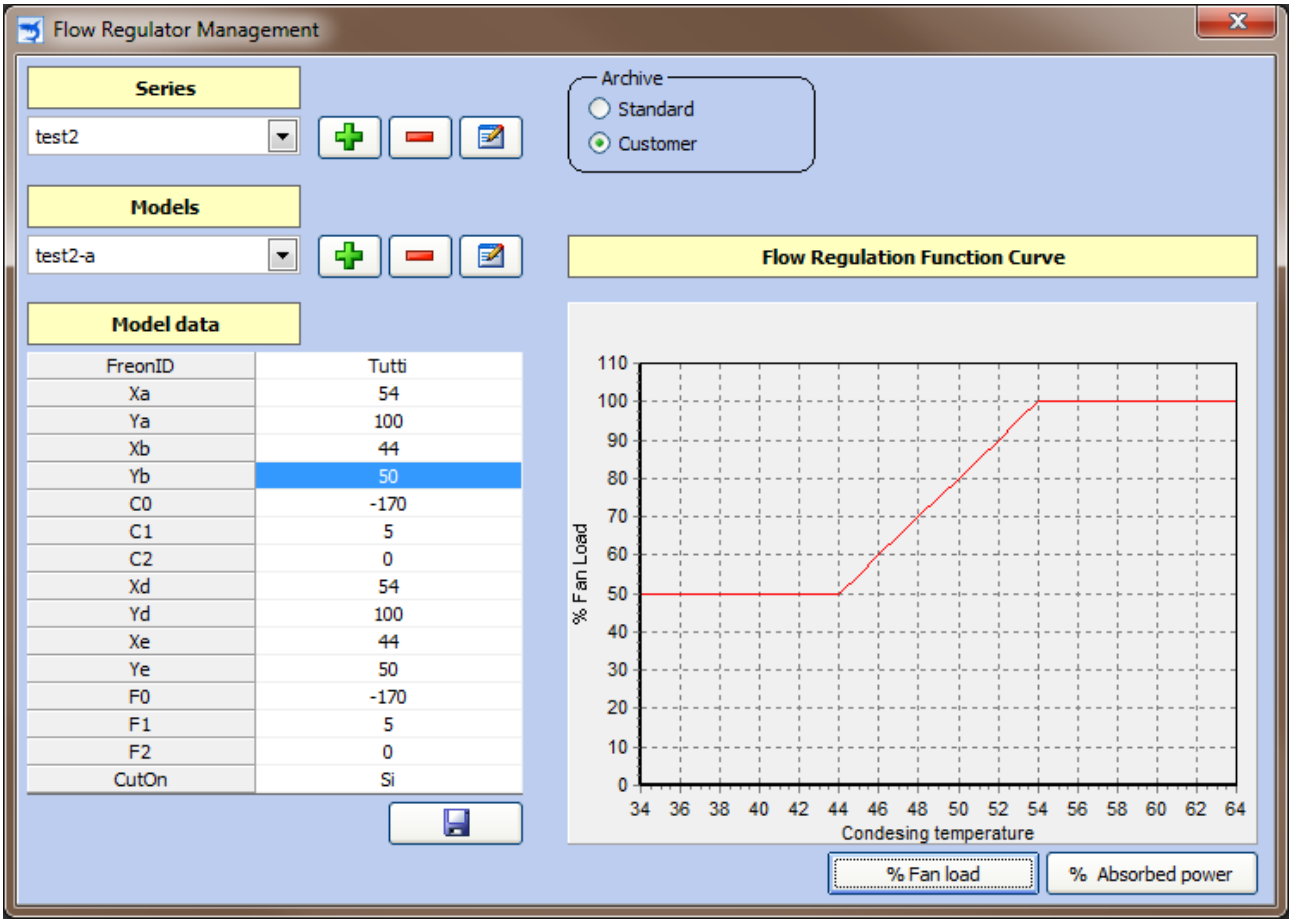


To insert also the variables "d,e,F".

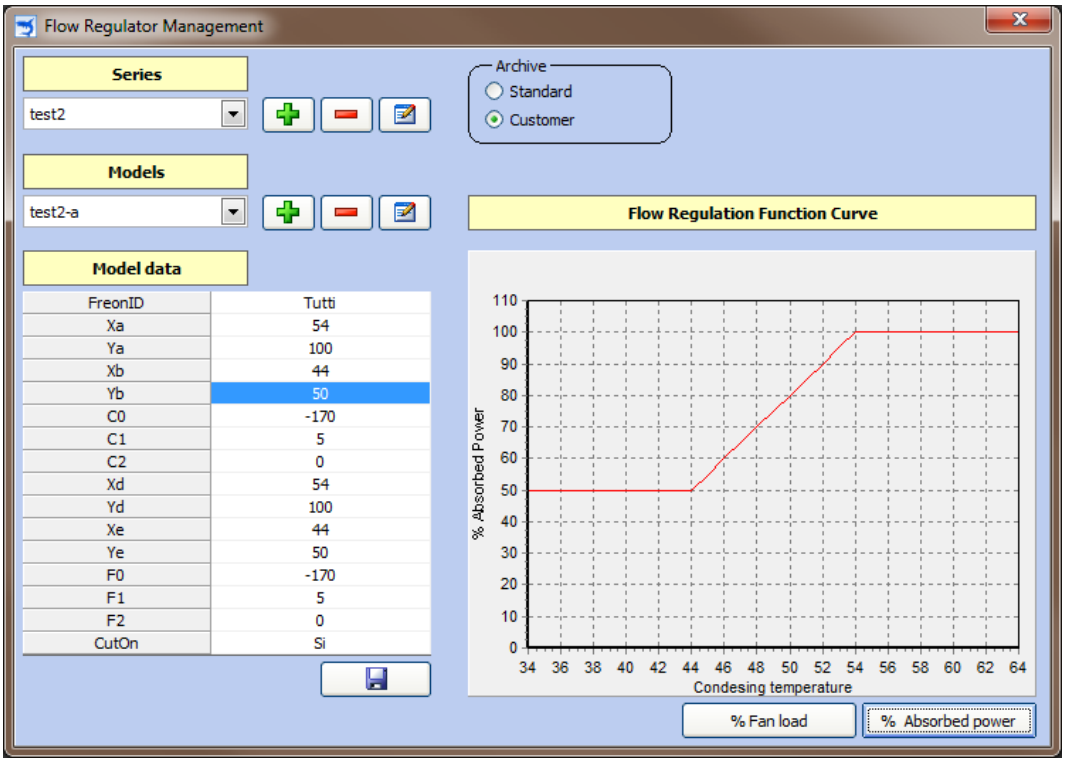


Click on  and on 

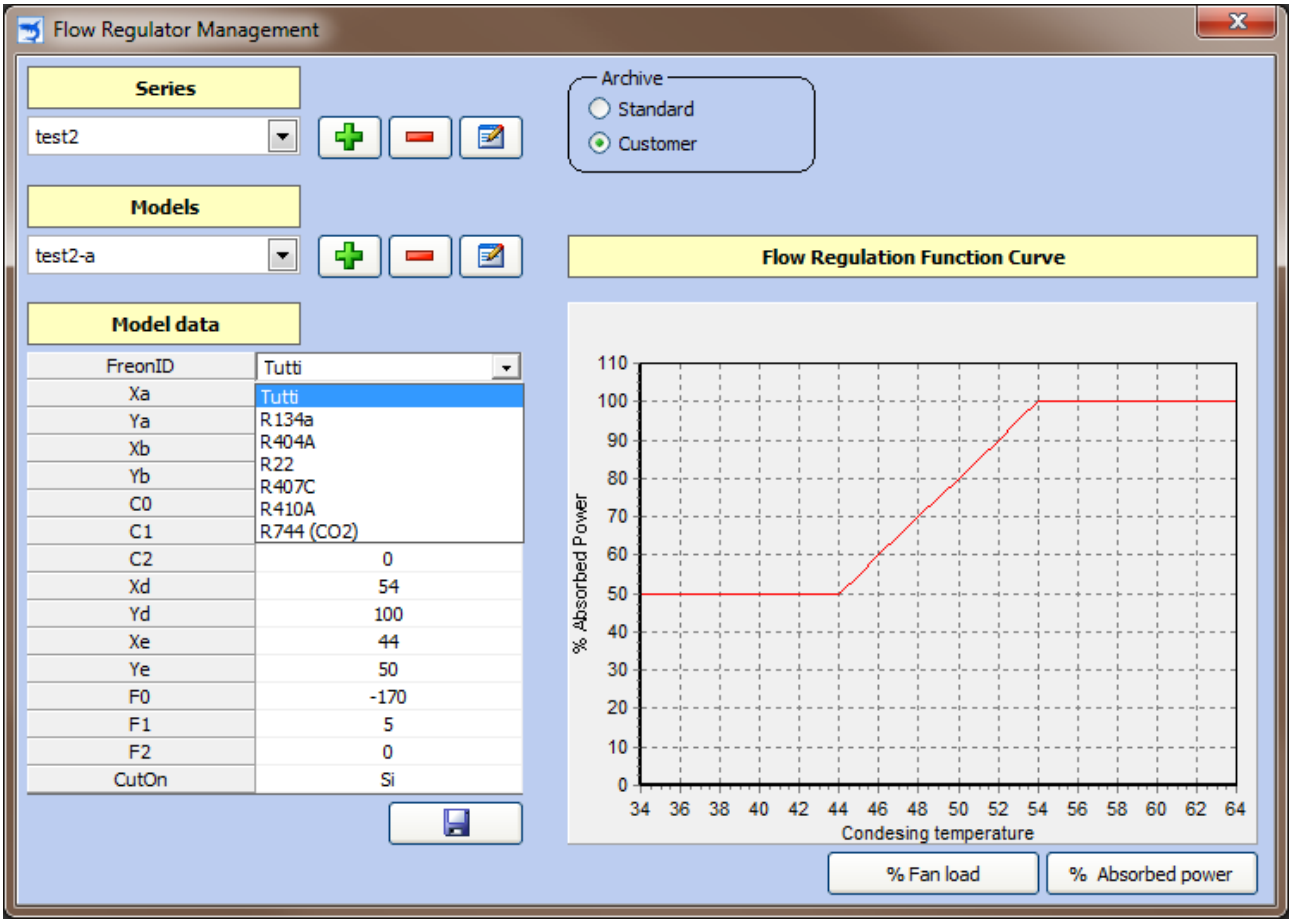
so you can obtain:



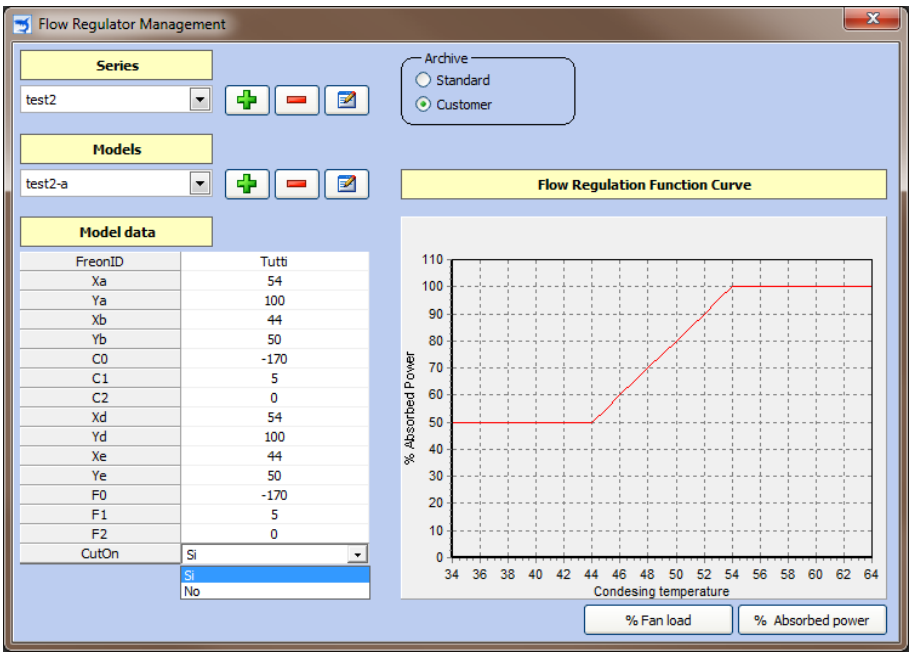
Click on % Absorbed power so you can see:



In the field "FreonID", you can choose the freon reference or activate all:

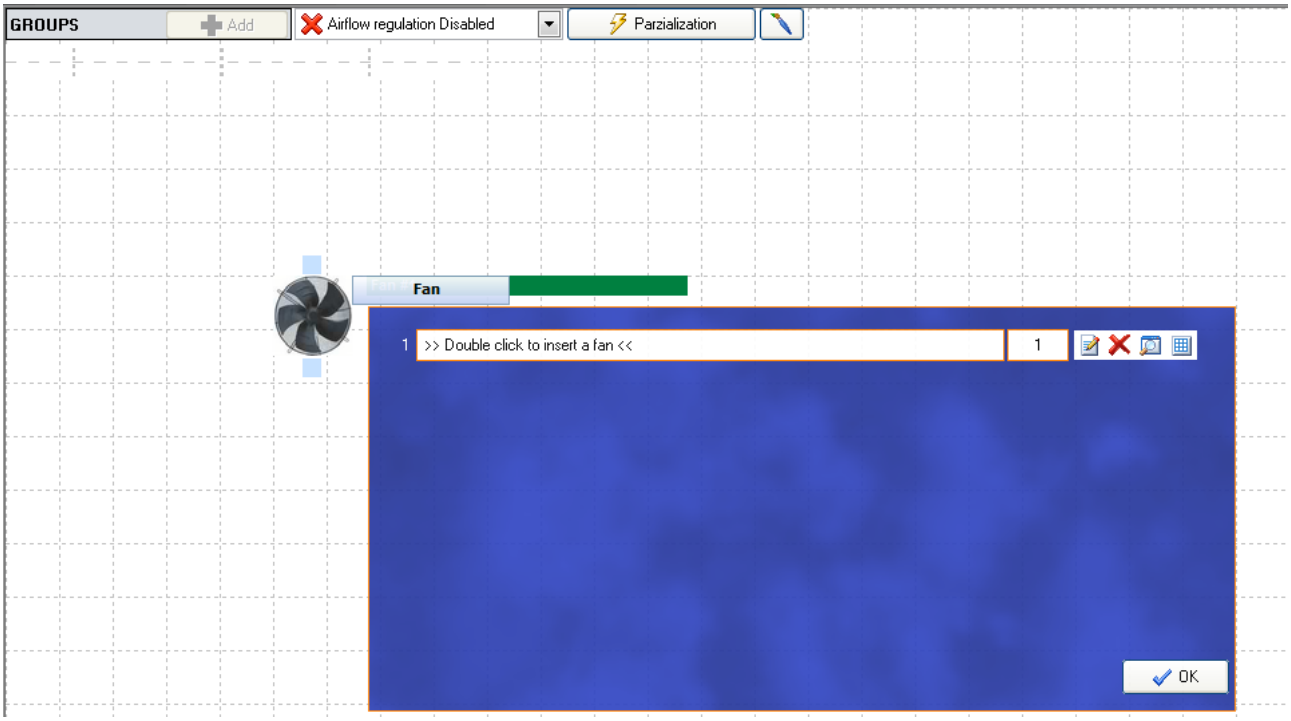


It is possible to simulate the fan shut down, choosing in the field "CutOn", YES or NO.

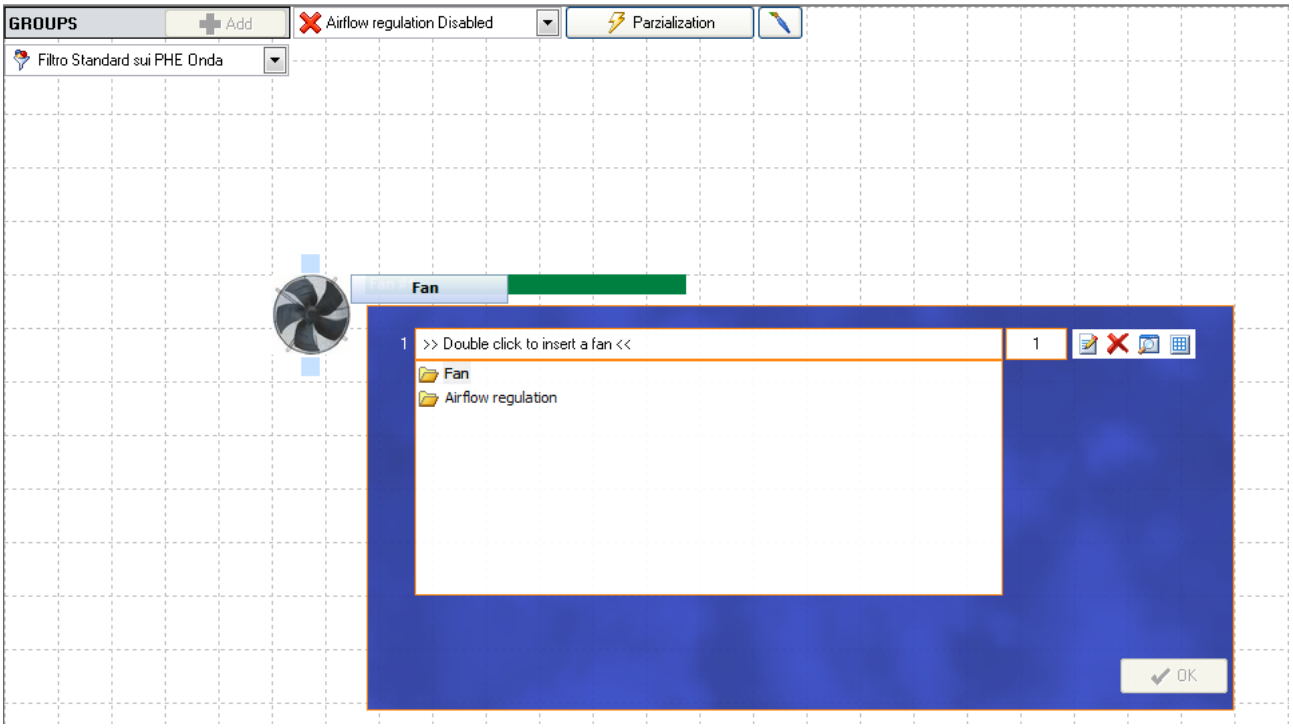


Example of application

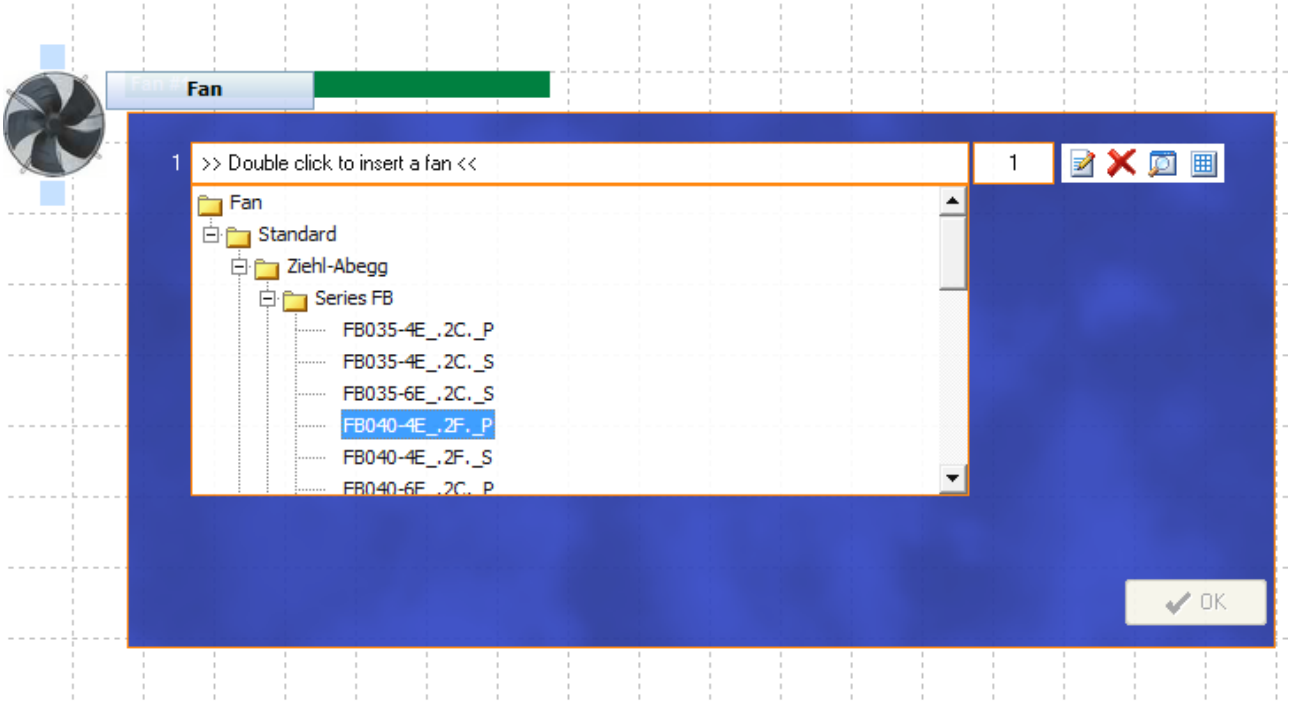
To test the new airflow regulator, it is possible to insert a fan in Shark software:



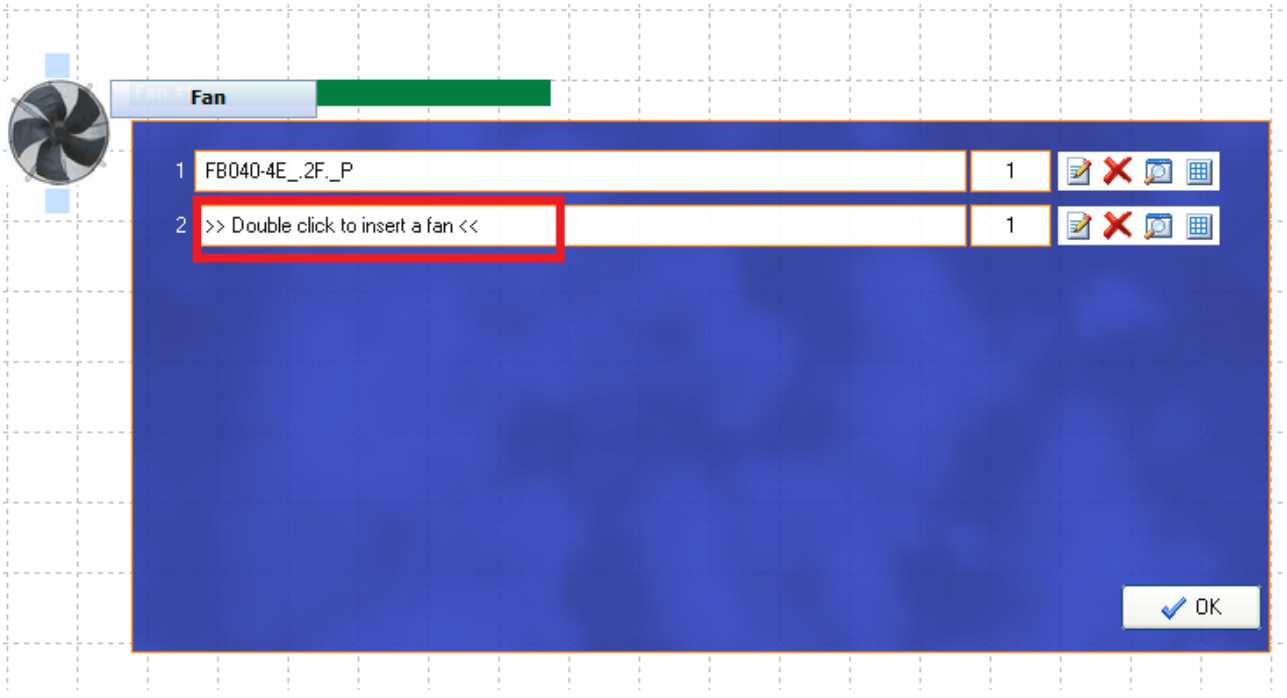
Click on "Double click to insert a fan":



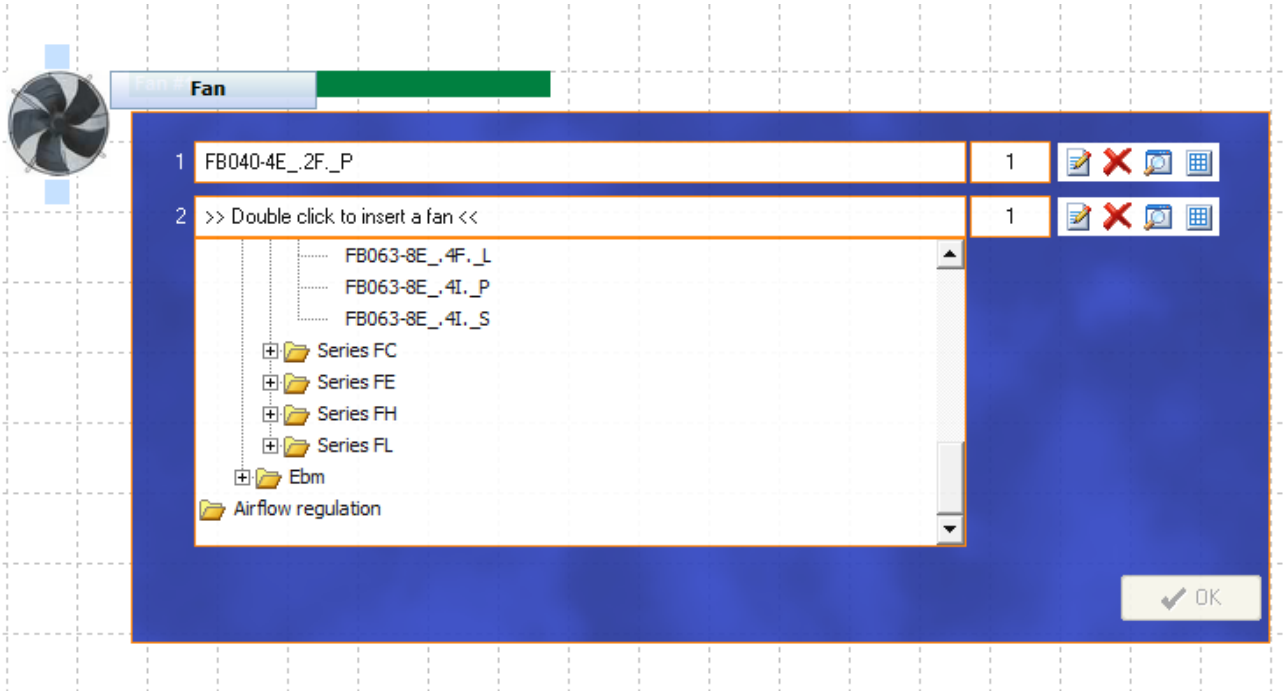
Click on "Fan" to choose a model:



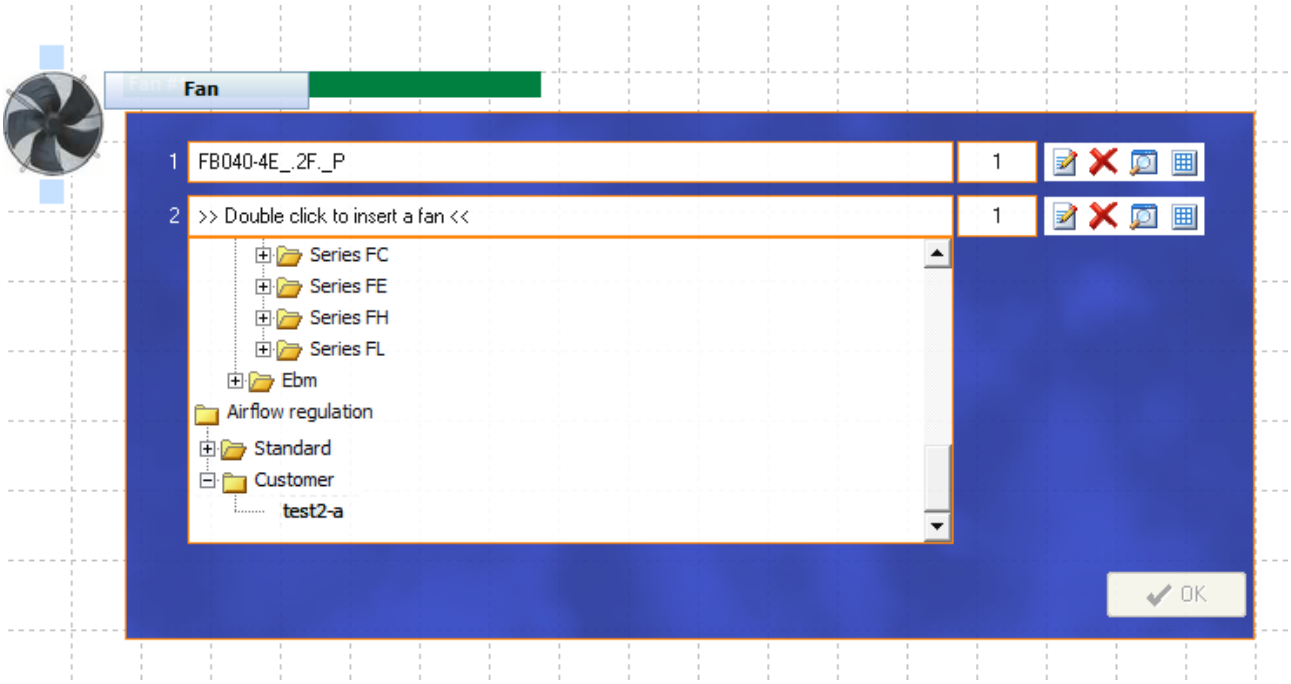
Then, click on:



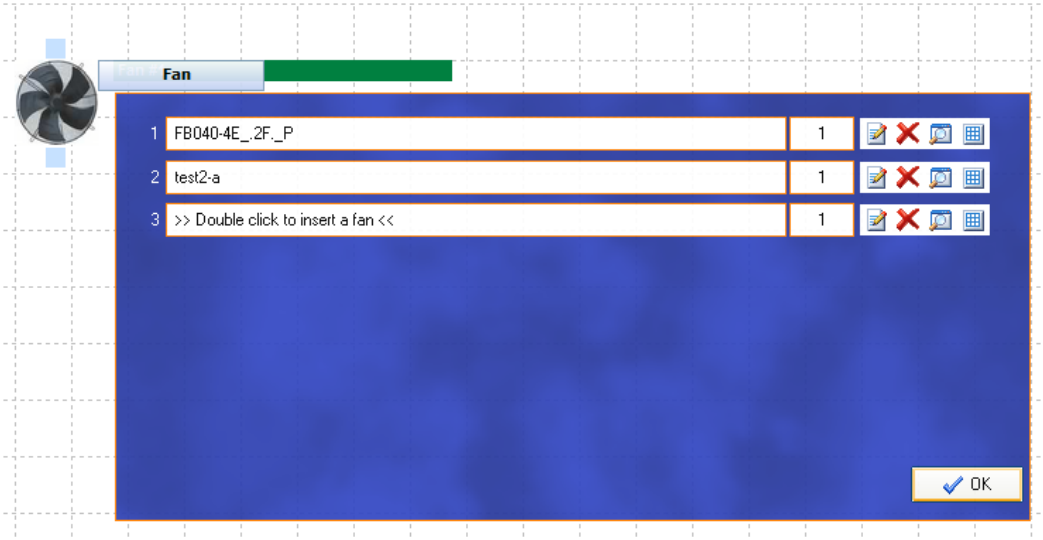
And on Airflow regulation:



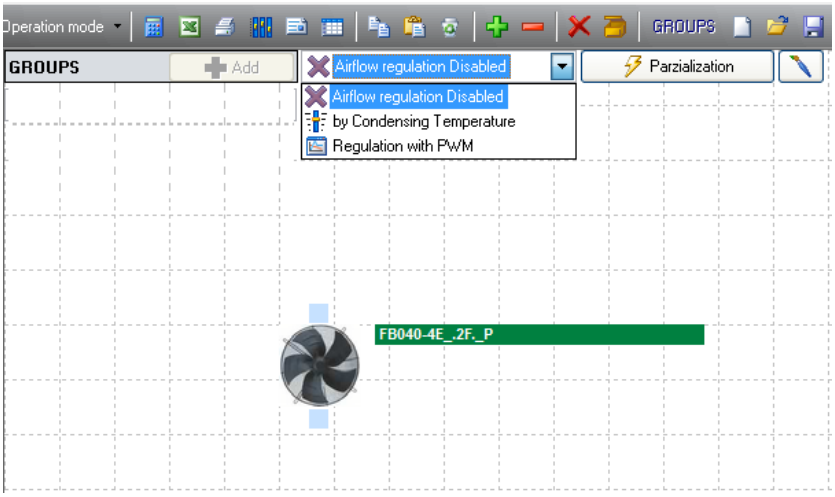
Airflow regulation ->Customer-> test2-a

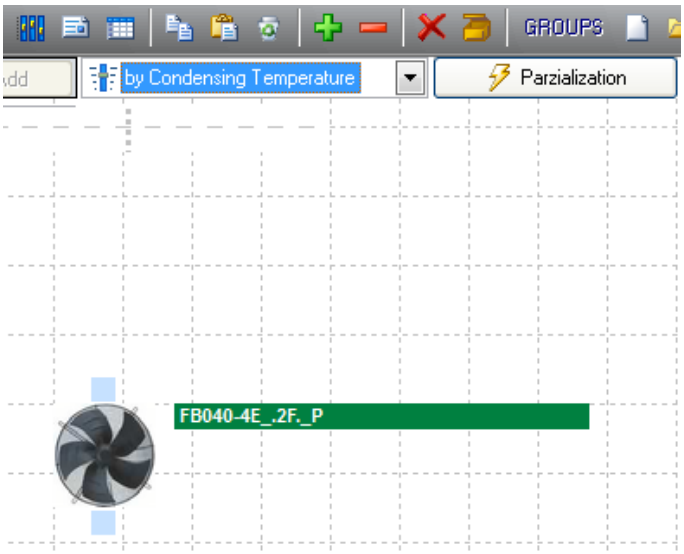


In the end, click on "OK".



Click to choose from "Airflow regulation Disabled" to "by Condensing Temperature":

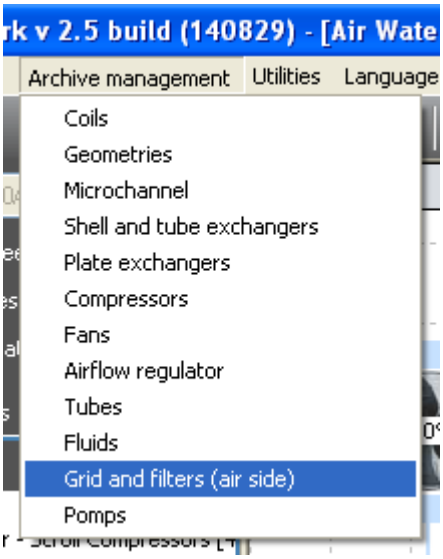




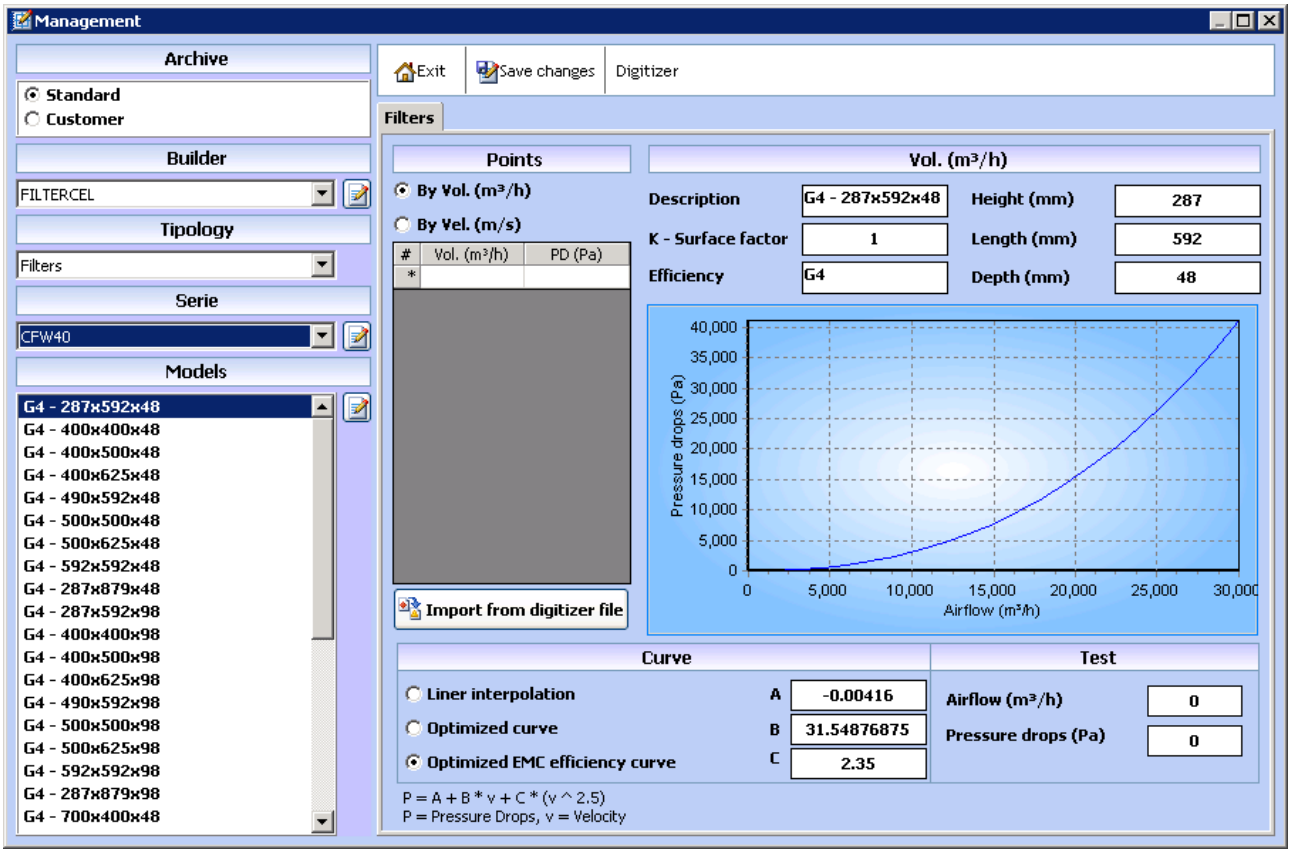
Now the program will simulate the action of the air flow regulator.

How to add an air filter

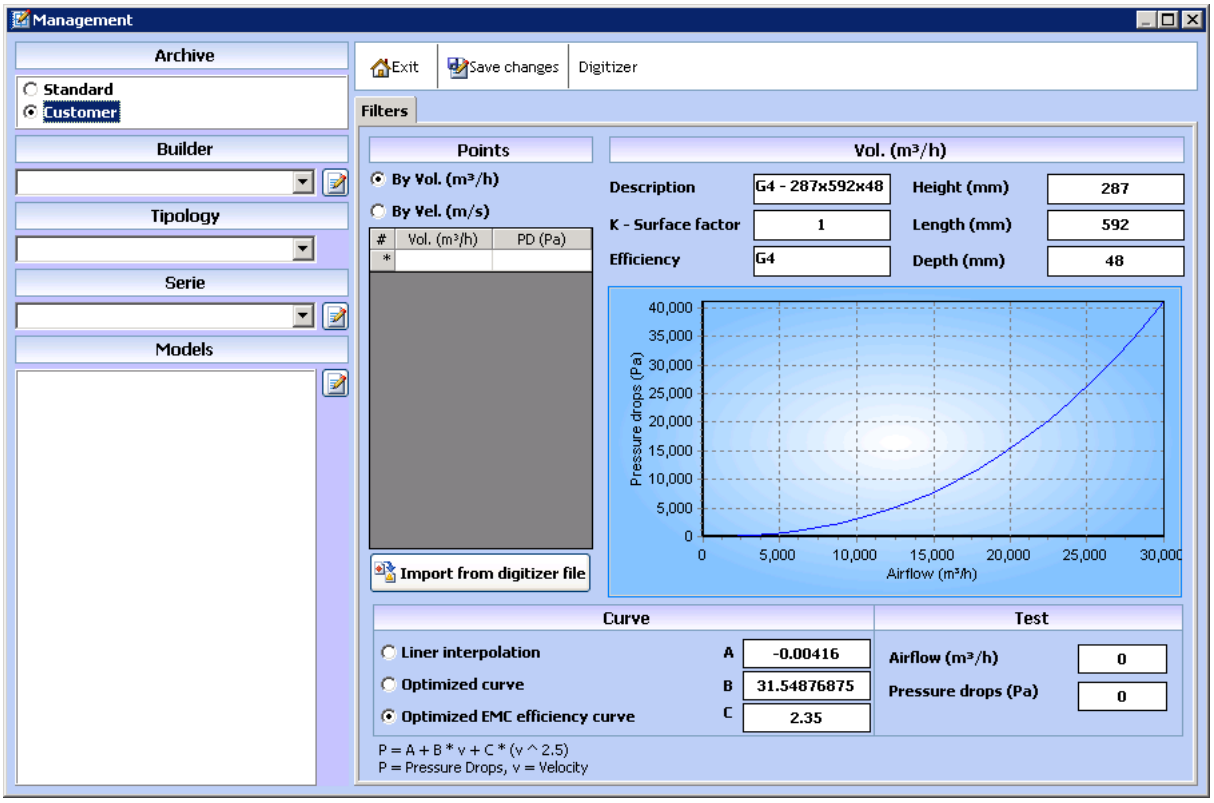
To add a filter in shark we click on "Archive Management", then on Grid And filters (Air side)



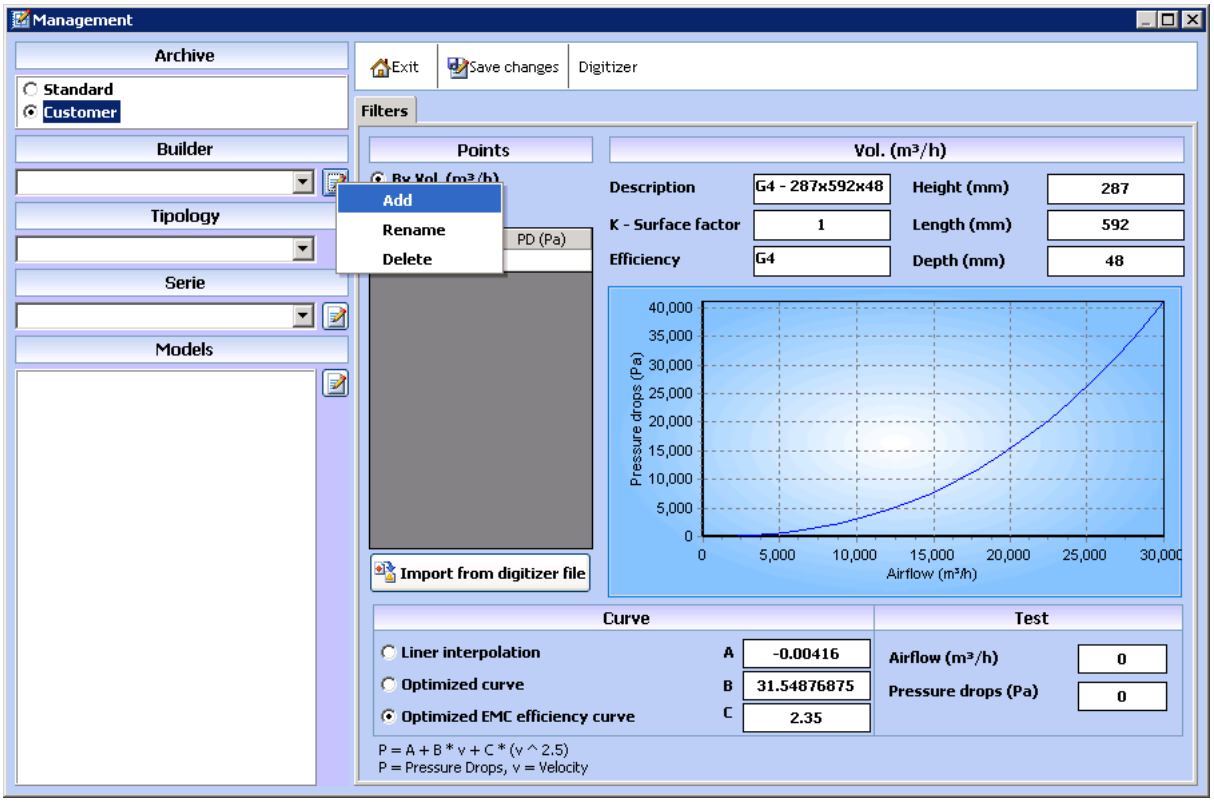
And we obtain:



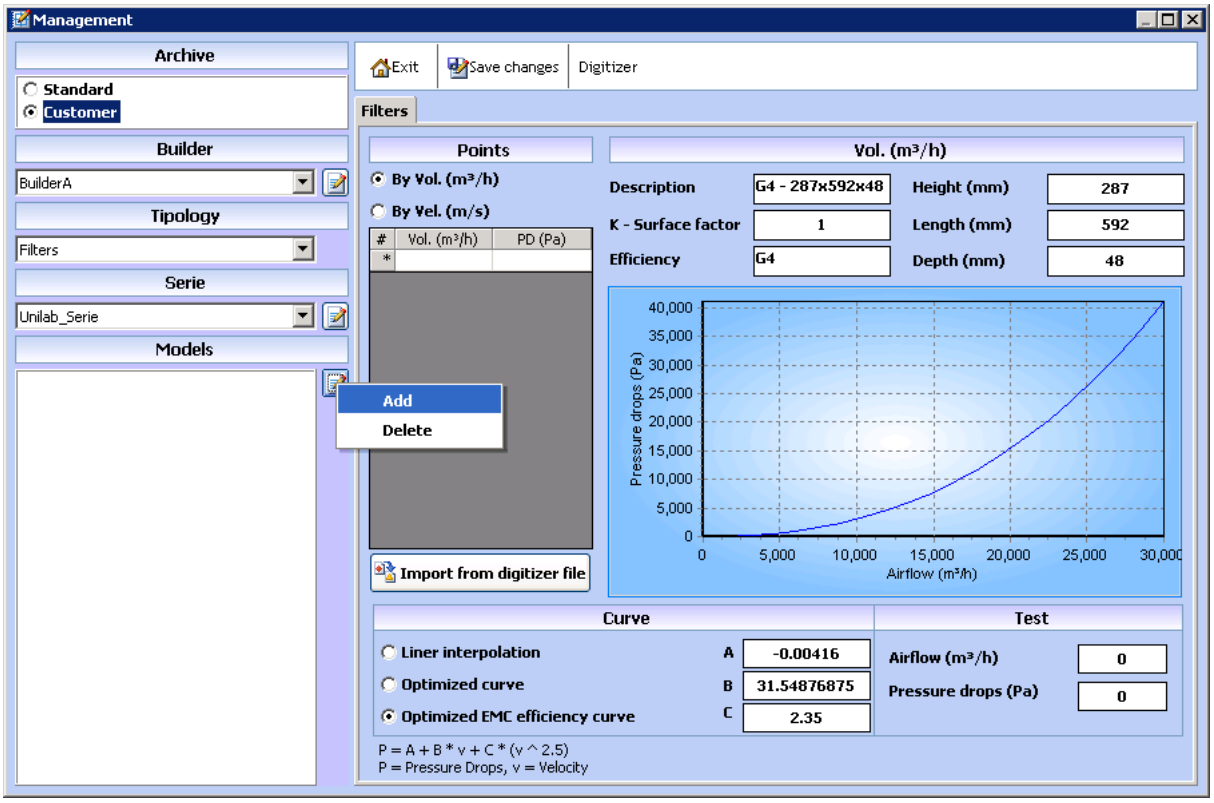
We click on "Customer" – then below the Builder to insert a new one, then on Add



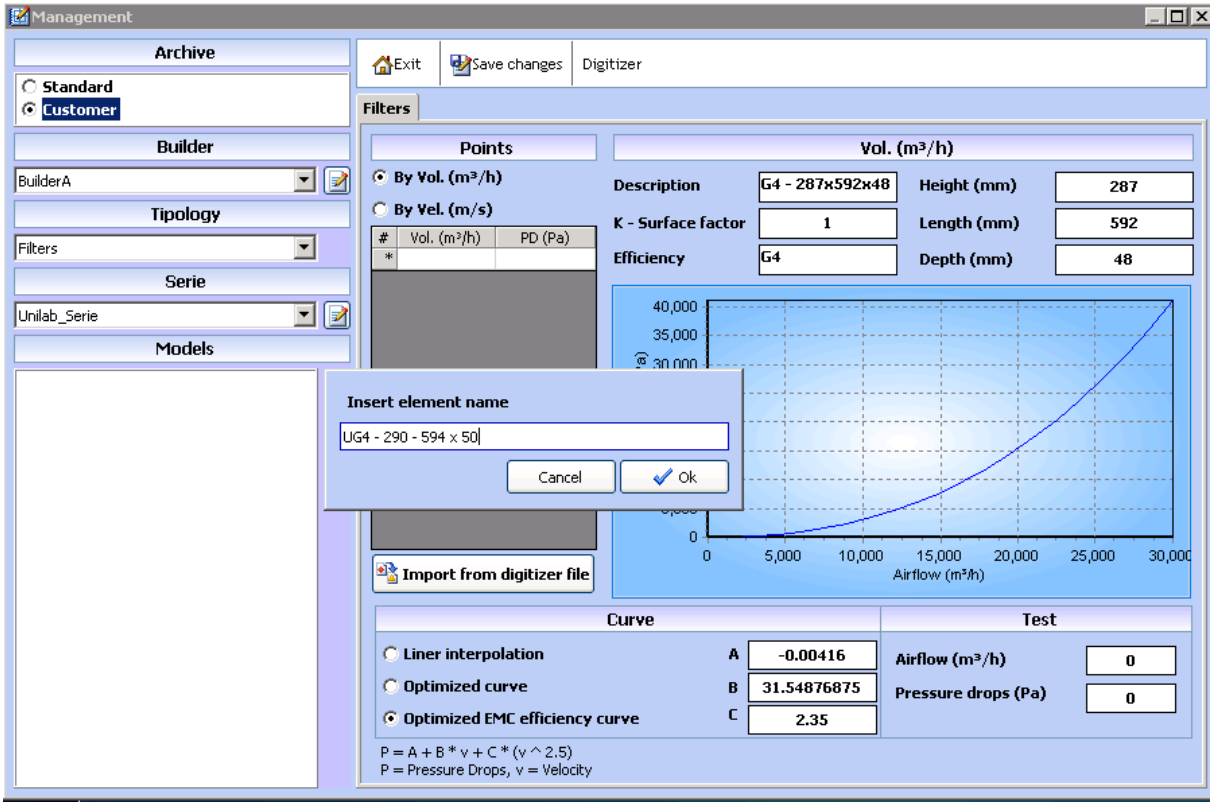
Then on "Series" and we click on Add



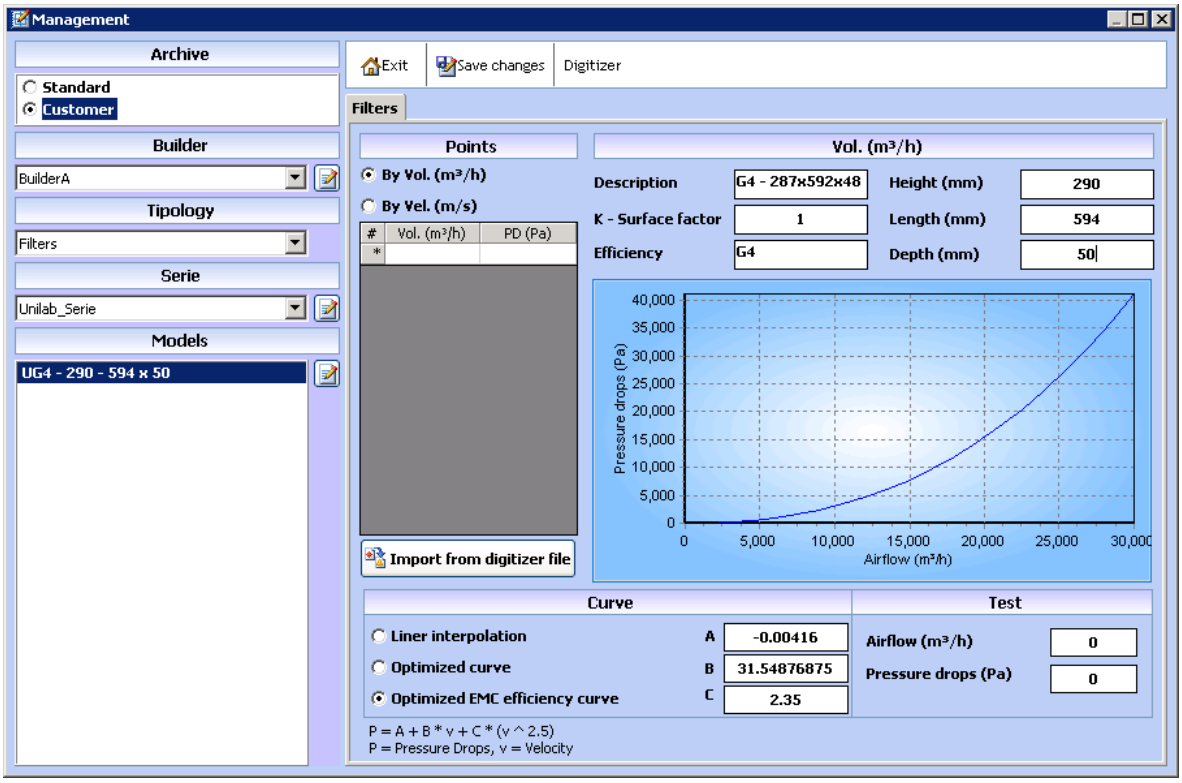
Then on "Models" and we click on Add



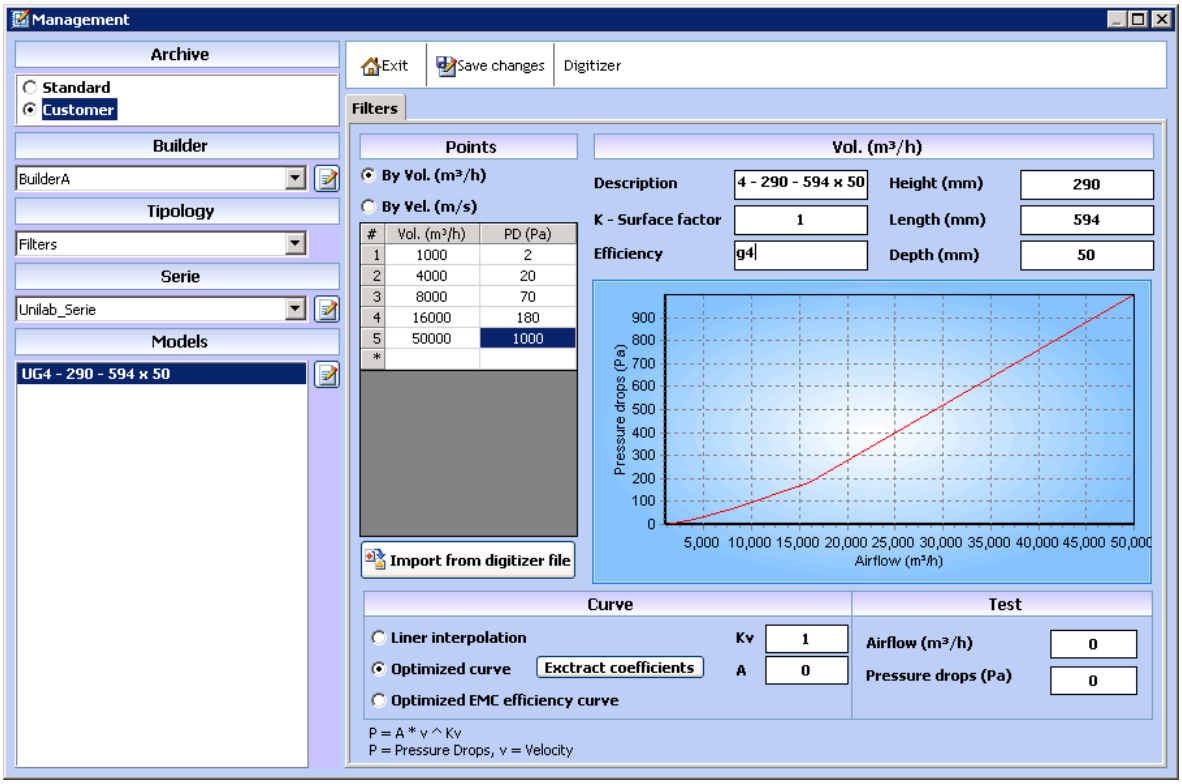
Then we can add the details:



As you can see:

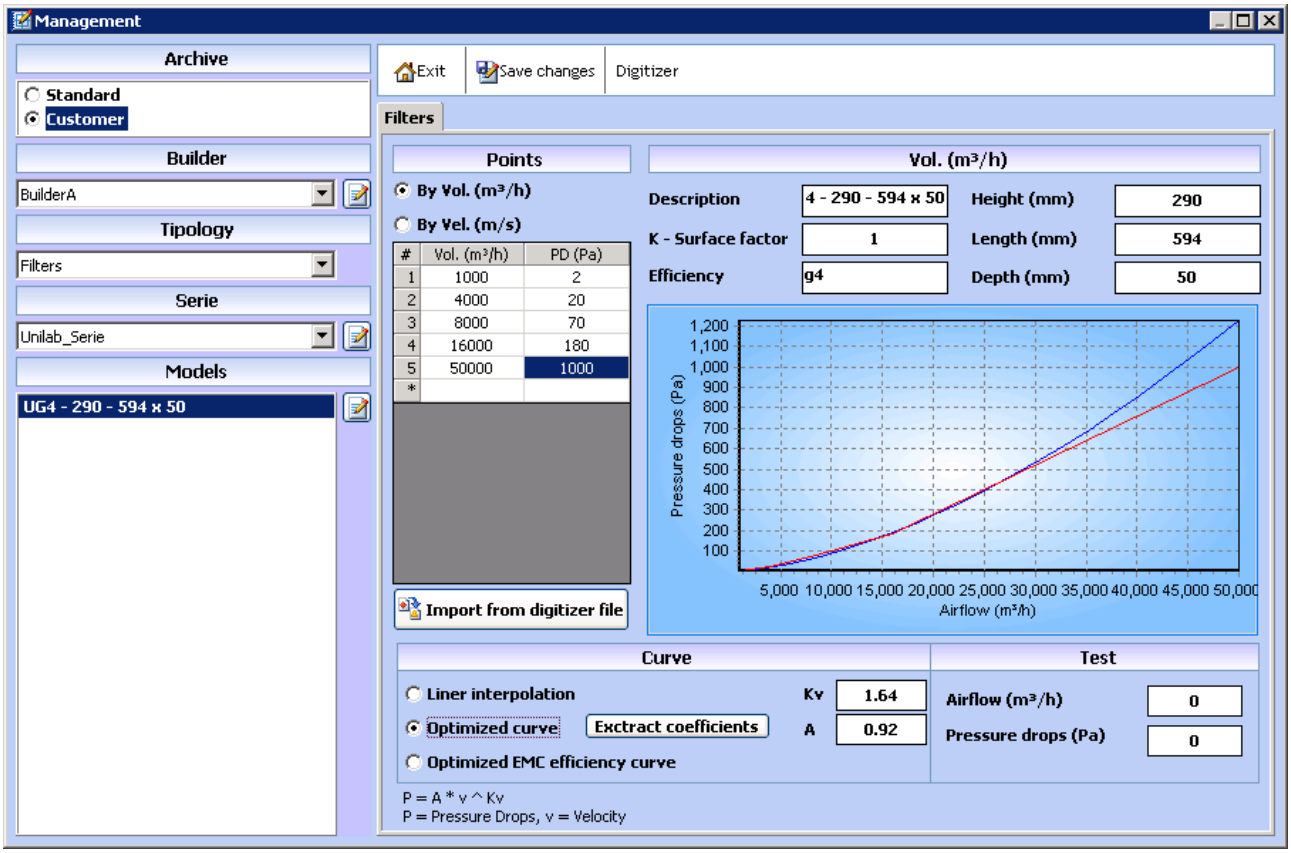


Then we insert the height, length, and depth:



Then we click on the Extract coefficients.

Thus we have finished inserting our data for the Gird and Filter.

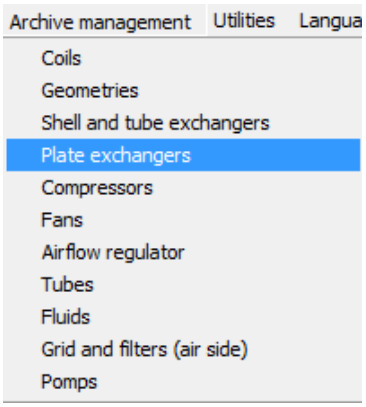


How to insert a Plate Heat Exchangers

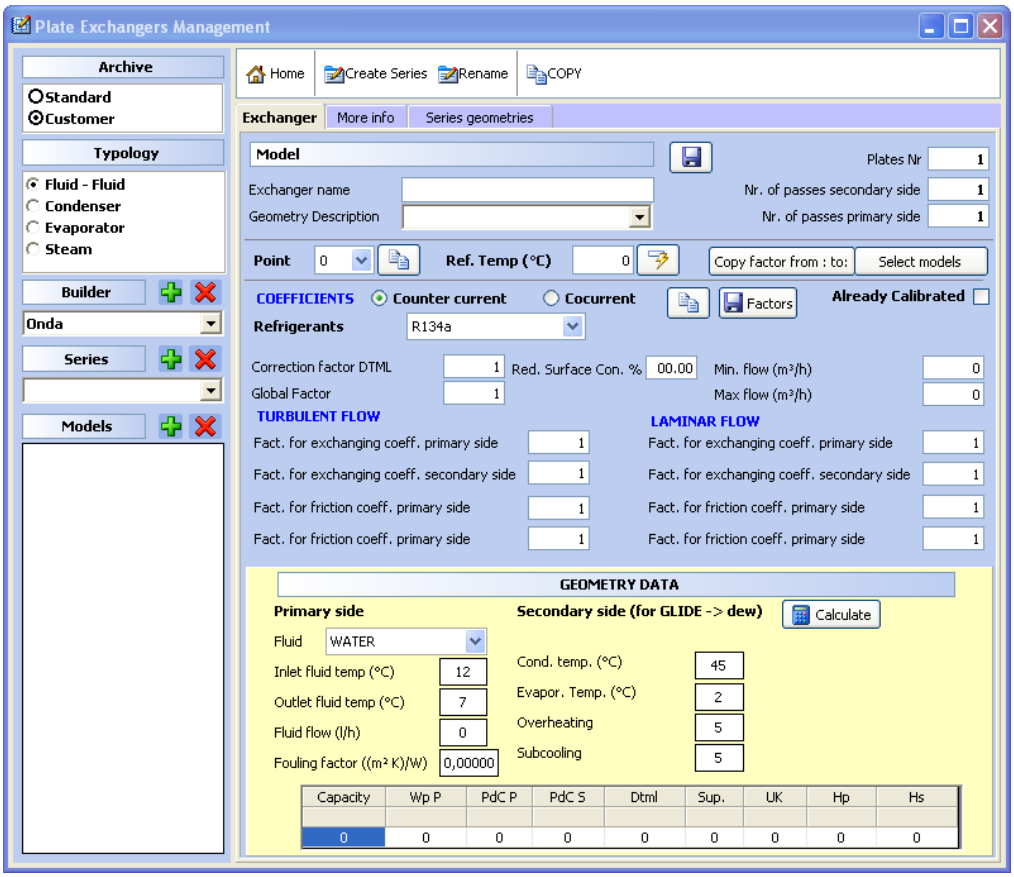
SHARK 2.5 allows the possibility to insert the components in the archive of the software. This guide will show you how to add Plate Heat exchangers by doing a practical example. It covers the minimal tuning features not the most advanced ones.

The window insertion of a new heat exchanger plates

First you need to open the control panel of the plate heat exchanger. To do this, simply click on the Archive Management menu, and then click on Plates exchangers:

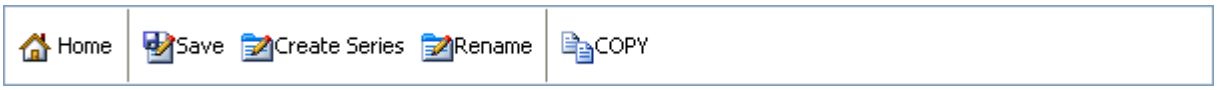


After clicking, the following will open:



The mask will be divided in the three main parts.

We can find in the upper most part, the tool bar that gives us the possibility to run some basic operations:



- Home: will close the archive management
- Save: save the exchanger currently chosen
- Create Series: utility for the creation of an entire series of exchangers starting from one already in the archive
- Rename: will rename all the archives of the current series
- Copy: allows the copy the exchanger in the archive customer to be modified.

The left side allows you to browse the archive of plate heat exchangers:

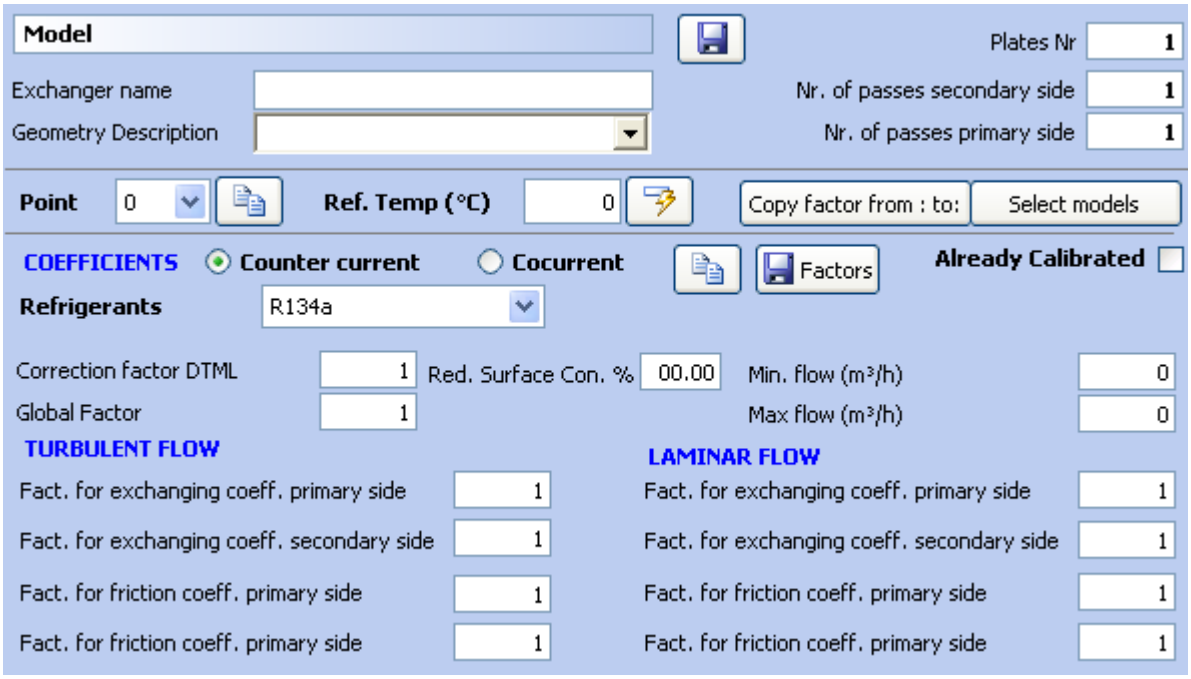
Archive: allows you to specify whether to display or modify the archive Standard or the Customer

Typology: mode of operation of the heat exchangers: Fluid Fluid, Condenser, Evaporator, And Steam. Shark uses only condenser and evaporator. The other two are for future purposes.

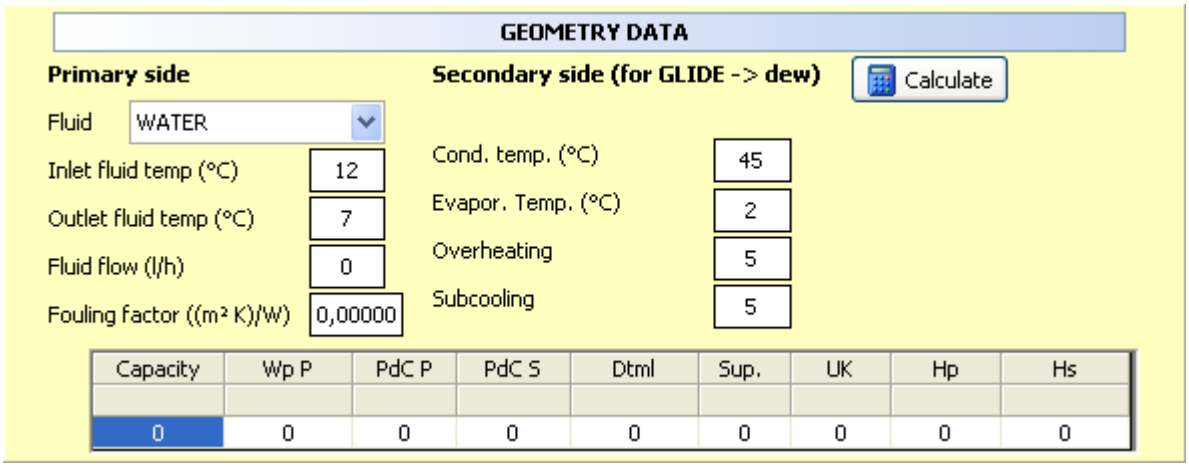
Builder: to select or modify the constructor of the heat exchanger (Alfa Laval, Onda, etc...). The "+" and "X" are used respectively to add a new constructor or delete the selected one.
Series: to select the series of the heat exchanger (AC, ACH, WP, etc.). The "+" and "X" are used respectively to add a new series or delete the selected one.

Models: List of models within the selected range. Clicking on the model, the data will be loaded in the right area. The "+" and "X" are used respectively to add a new template or delete the selected...

The right part of the window is divided into two: we find the name of the exchanger, which uses the geometry, the number of plates and the steps to each side at the top. Immediately below are the calibration factors usable:

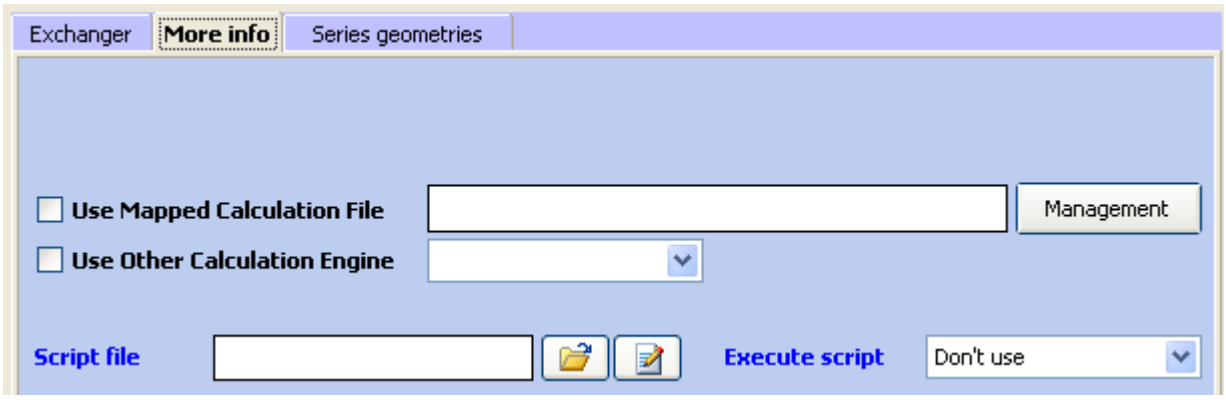


Down in the same form we find a small utility for the calculation of the heat exchanger at a point, which is useful during calibration:

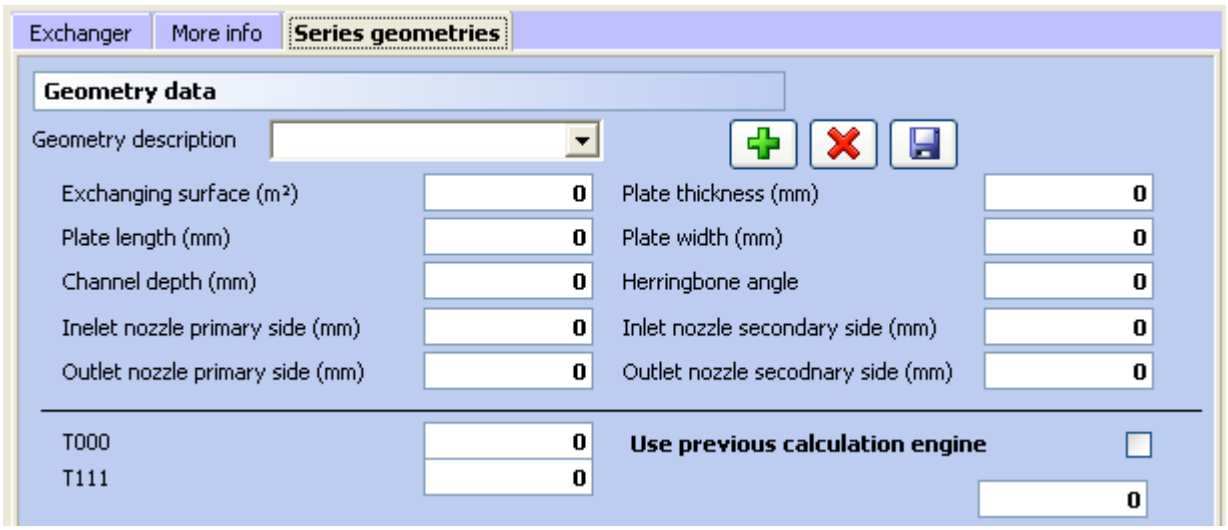


NOTE: Unilab distinguishes the single plate (or geometry) of the heat exchanger by the heat exchanger itself. The geometry includes parameters such as length and width of the single plate, the exchange surface, the depth of the channel, etc... The exchanger is made instead by the geometry of the plate and the number of plates that compose it, in addition to the number of passes for each side. This means that one AC130DQ exchanger with 80 plates will be considered as a model different from AC130DQ with 90 plates, having in common the same geometry.

In the "More Info" are additional parameters for the calculation of the heat exchanger:



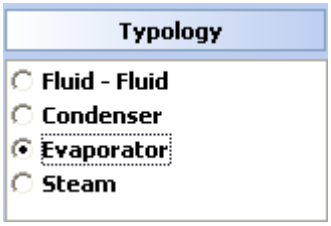
While in the "Series geometries" we find the geometry data:



Insertion of a new Plate Heat Exchanger

Let's see how to insert a heat exchanger. First, select the archive Customer:

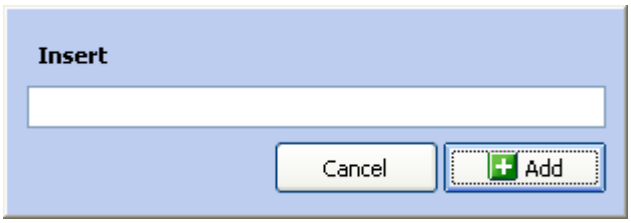
Then the typology:



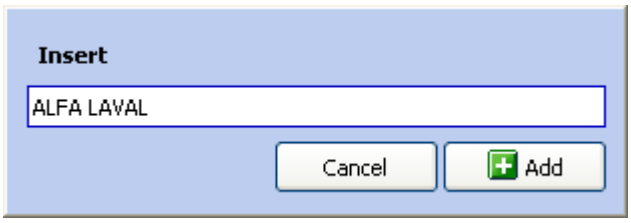
NOTE: So that Sharks works well, it is necessary to insert the plate exchanger in evaporation and in condensing. So the following procedure will have to be done twice, choosing the Condensing.

We add the builder Alfa Laval in the builder voice. We click on "+" on the builder:

The following will appear:



We insert Alfa Laval in the field:

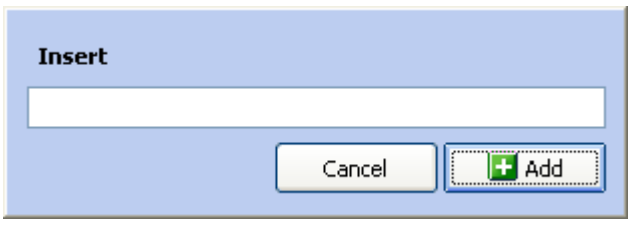


We click on Add:

As you can see from the figure below, the manufacturer has been successfully added to:

We must now enter the name of the series. Click the add button:

You will see the following screen where you can specify the name of the series:

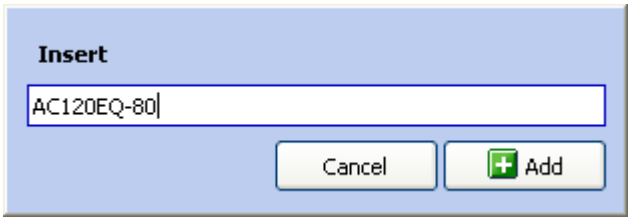


Specify AC120EQ and click and we click on Add:

As can be noted from the mask, the series has been added successfully:

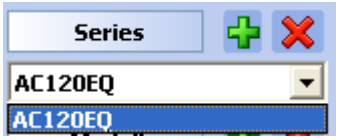
Let us now add the template AC120EQ with 80 plates. Let's click on the add button like before:

We specify the model name in the format [geometry]-[n° plates], as shown:



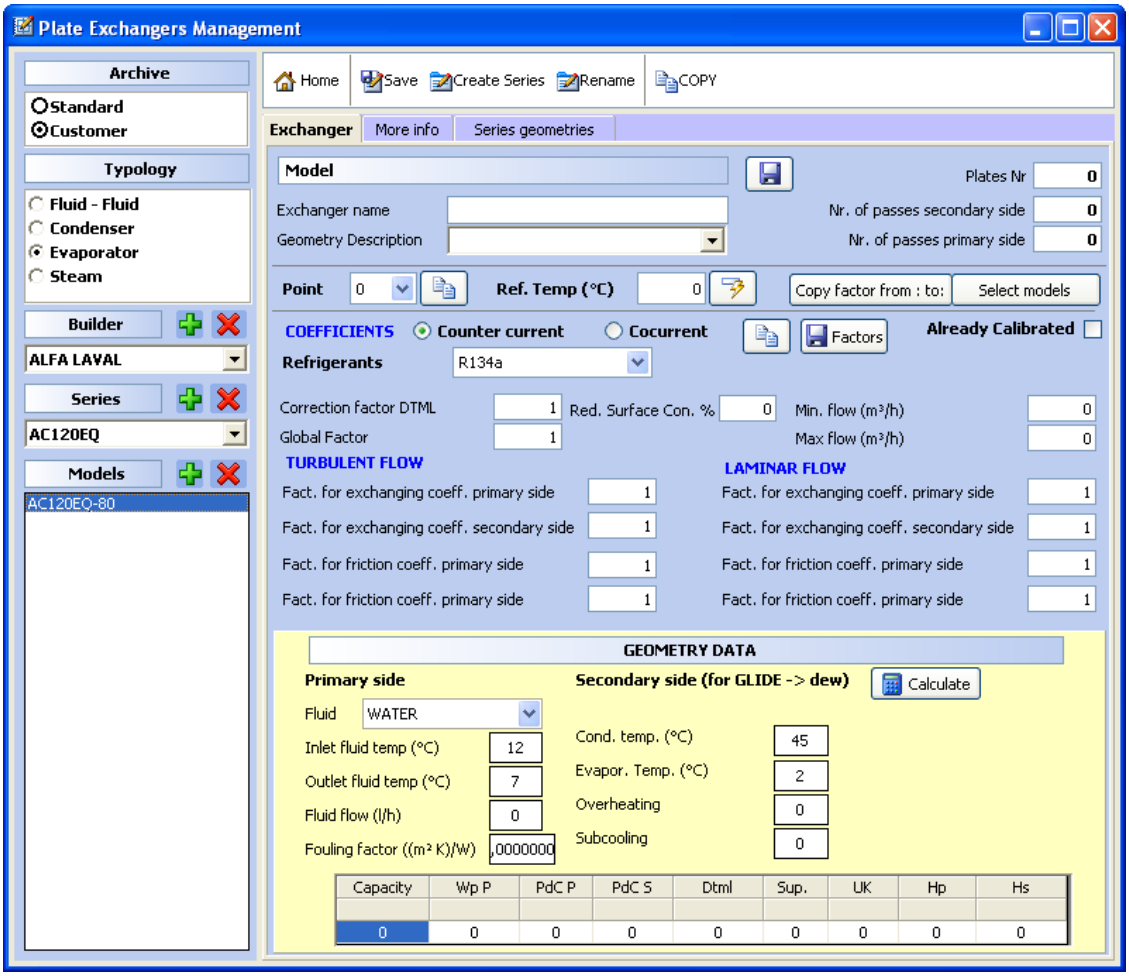
In some cases, the model of the heat exchanger does not appear immediately in the list of models:

In this case, click on the box of the series and re-select the series AC120EQ:

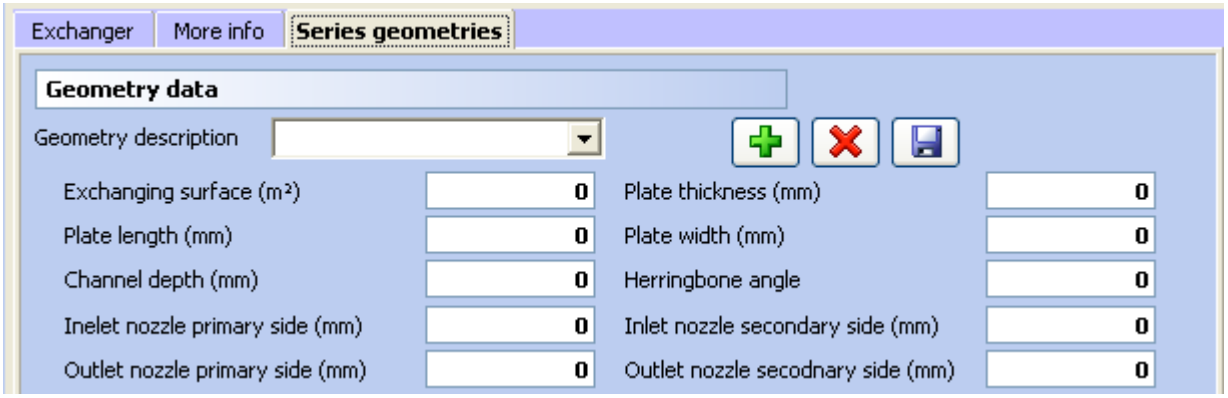


The model will automatically appear:

Here is the window we will get:



Now we have to insert the geometry of the heat exchanger. Click on the tab "Series Geometry" at the top. This is the window we get:



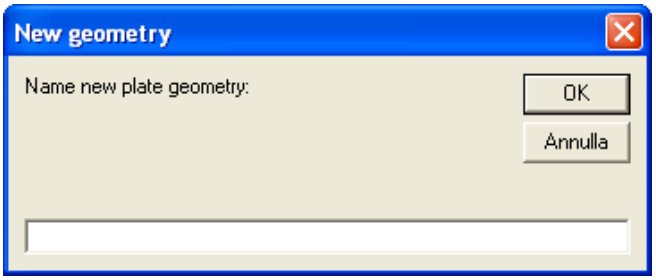
We see the parameters:
• Exchange Surface: exchange surface of a single plate. You can ask the manufacturer or get as length x width, then adding a certain percentage of the surface in order to take more account of the additional area created by the channels.
• Thickness of the plate: the plate thickness of the single plate
• Length of the plate: length agreement between the distances of the nozzle, i.e. the effective length
• Width: width of single plate
• Depth of the channel: the depth of the channel between the plates

• Herringbone angle: 30 ° 60 ° 45 °
Then the four fields below are used to specify the diameters of collectors, from left to right, top to bottom:
Inlet primary side
Outlet primary side

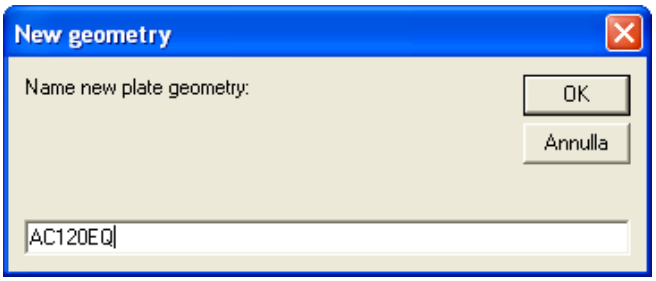
- Inlet secondary side
- Outlet secondary side

To add a geometry, click the add button: 

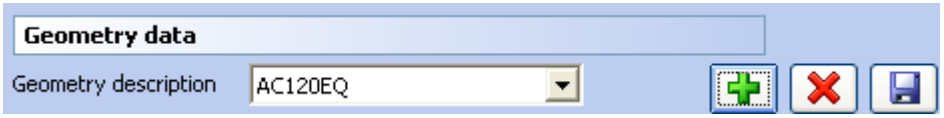
You will see the following screen:



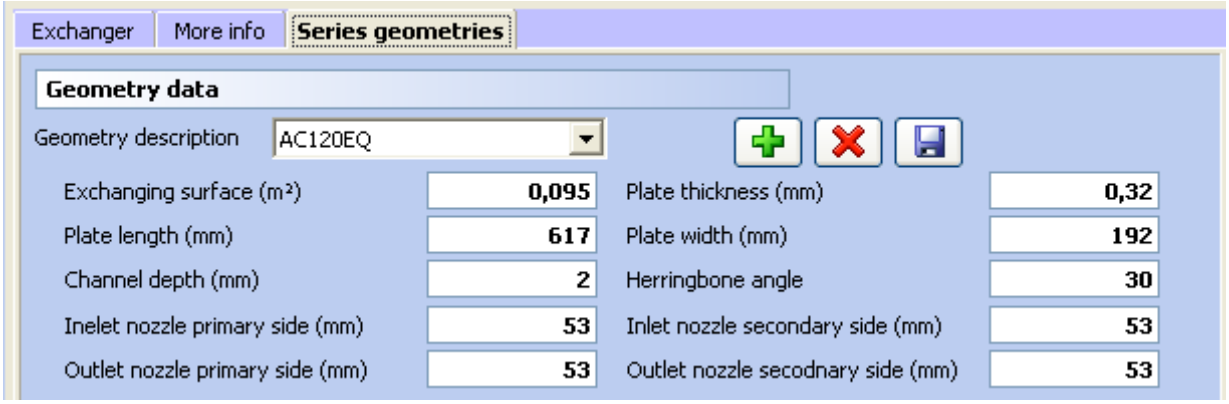
Specify the name of the geometry AC120EQ:



Click OK to add the series. In the selection box of the series you see the new element:



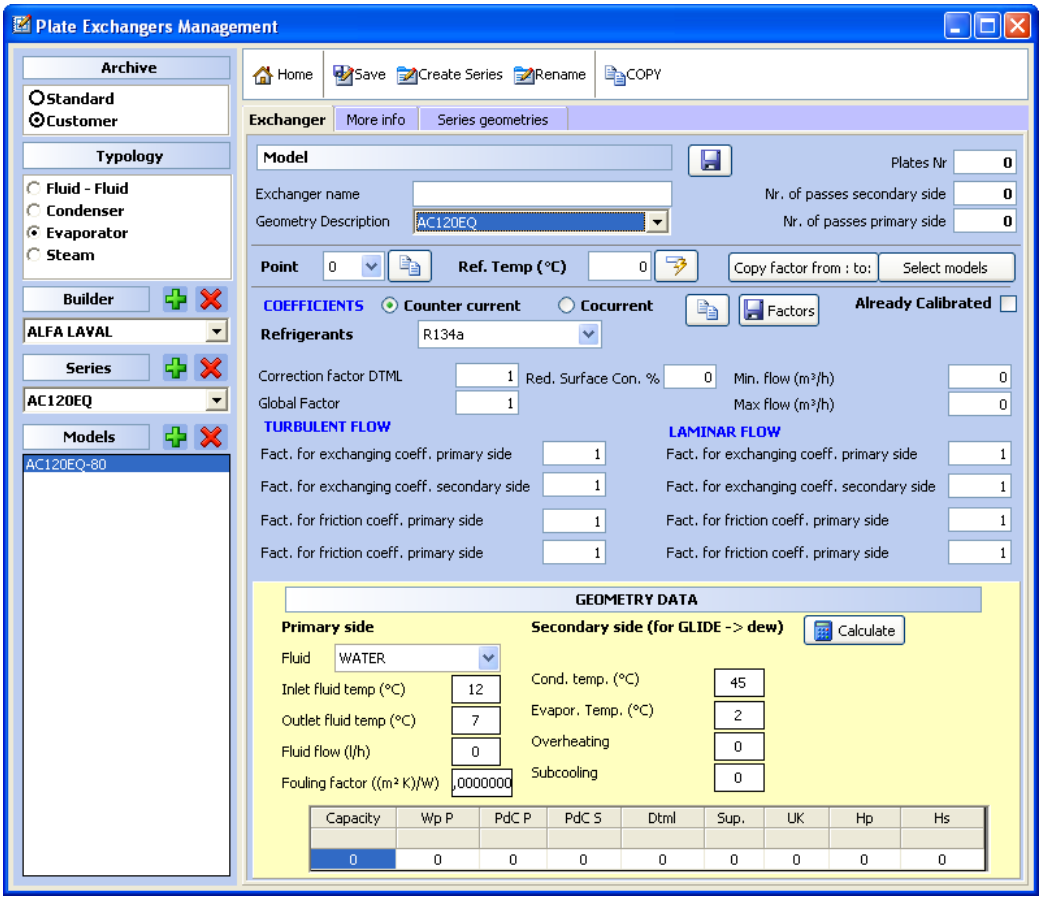
Now, compile the fields of the series, as in the example below:



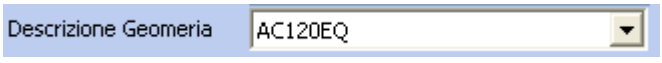
Finally, click Save to save the data of the Series:

Let us now turn to the form of the parameters of the heat exchanger, by clicking on the first tab at the top:

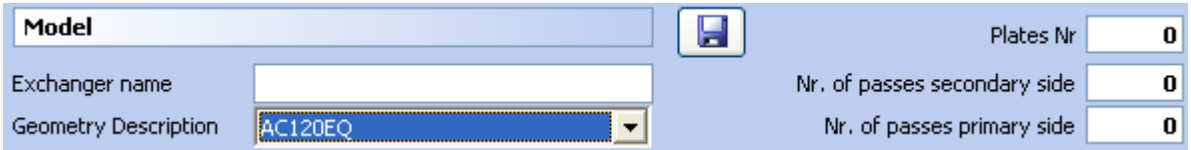
In this screen you can specify the remaining parameters of the heat exchanger:



As you can see, the geometry is correctly set in the mask:



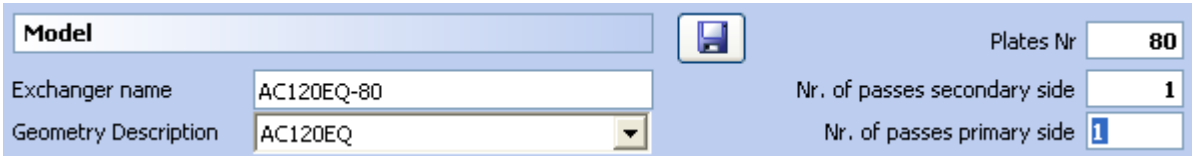
Next, you enter the remaining parameters of the heat exchanger:



The parameters are:

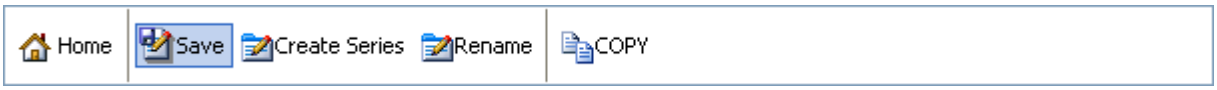
- Exchanger name: description of the exchanger
- N° of plates
- N° passes primary side primary side
- N° passes secondary side

Now specify the parameters as shown:



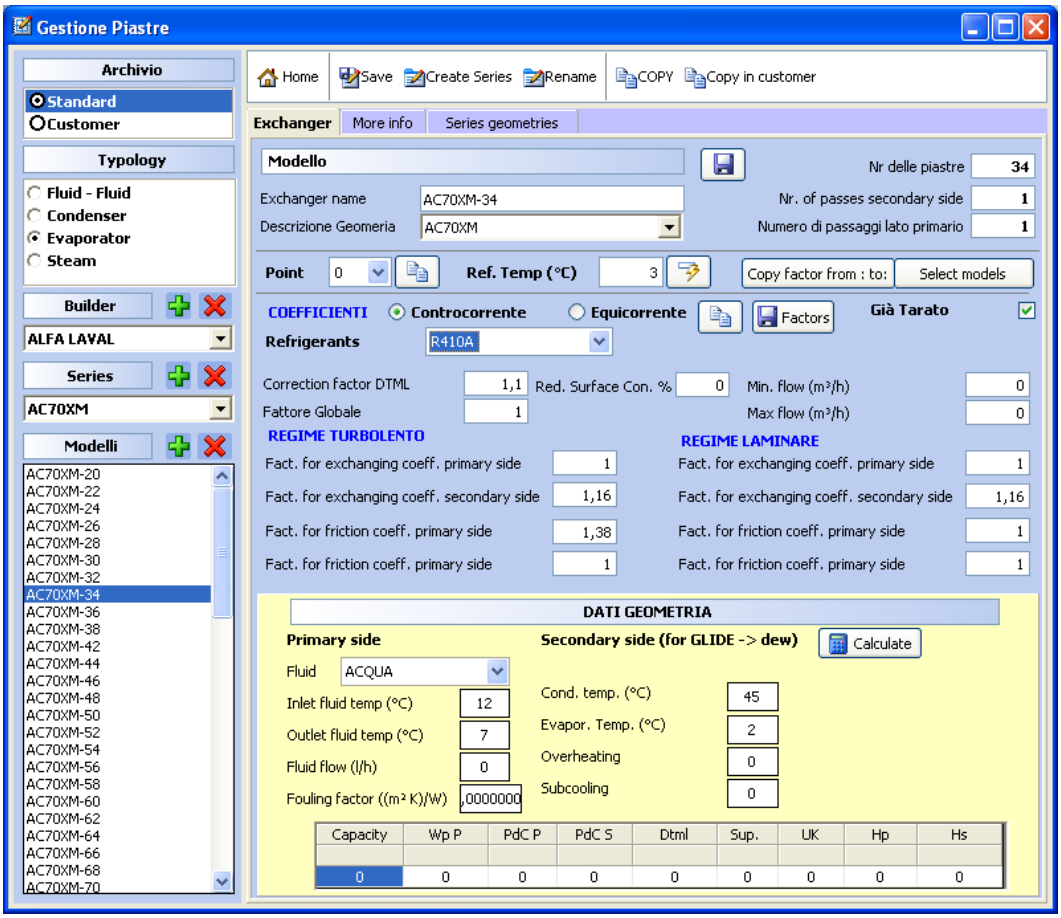
And finally we click on the Save button next to the word Model: 

Finally, to validate the data, we click on the Save button in the top bar:

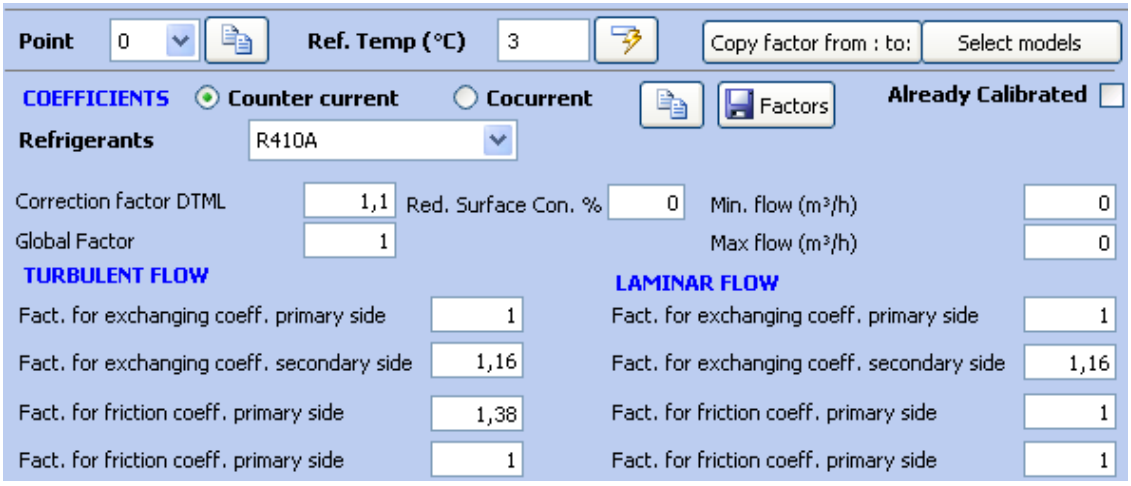


Calibration of a heat exchanger

The calibration of a heat exchanger can be made on a single point or multiple points. Involves inserting, by the user, of a given set of factors that act on the mathematical model, based on: the calculation in countercurrent / cocurrent, refrigerant, turbulent / laminar flow. These factors are accessible through the main form of management of the plate heat exchangers:



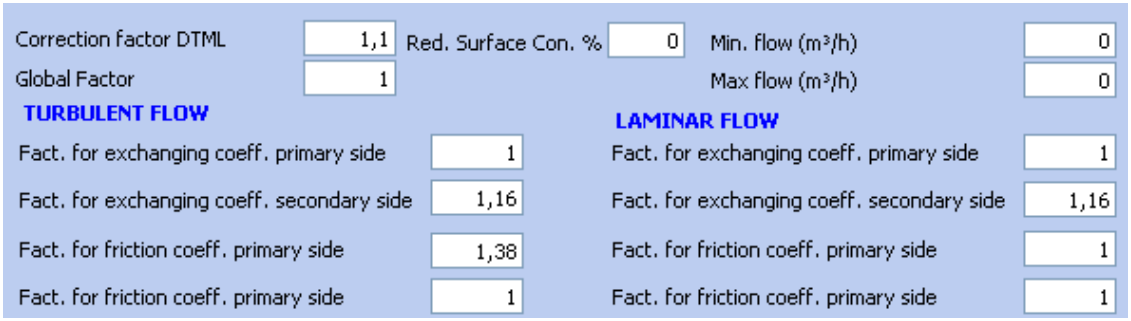
This mask, just below the part related to the number of plates, number of circuits, etc... Top shows the calibration factors and some options related to them:



For the moment we will not cover the top line, which is used for the multipoint calibration. We see immediately the second part of the mask.

In this part we find the top selection options "Countercurrent" and "co-current", and just below the coolant:

These three parameters identify a combination of factors. This combination can be set underlying factors:

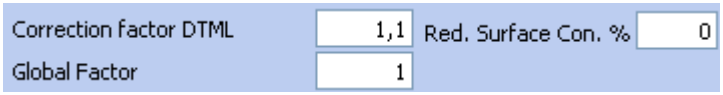


We will see these factors one by one below.

Immediately to the left of the options views, we find the button "Copy in Cocurrent" which serves to duplicate the calibration factors included in the combination "Countercurrent" the combination "co-current":

And the button "factors", which saves the current scheme: 

Now let's see the factors. The first three above factors act globally:



- Correction factor DTML: global correction factor of the performances based on the DTML
- Global factor: proportional "commercial" global correction factor of the performances
- Red. Surface Con. %: manifolds area correction factor, to simulate distributor's pressure drops.

Factors for the Turbulent Flow:

Fact. for exchanging coeff. primary side	1
Fact. for exchanging coeff. secondary side	1,16
Fact. for friction coeff. primary side	1,38
Fact. for friction coeff. primary side	1

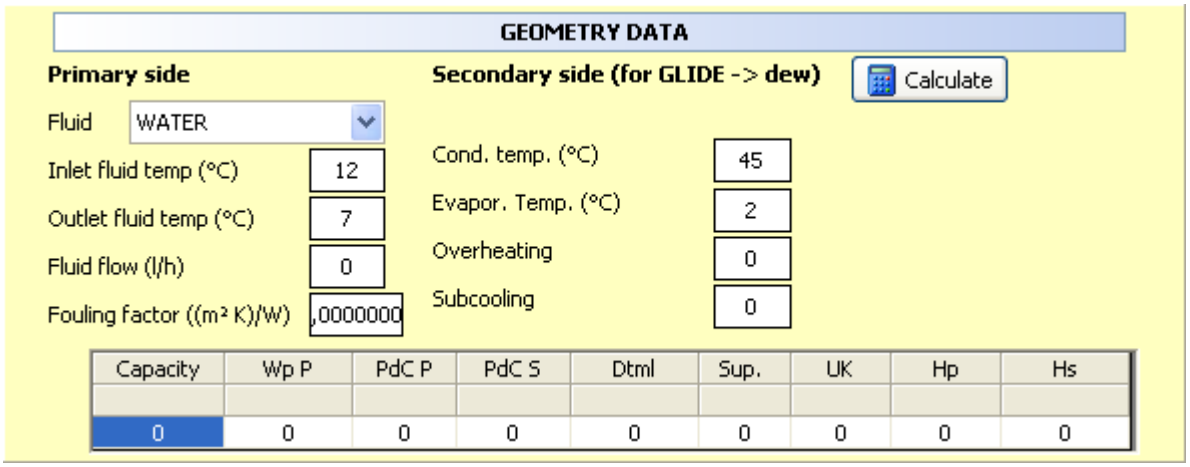
Factor on the exchange coefficient primary side (user)
Factor on the exchange coefficient secondary side (refrigerant)
Factor on the pressure drops primary side (user)
Factor on the pressure drops coefficient secondary side (refrigerant)

Factors for the Laminar Flow:

Fact. for exchanging coeff. primary side	1
Fact. for exchanging coeff. secondary side	1,16
Fact. for friction coeff. primary side	1
Fact. for friction coeff. primary side	1

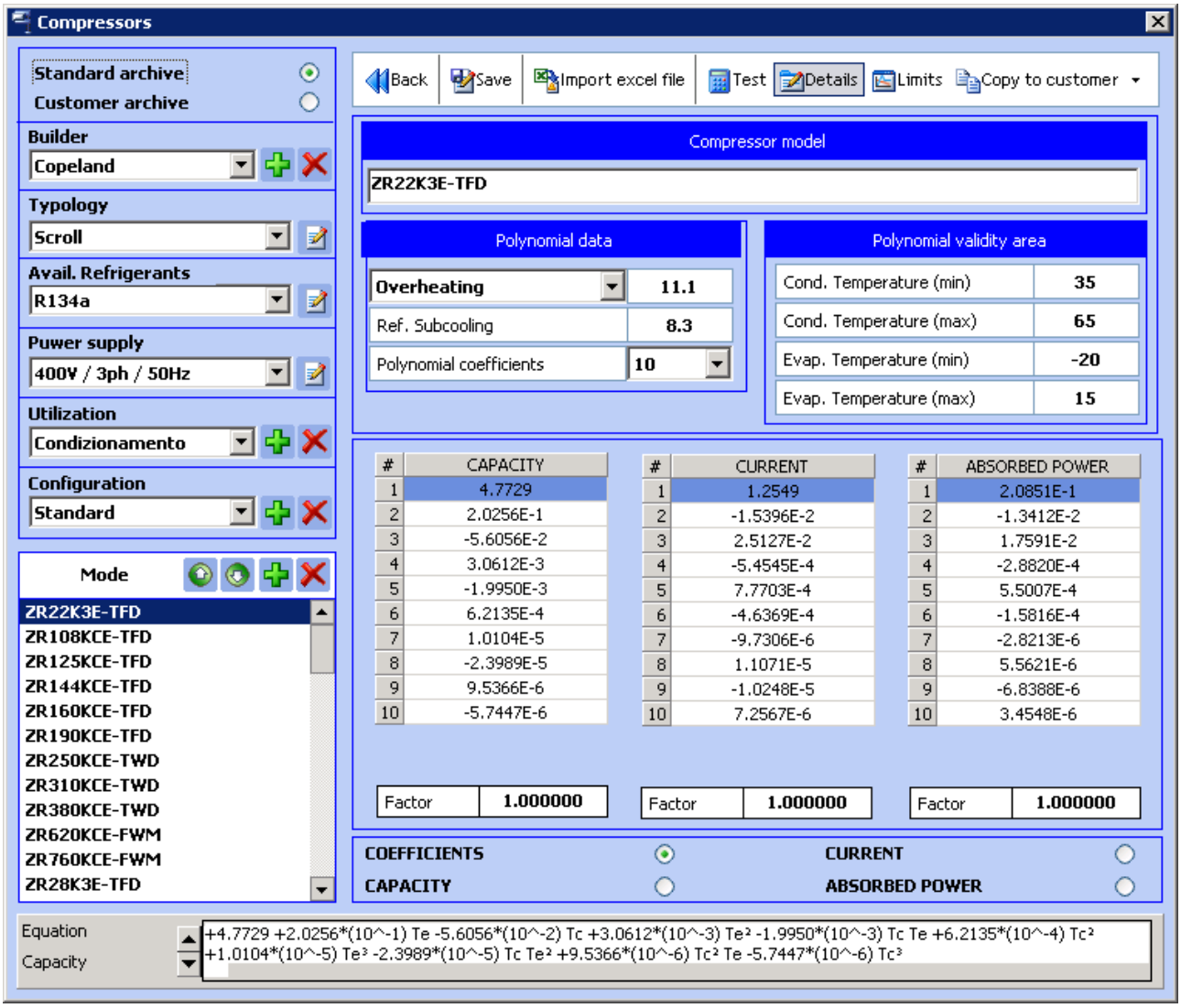
The same as the above

Finally, the lower part of the form allows you to calculate and verify the effect of the factors on capacity and pressure drops:

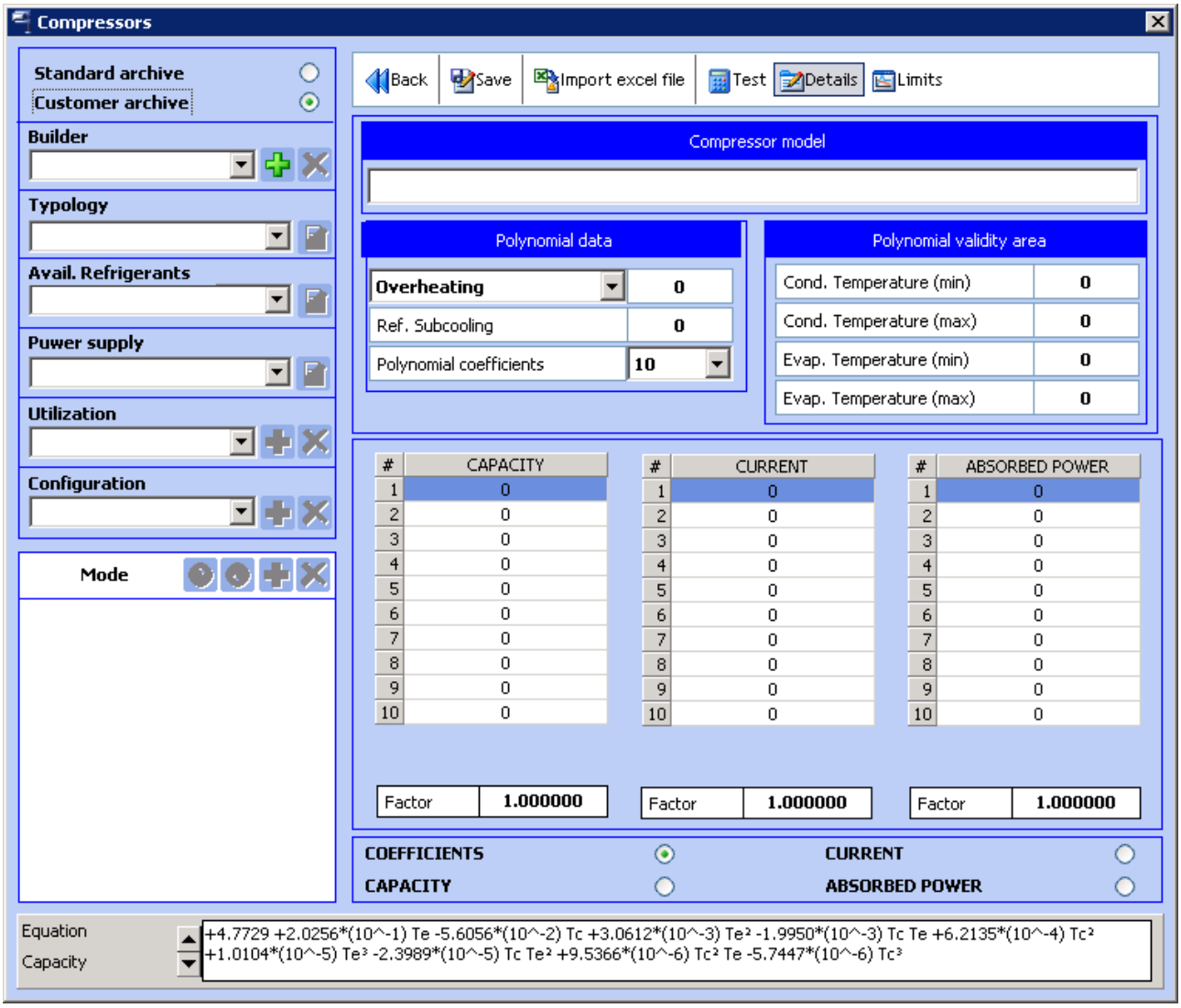


How to insert a compressor

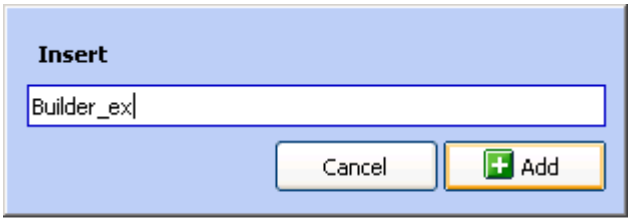
To insert compressor in Archive Management -> then on Compressor and we get the following:



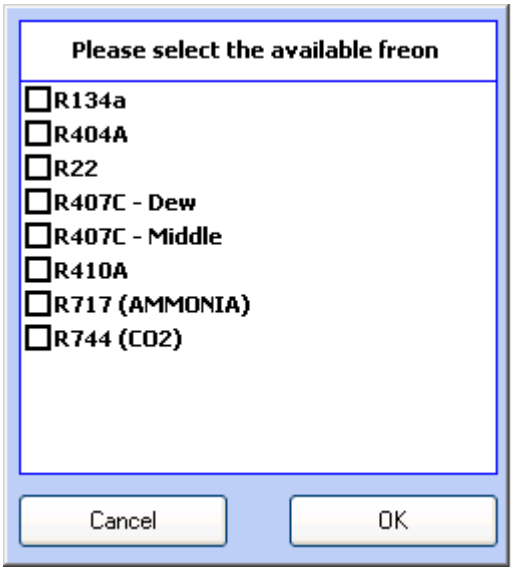
Then we click on "Customer Archive":



We add the builder:

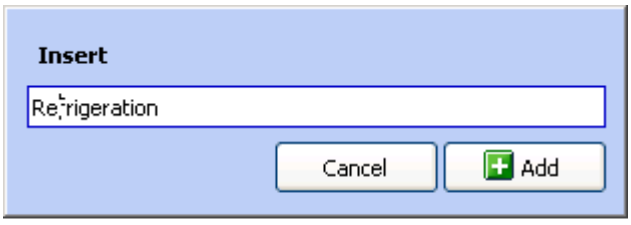


Then we add the refrigerant of the compressor:



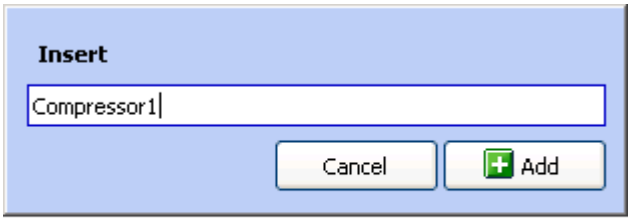
Then we add the power supply:

Then we choose the usage of the same:

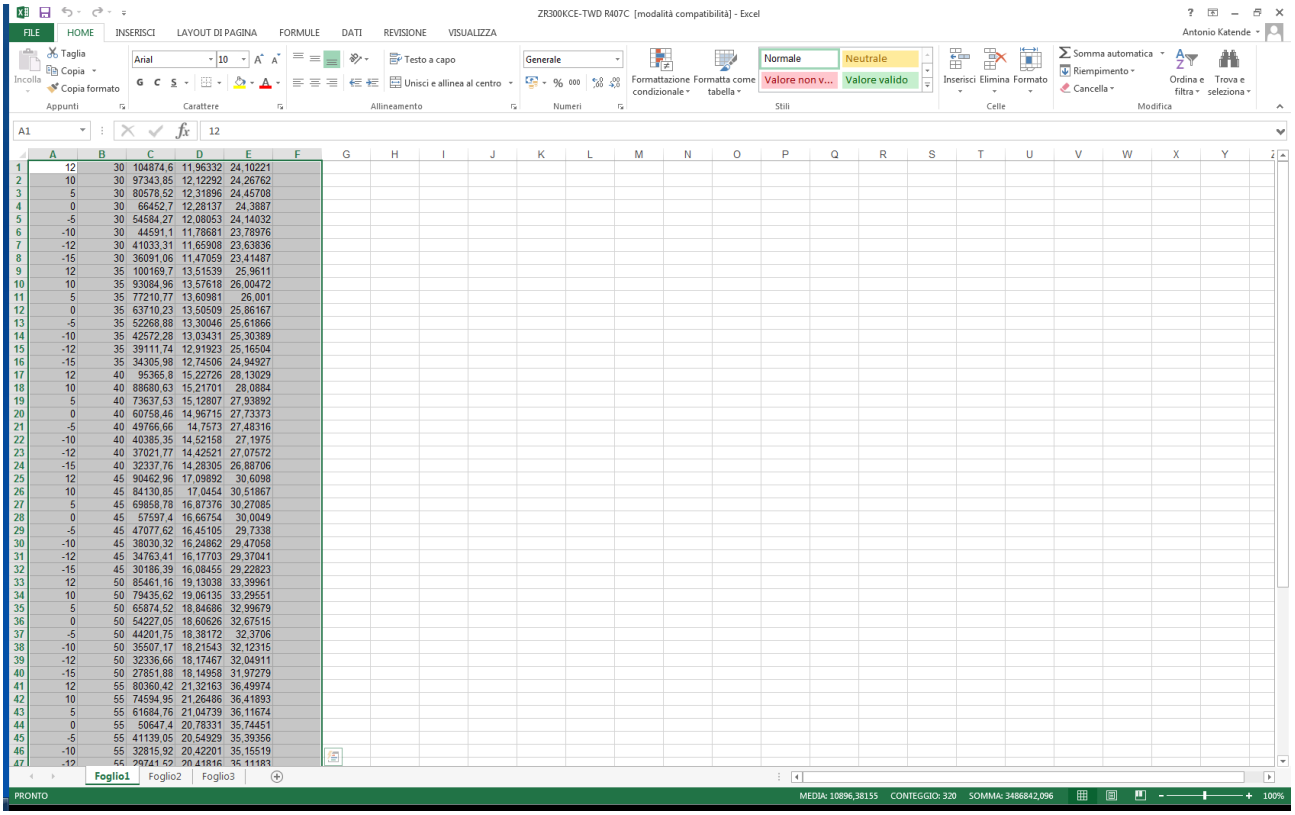


Then we add the configuration and the use separately.

Then we insert the compressor model:



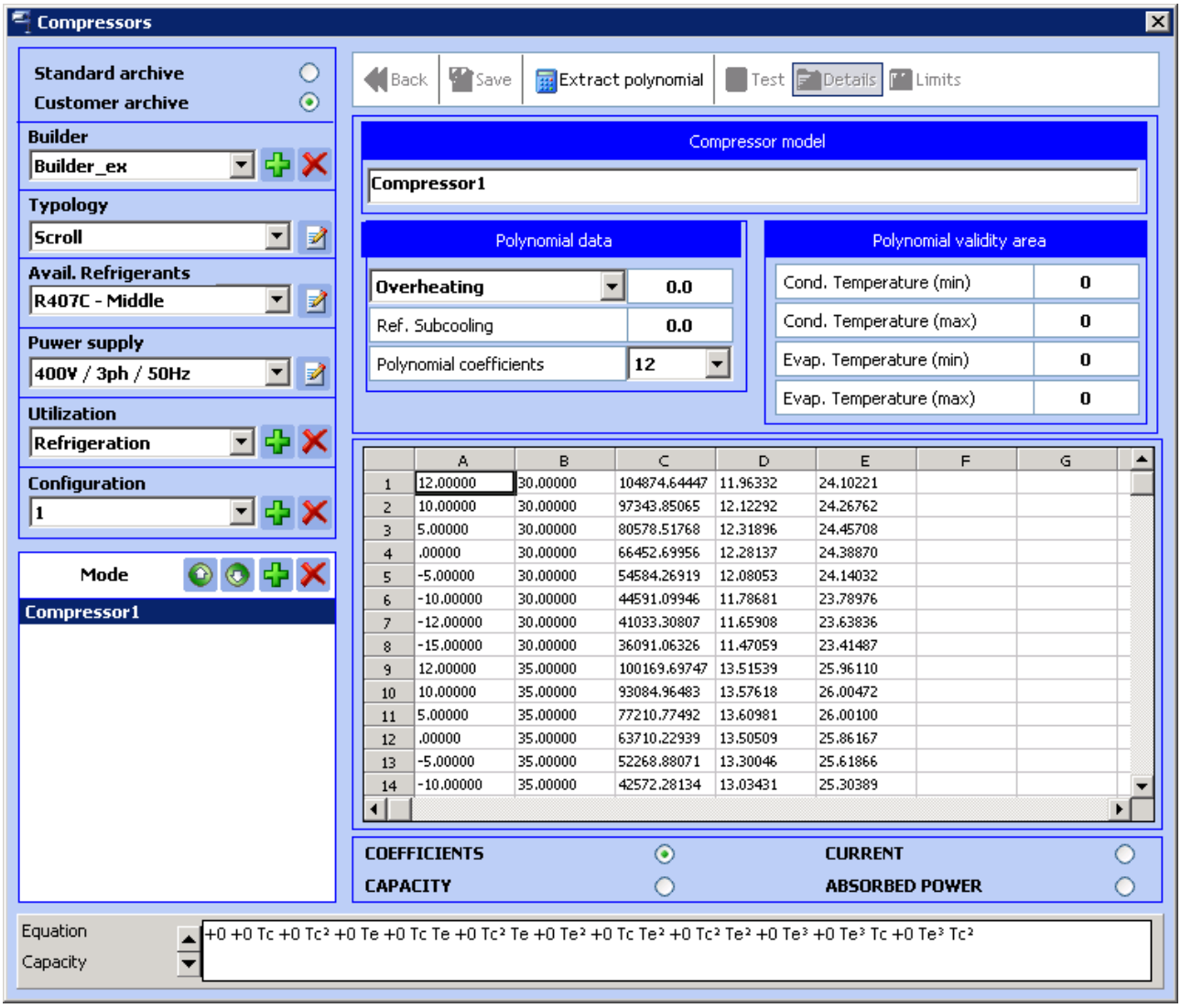
Then we can import the compressor data from an excel table. Where we can see the data like this from a previously saved excel file:



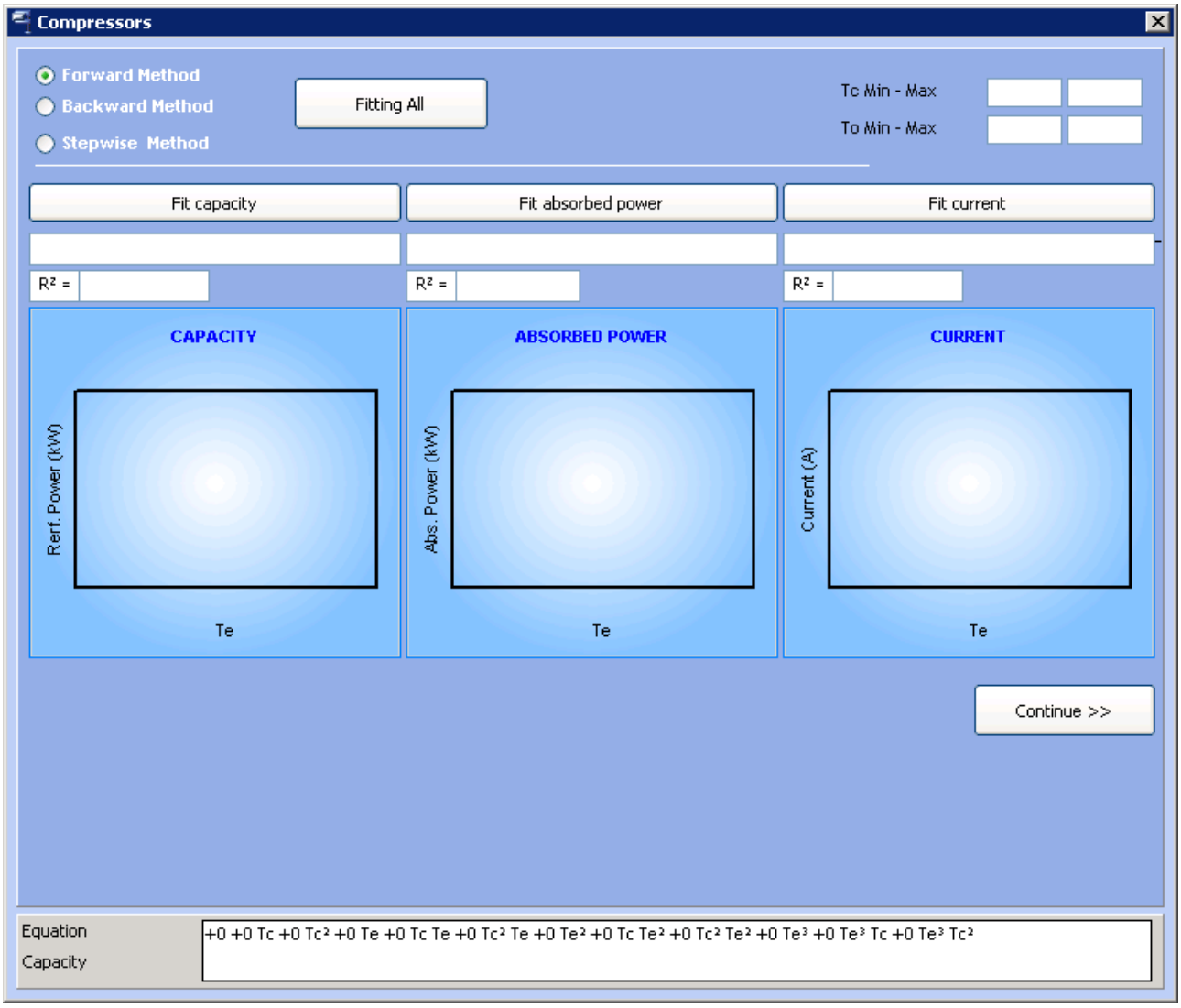
Where we have 5 columns which are:

1. **is for evaporating temperature C° which needs to be decreasing**
2. **is for condensing temperature in C° which needs to be increasing**
3. **Capacity in kW**
4. **Absorbed Power in kW**
5. **Absorbed Current in A**

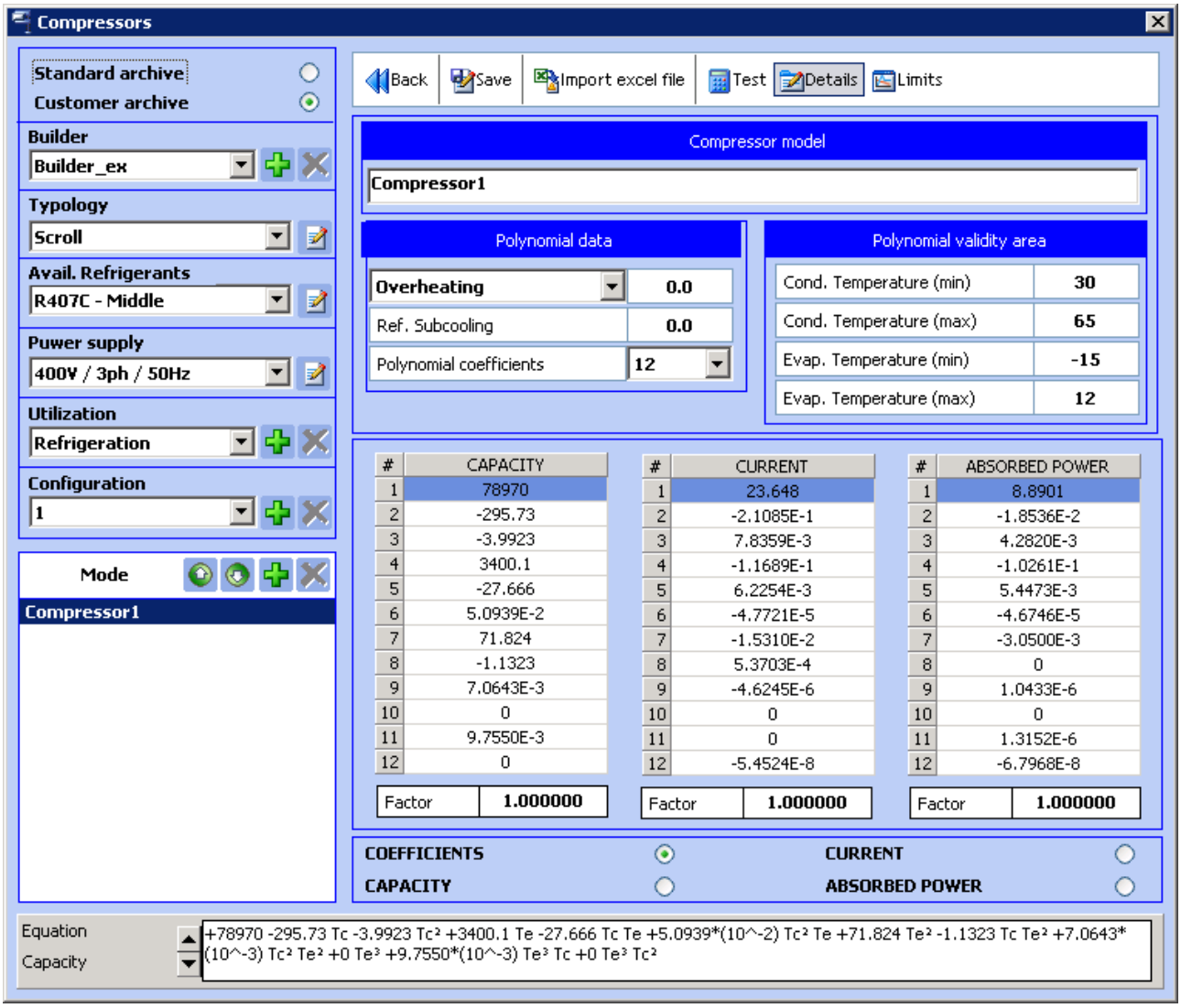
We click on Import Excel file and on the first option, and then we get:



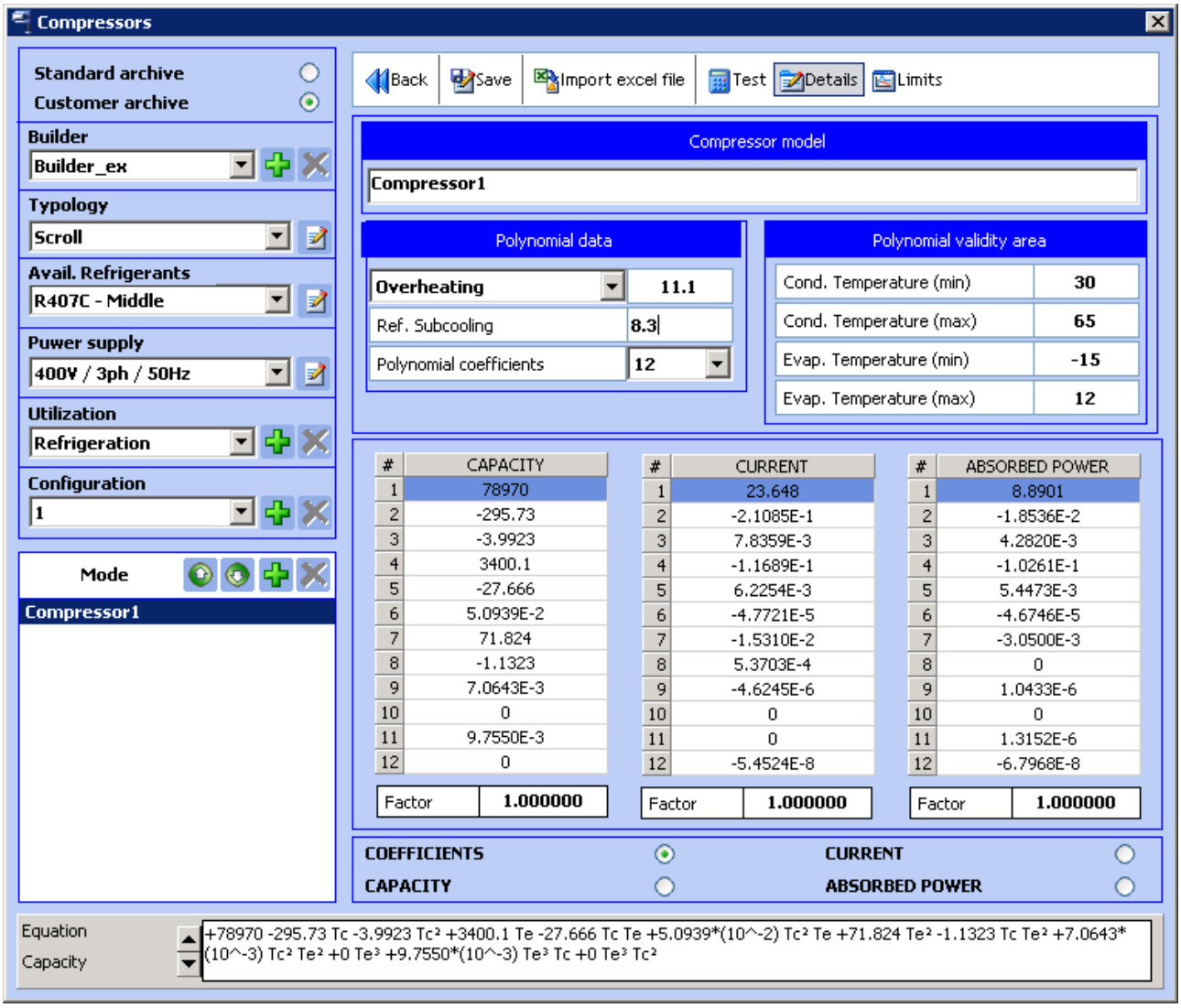
Then we click on "Extract Polynomial":



Then we click on Fitting All and con continue and we get:



We can then compile the relative data like "Polynomial Data". Then we insert the overheating, ref sub cooling and polynomial validity area:



Then we can click on "Save".

Multiple Envelopes in SHARK

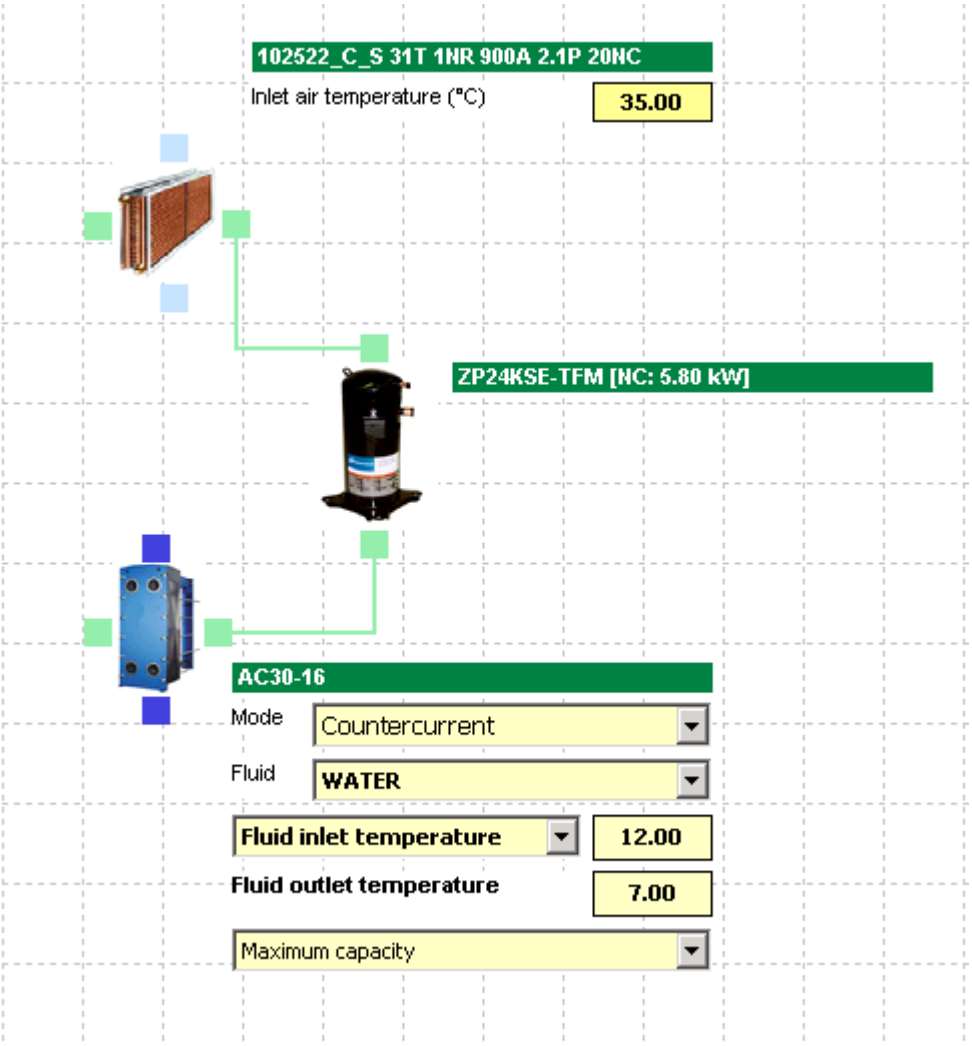
SHARK gives the possibility to link to a certain compressor one or more polygon or different "envelopes"; so that we can choose which polygon we can use in the calculation phase and simulate the unit outside the default envelope.

Actually the envelopes are not linked to the unit, but to the compressor, and it is possible to insert up to 10 different polygons for each compressor. For each polygon it is possible to link a different description (in English and Italian), as per example "T Cond Increased of 5 °C".

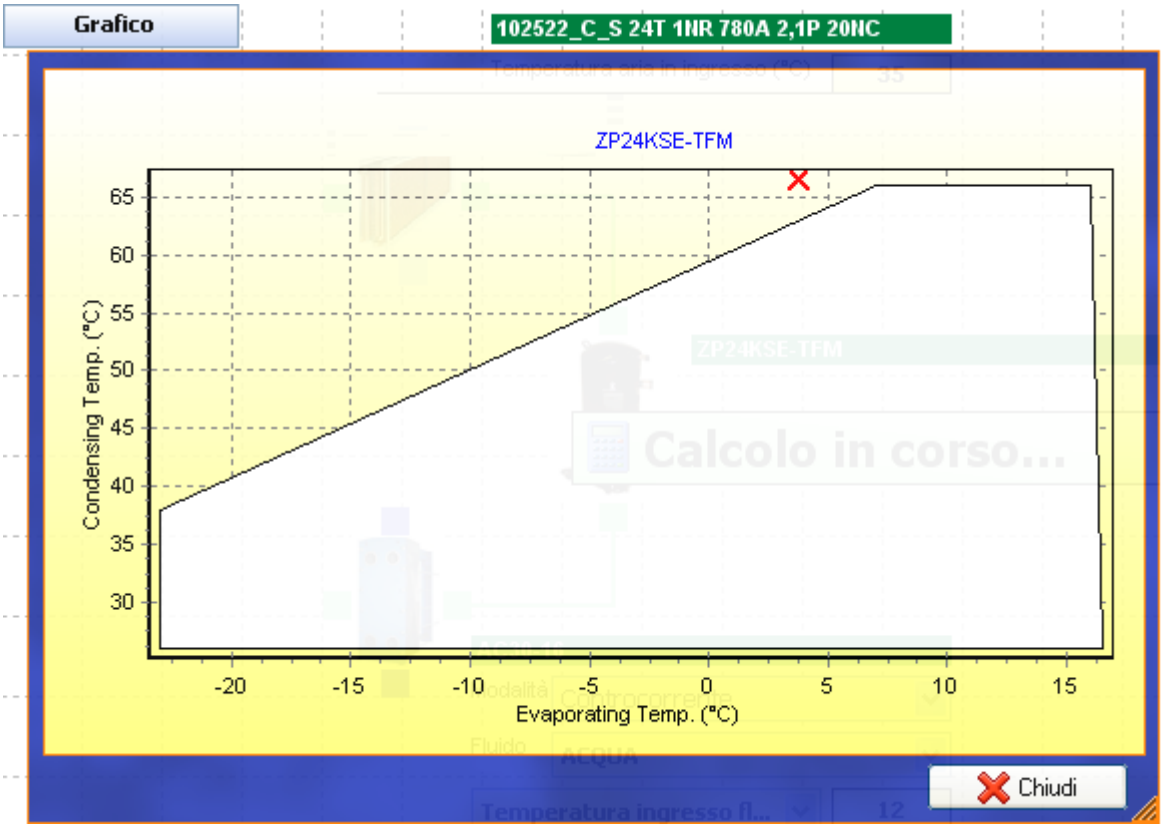
Each time that the user wants to calculate a project that uses a compressor to which different envelopes are linked, SHARK will ask which polygon to use, and i twill save such setting in the project, so that in the project the chosen envelope will be calculated.

Practical Example

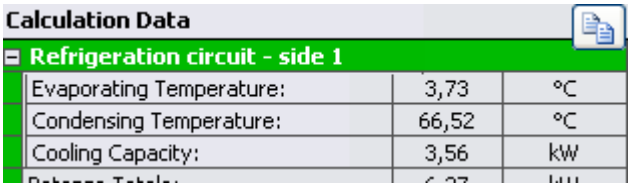
Suppose we want to simulate the following project :



If we proceed with the calculation, after inserting all the requested data, the software will let us know that the compressor is working at condensing temperature outside the envelope:



As we can notice, the compressor is condensing at 66,5 °C:



Calculation Data

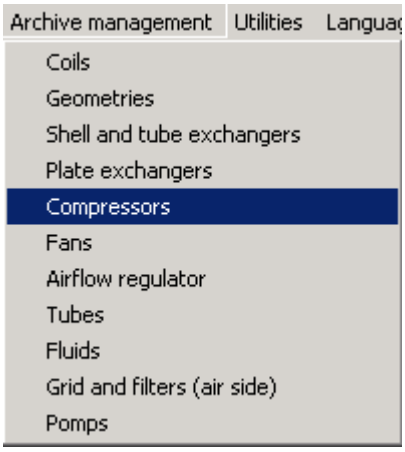
Refrigeration circuit - side 1		
Evaporating Temperature:	3,73	°C
Condensing Temperature:	66,52	°C
Cooling Capacity:	3,56	kW

In this case, if we want that compressor works on these conditions and we the certainty, for example from experimental data, that the compressor is able to do so, we need to add a new extended envelope.

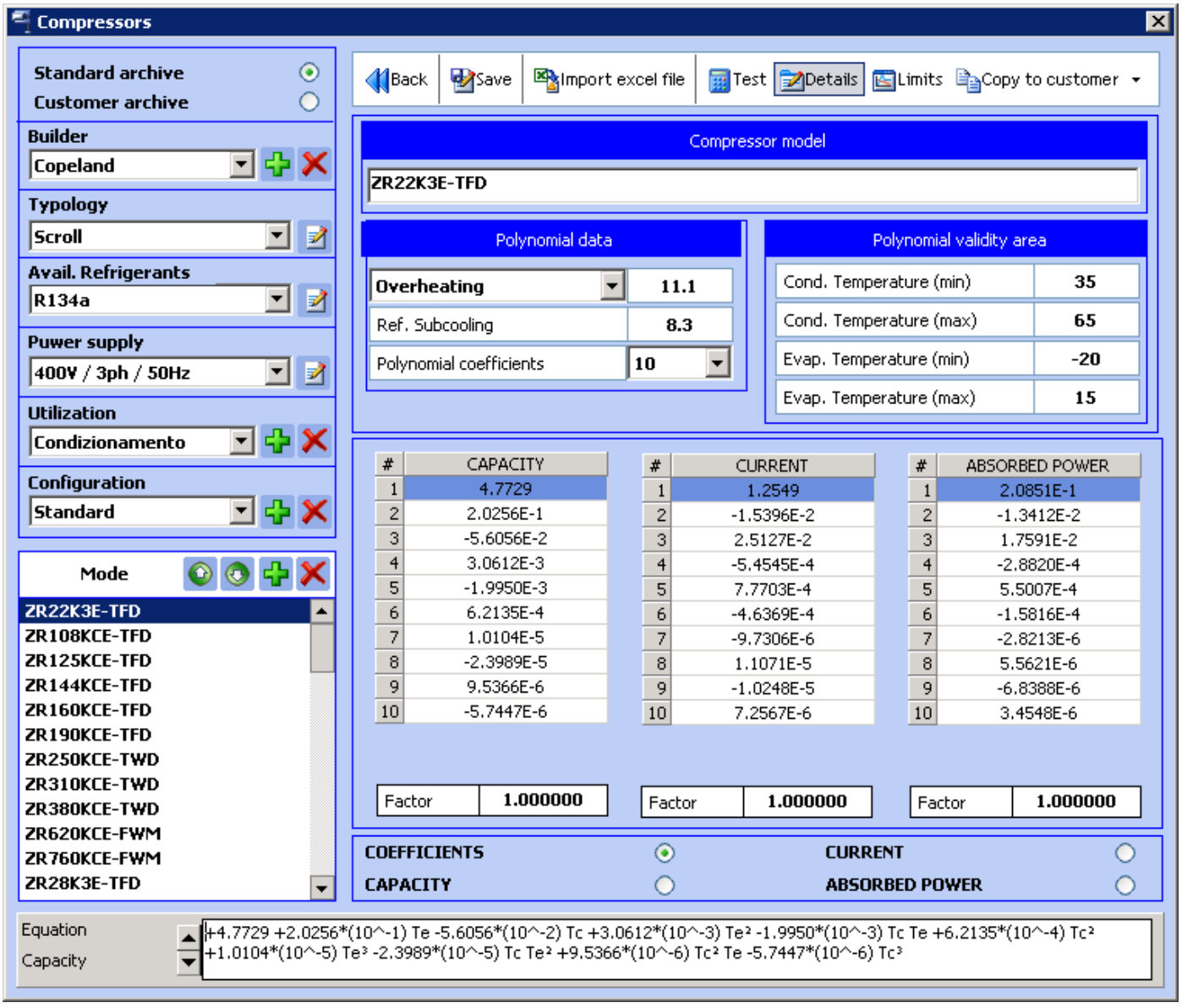
Choice of the descriptions

The possible descriptions of the polygons are 10, but are applied at the global level to all the compressors in the archive. This means that it would be better to apply standard descriptions, not linked to the single compressor, as for example "3°C Increase Condensing Temperature", and it should never include name of units, series, etc… At the most name of accessories that can be shared with various units/ series.

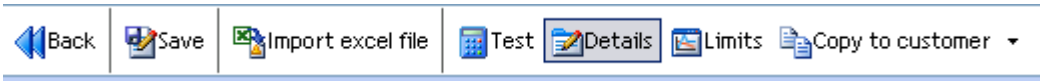
Let's see first how to change such descriptions. At first we need to open, with a closed project, the management panel of the compressors and click on the menu "Archive Management" and then "Compressors":



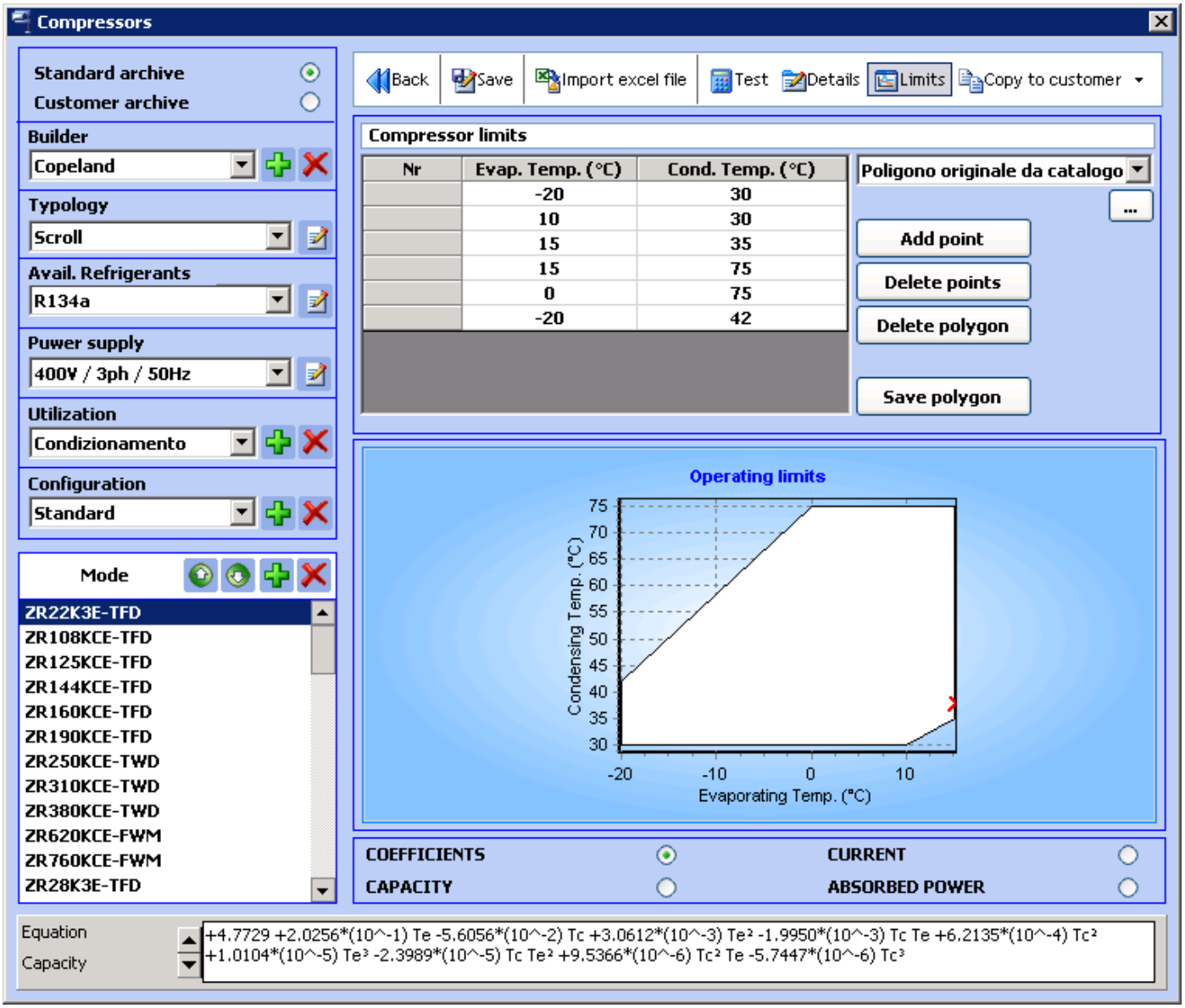
The compressor's management panel will open:



Let's choose the option "Limits" from the tool bar:

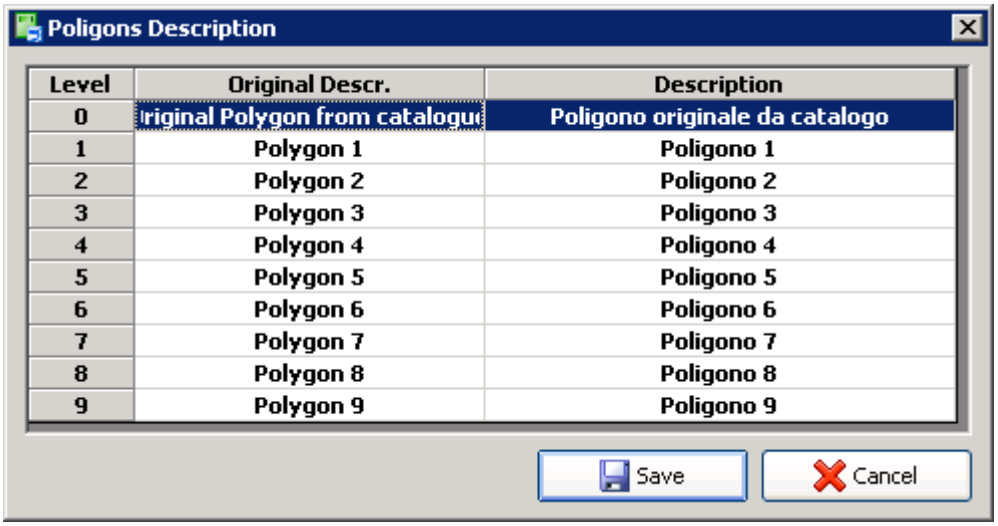


At this point the envelope of the compressor chosen will be shown:

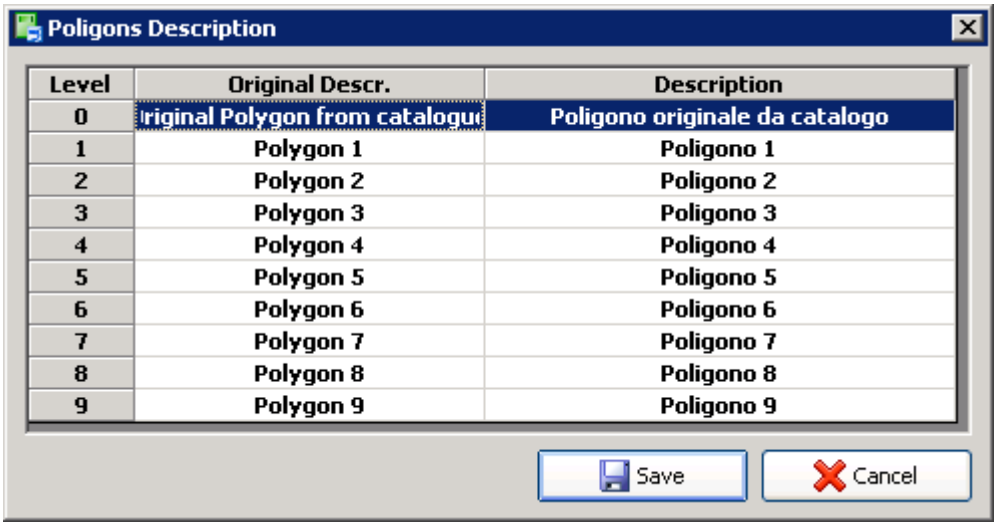


We click on button "…" under "Poligono originale da catalogo":

A new window in which to modify the descriptions:



Let's suppose, in the following phase, we need to augment all the envelope of the 2°C. The new description will be "2°C Increase Envelope":

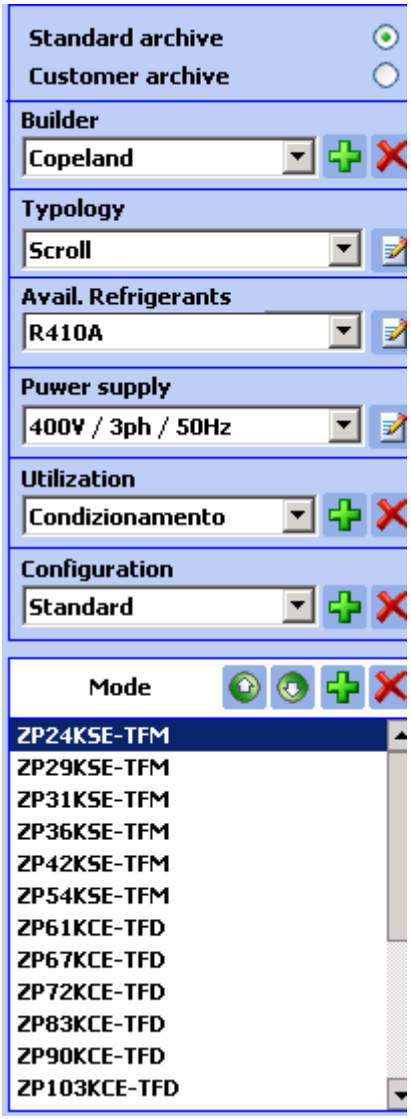


We can insert other standard descriptions "standard", such as "3°C Increase Envelope", "3°C Increase Envelope Cond", "3°C Increase", so that we can cover all possible cases.

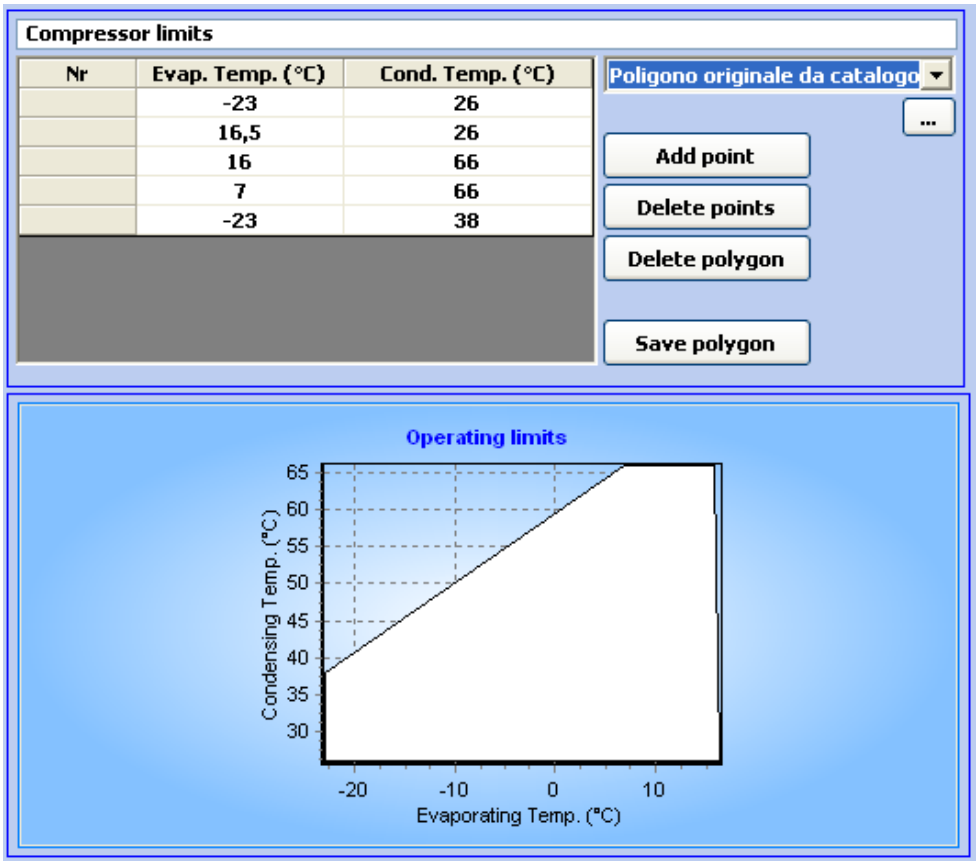
Once the descriptions are modified, let's click on "Save":

Association of a new envelope

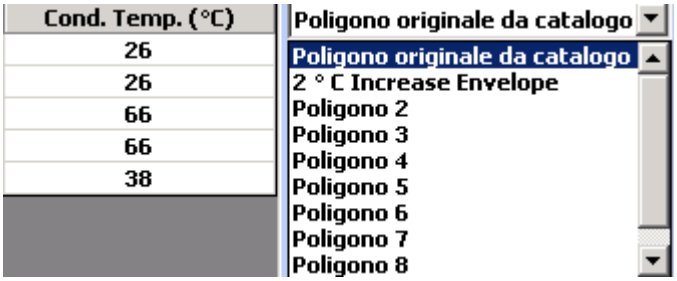
Select then the compressor that we want to modify:



At this point, the default envelope of the compressor ZP24KSE-TFM will be shown:



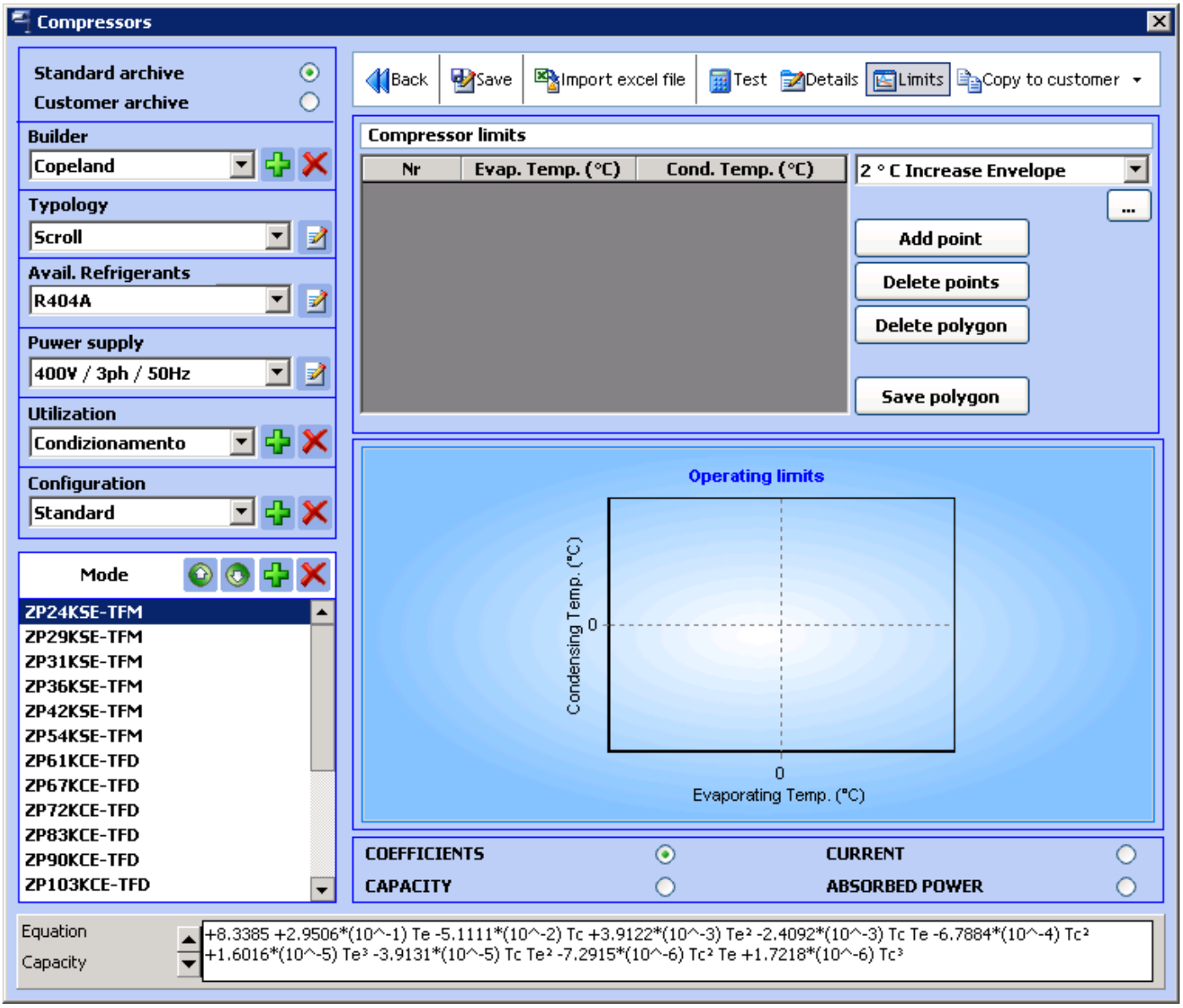
From the above figure, we can notice that in the evaporating range temperatures from 7 °C to 16 °C, the top condensing temperature allowed is è 66 °C. To insert a new envelope and not modify the default one, we click on list on the polygons like below:



And we choose "2° C Increase Envelope "

ATTENTION: at times the old name "Polygon 1" could be seen. To correct, open the window to manage the descriptions, save and close. The new description will be shown.

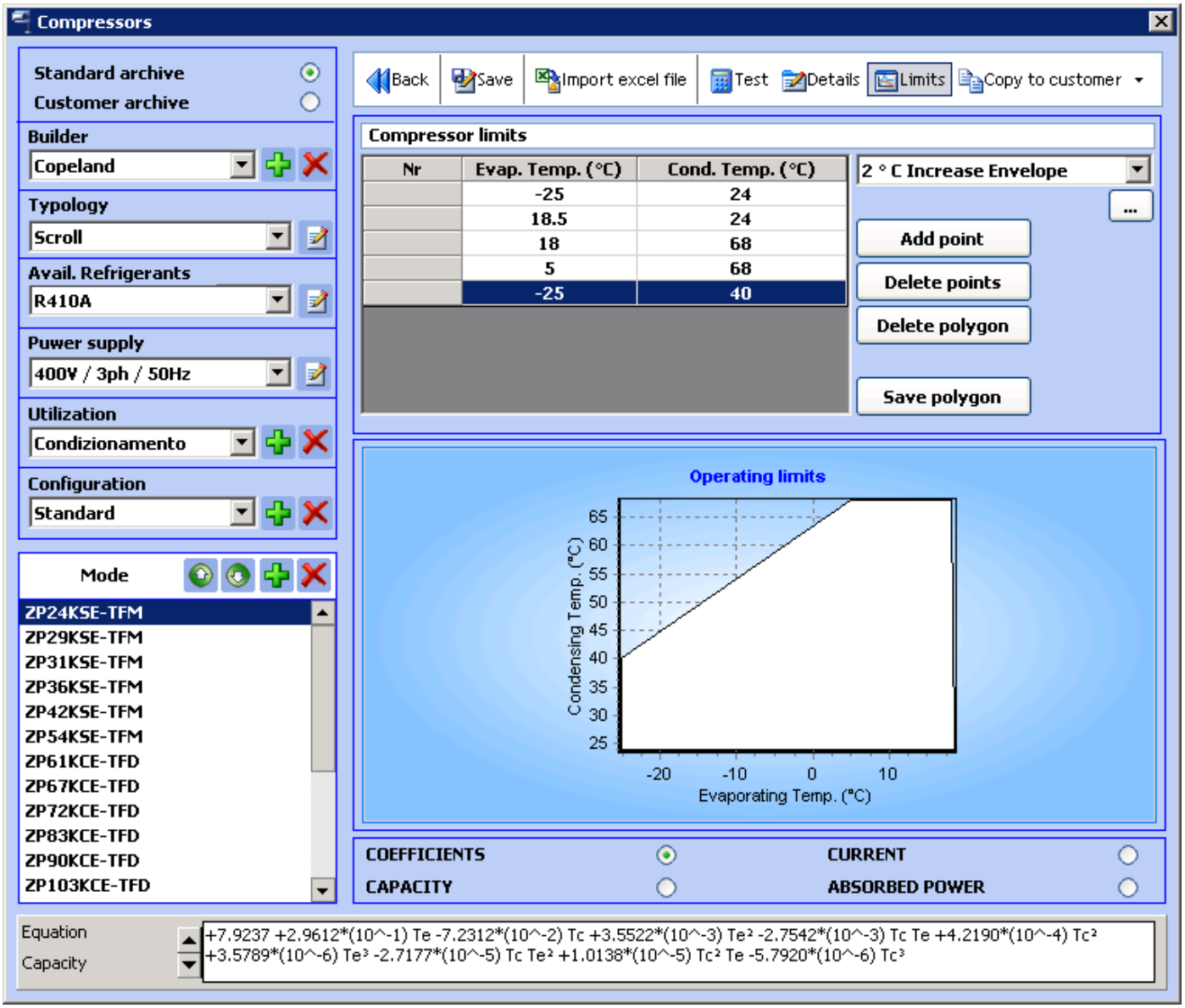
The empty polygon will be chosen:



At this point, we click on "Add point" it is possible to insert the points of the new envelope, that will have to be inserted in anticlockwise and starting from the one on the lower left. Let's suppose they are the following:

Nr	Evap. Temp. (°C)	Cond. Temp. (°C)
	-25	24
	18.5	24
	18	68
	5	68
	-25	40

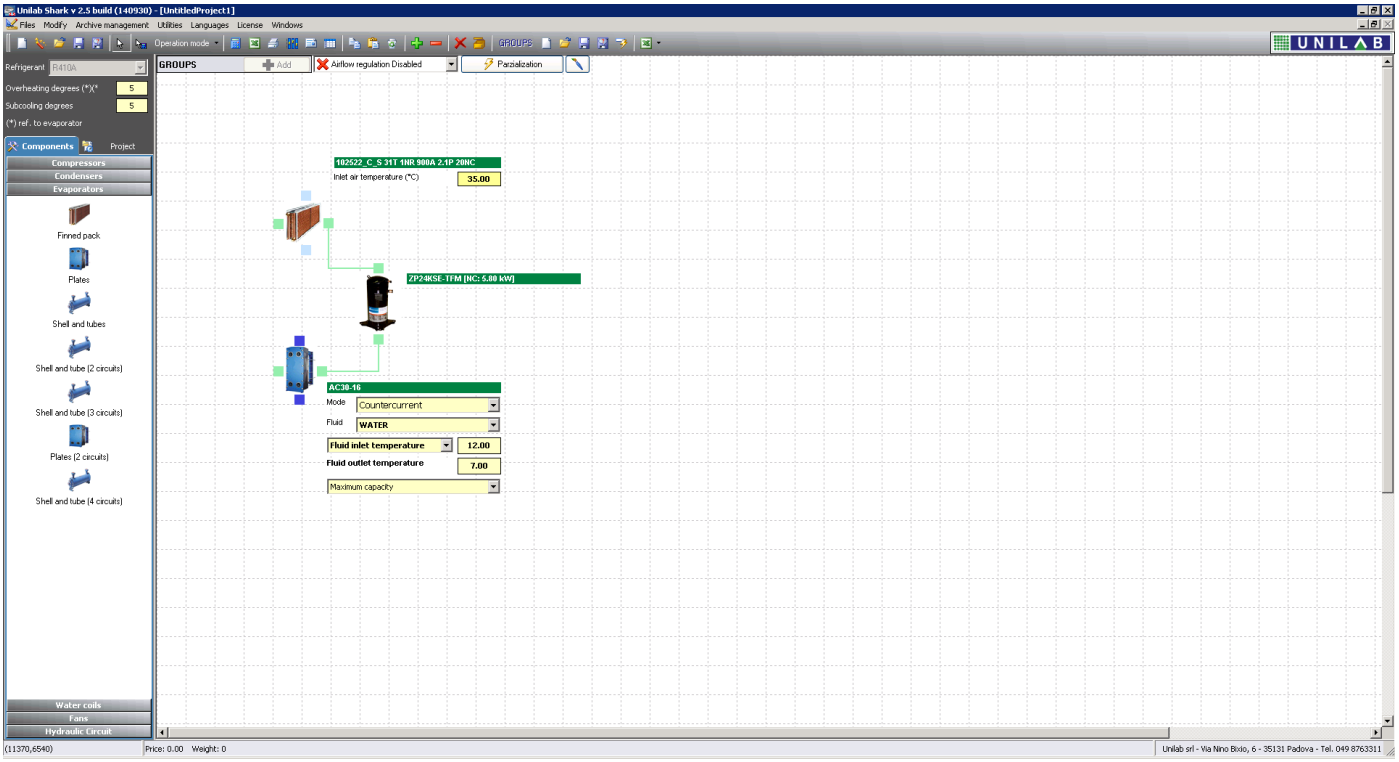
Once all point has been inserted, we click on "Save Polygon" so that we can save the polygon in the database and see its preview:



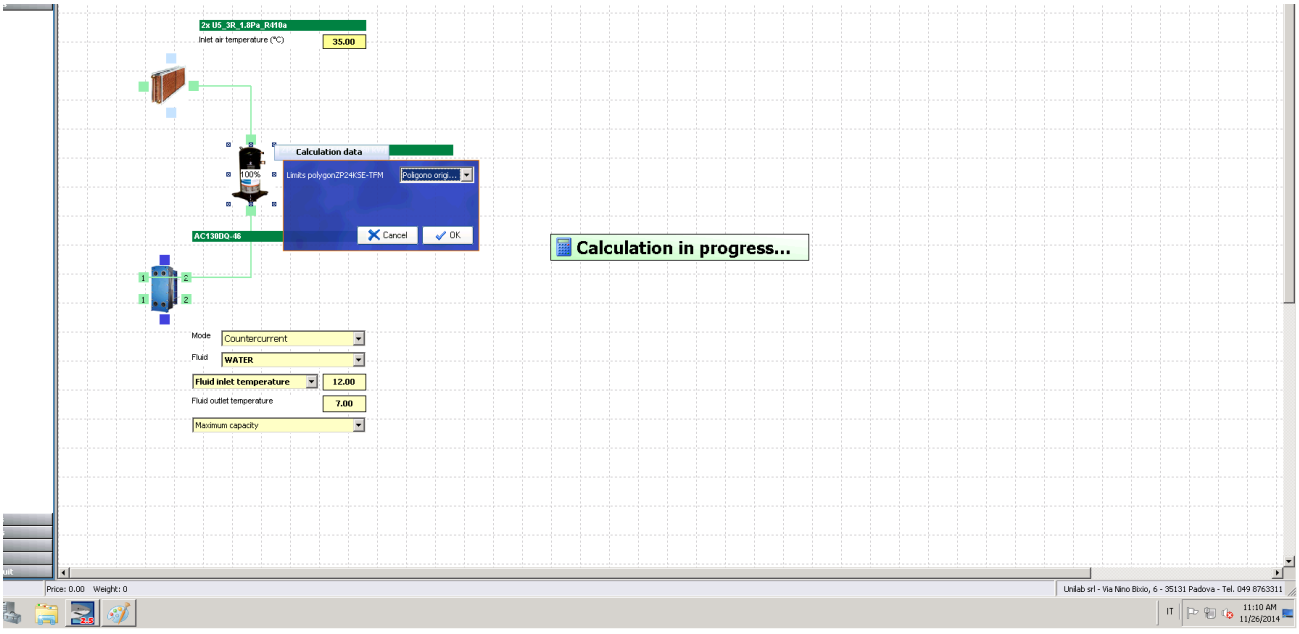
At this point, the compressor ZP24KSE-TFM is associated two envelopes, the default 1 and "Polygon 1", that has higher limits.

Calculation

We open again the project that we were simulating:

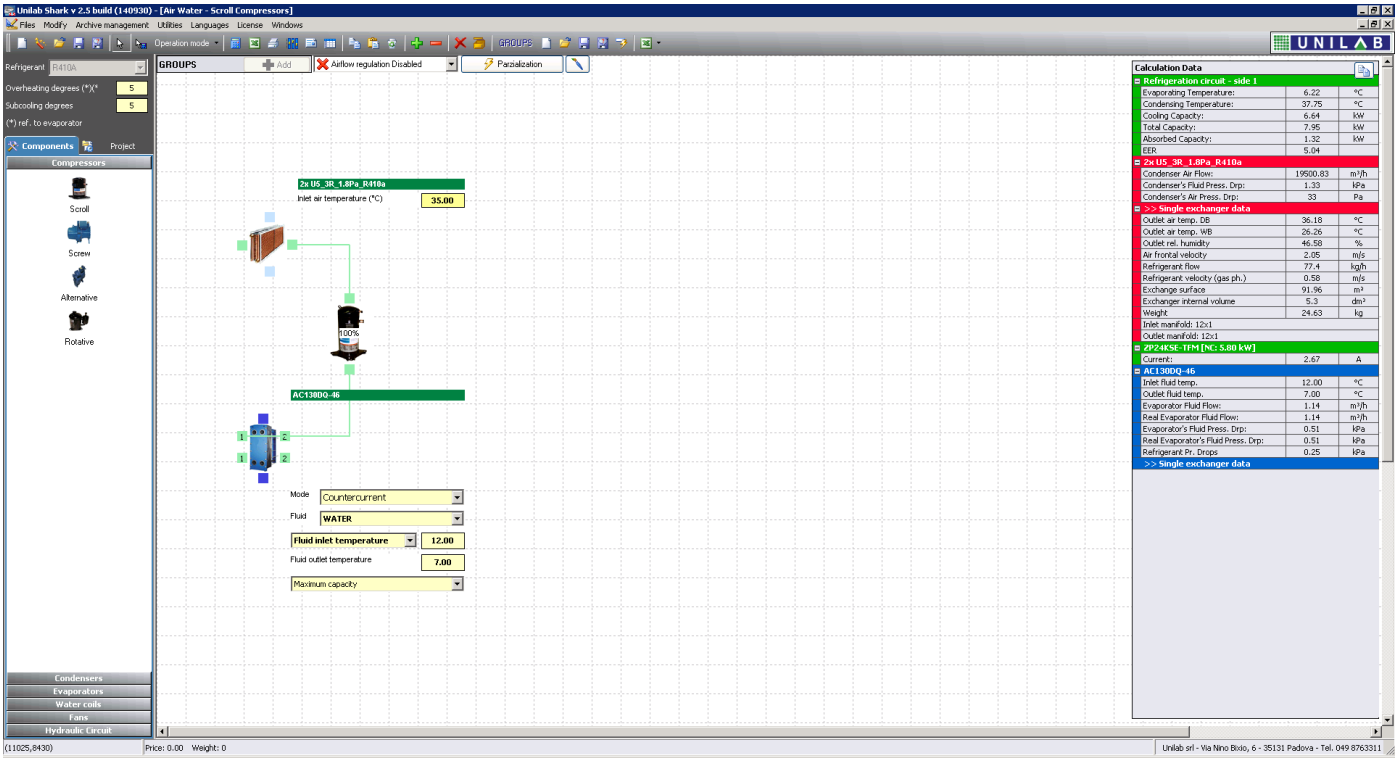


We do the calculation. At this point the software will query which envelope to use:



We choose the second, as soon as it is inserted, and we click on ok:

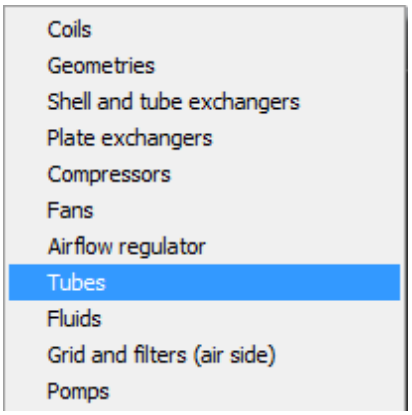
At this point the unit will be calculated without any warning and the result seen in the calculation window:



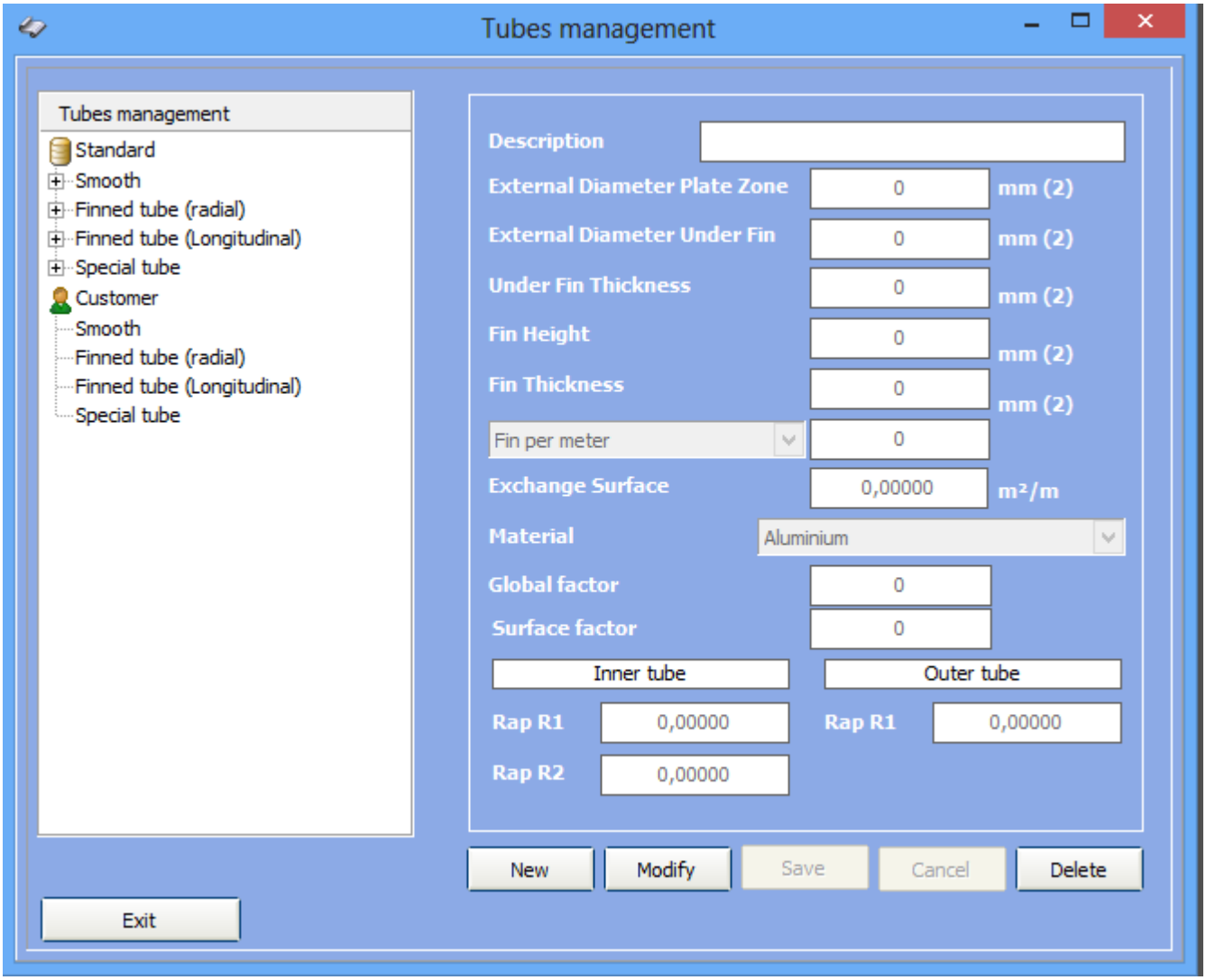
Besides the choice of the envelope will be saved in the project and I twill remain also while opening SHARK and doing other calculations (single, tables, etc) at other conditions.

How to insert a tube

This is mandatory before adding a new Shell & Tube heat exchanger. Click on "Archive Management", e then on "Tubes":

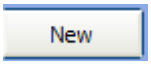


This window will open:

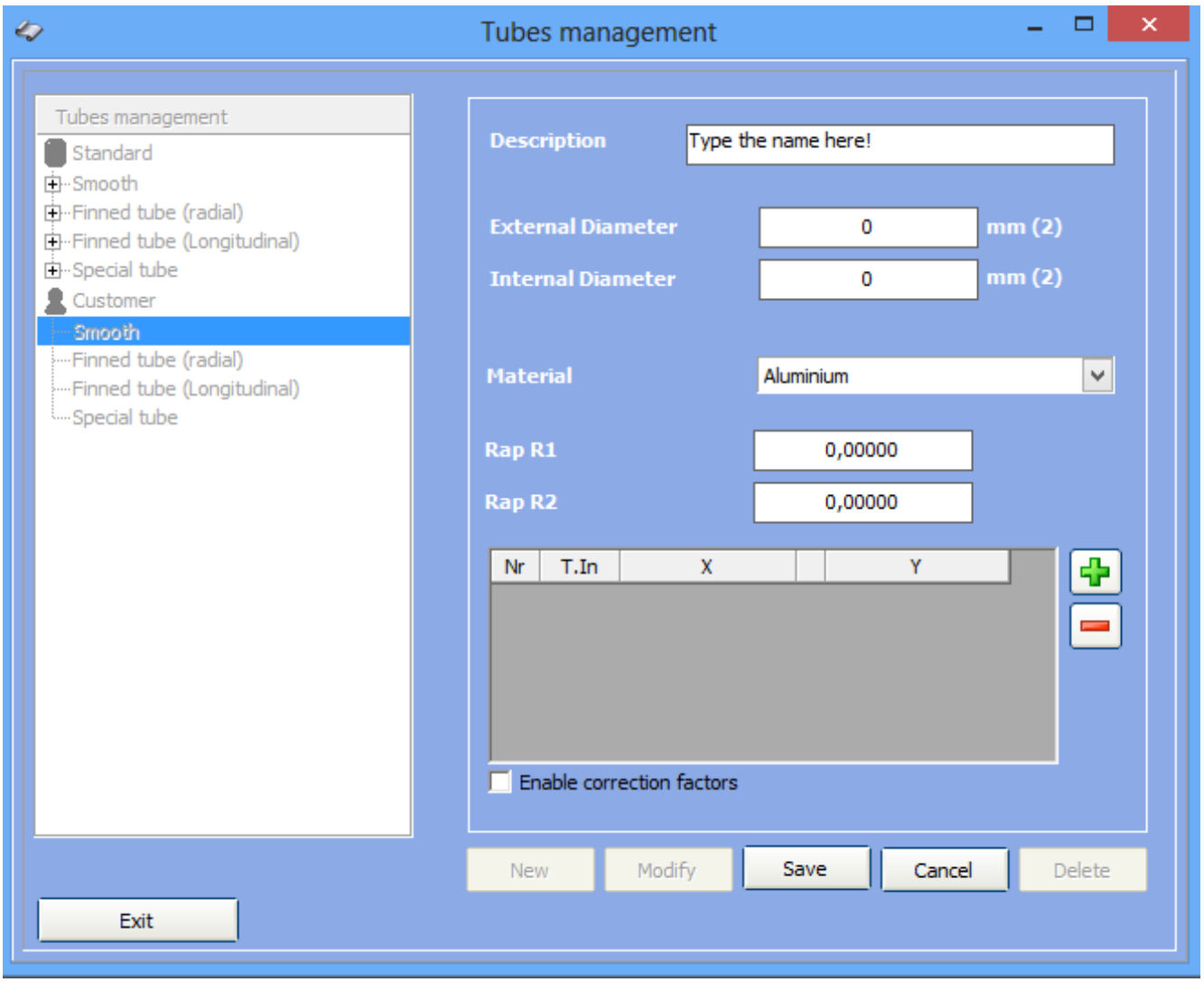


We go to customer "Customer" and decide the type tube, for example "smooth":

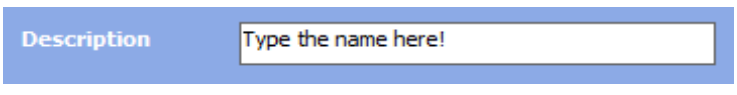
We click on "New" to insert the tube:



Now we can modify the insertion fields:



The first field is the description of the tube:



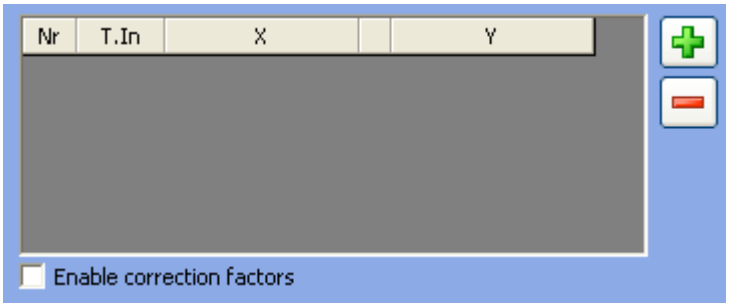
We have the external and internal diameter:

You choose the material from a list:

The factors R1 and R2:

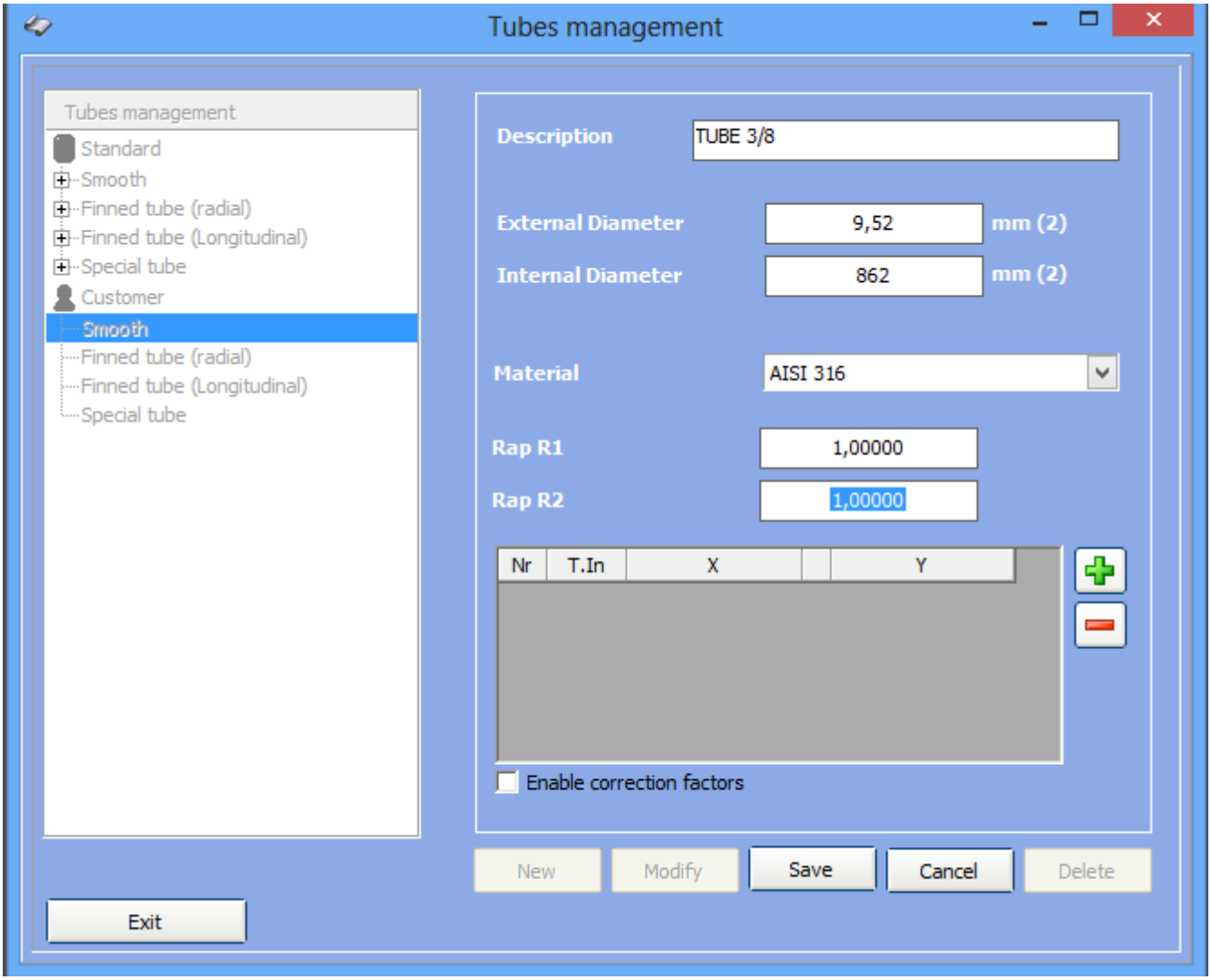
These factors have as "central" value 1; the first refers to the heat transfer coefficient of the tube, and the second to the pressure drops generated. When you calculate a shell and tube, these factors influence the result if different from 1 if the tube is used by multiple heat exchangers, this effect will be reflected on all the associated heat exchangers. Therefore, they are a useful tool for "global" calibrations on a range of heat exchangers that share the same model of the tube.

Under these two factors, we find a table in which we can specify a curve as a function of factors DTML (X) and the inlet temperature of the tube side:

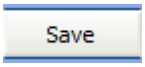


NOTE: You should not use this feature if you do not know what values to enter.

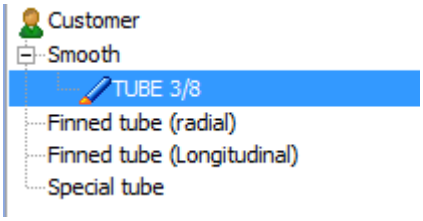
We insert now the following example values:



We click on the "Save" button:



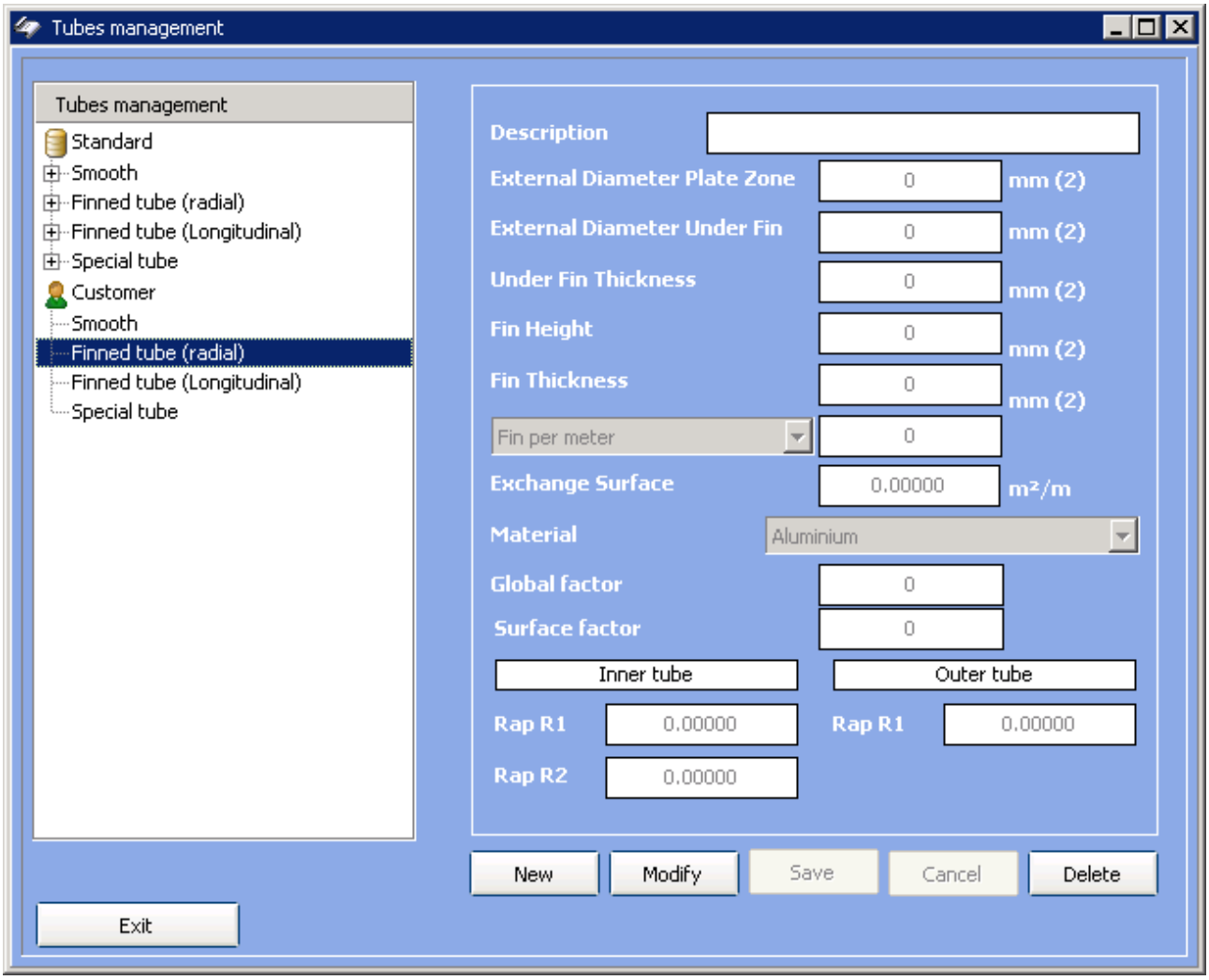
And the tube will be added to the list within the selected category:



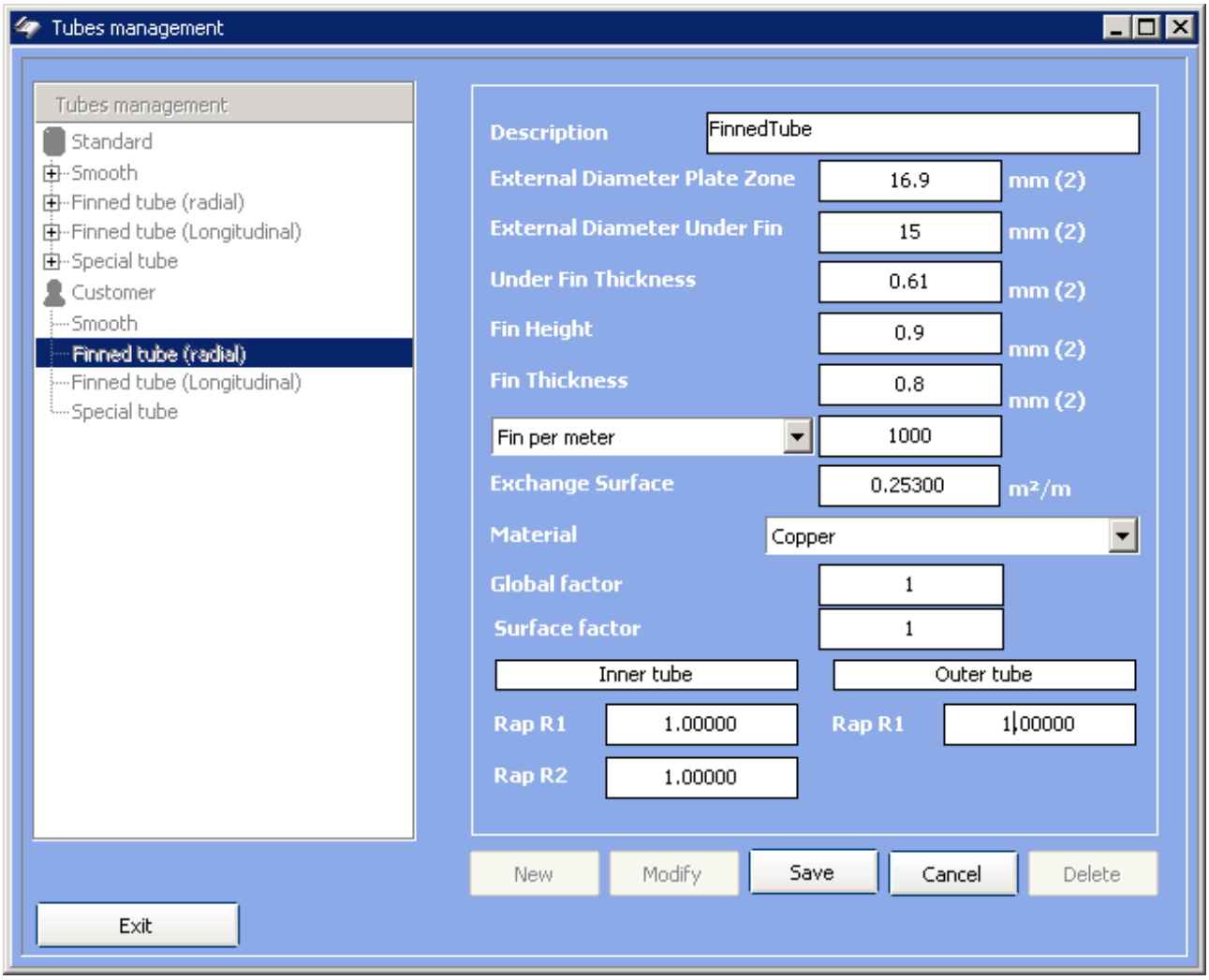
We click on "Exit" to end this procedure:

Let us proceed with the insertion of a "Radial Finned Tube Example".

Under customer, we click on finned tube (radial) and click on New and start inserting the following fields



Let's insert the following data:



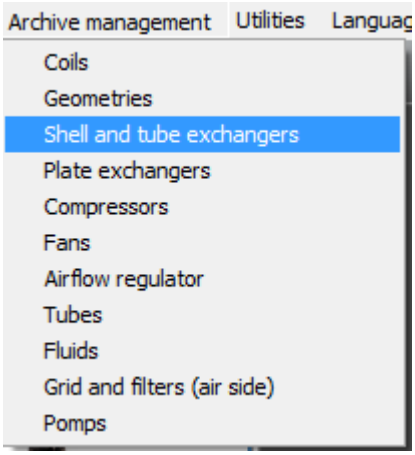
Then we click on the save button.

Shell and Tube Insertion

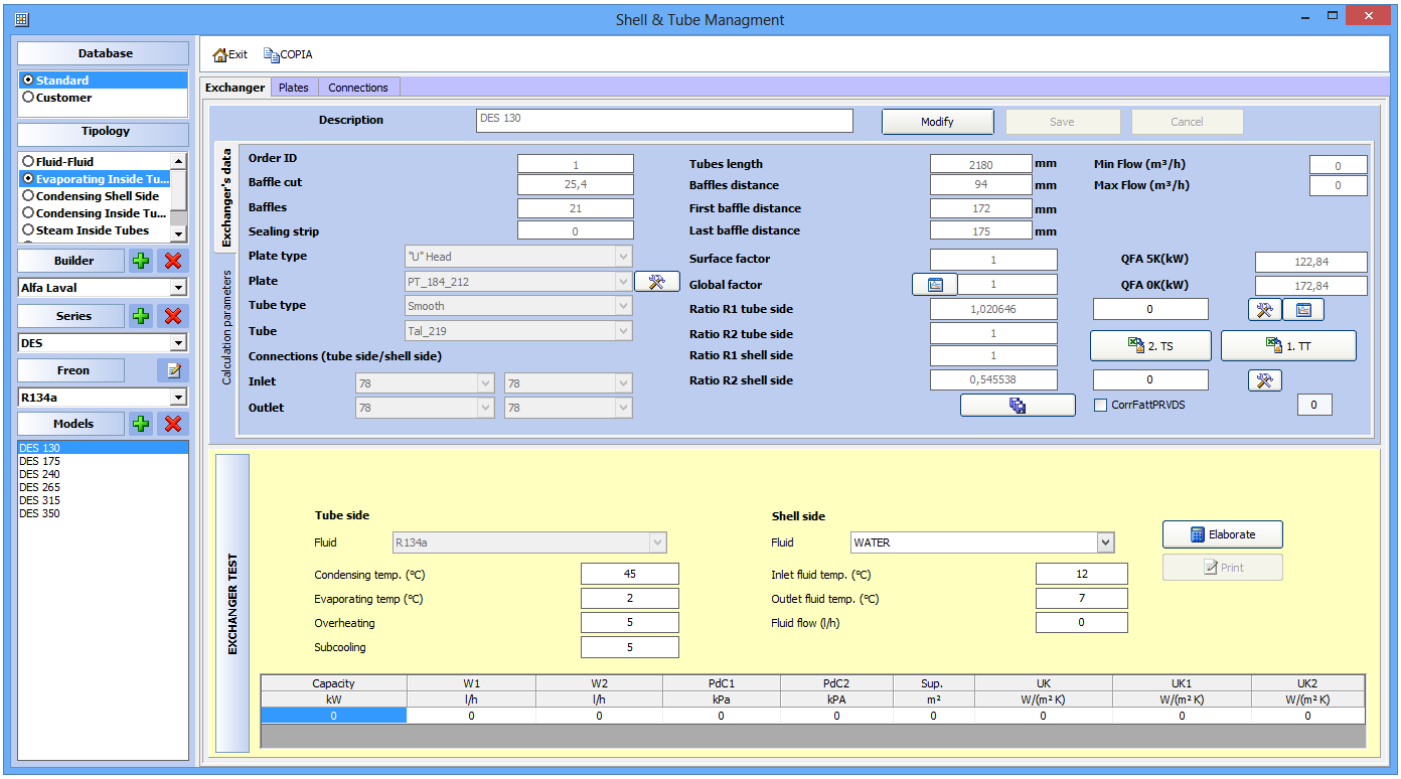
SHARK 2.5 provides the ability to insert tube heat exchangers in the archives CUSTOMER. It is important to follow the following order to enter the data:

1 Type of pipe and tube. Even if the tube is standard, make sure it is present in the CUSTOMER archive.
2 Plate
3 Shell And Tube

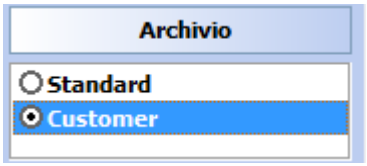
We click on "Archive Management", and on "Shell and tubes":



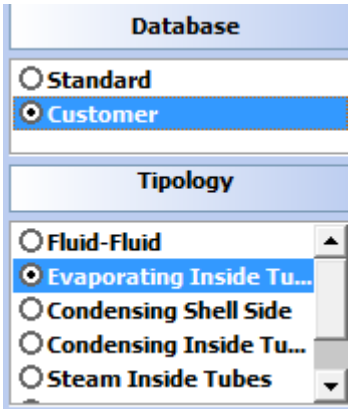
The following window will open:



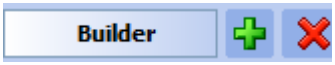
To insert a new heat exchanger in the archive click on the "Customer" in the "Archive" field:



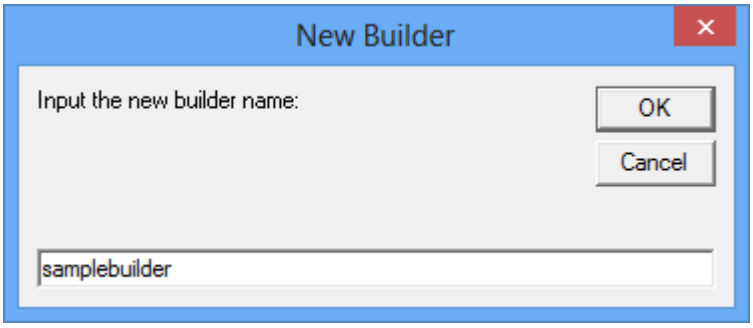
Once positioned correctly on the archive, select the type of heat exchanger that we want to insert:



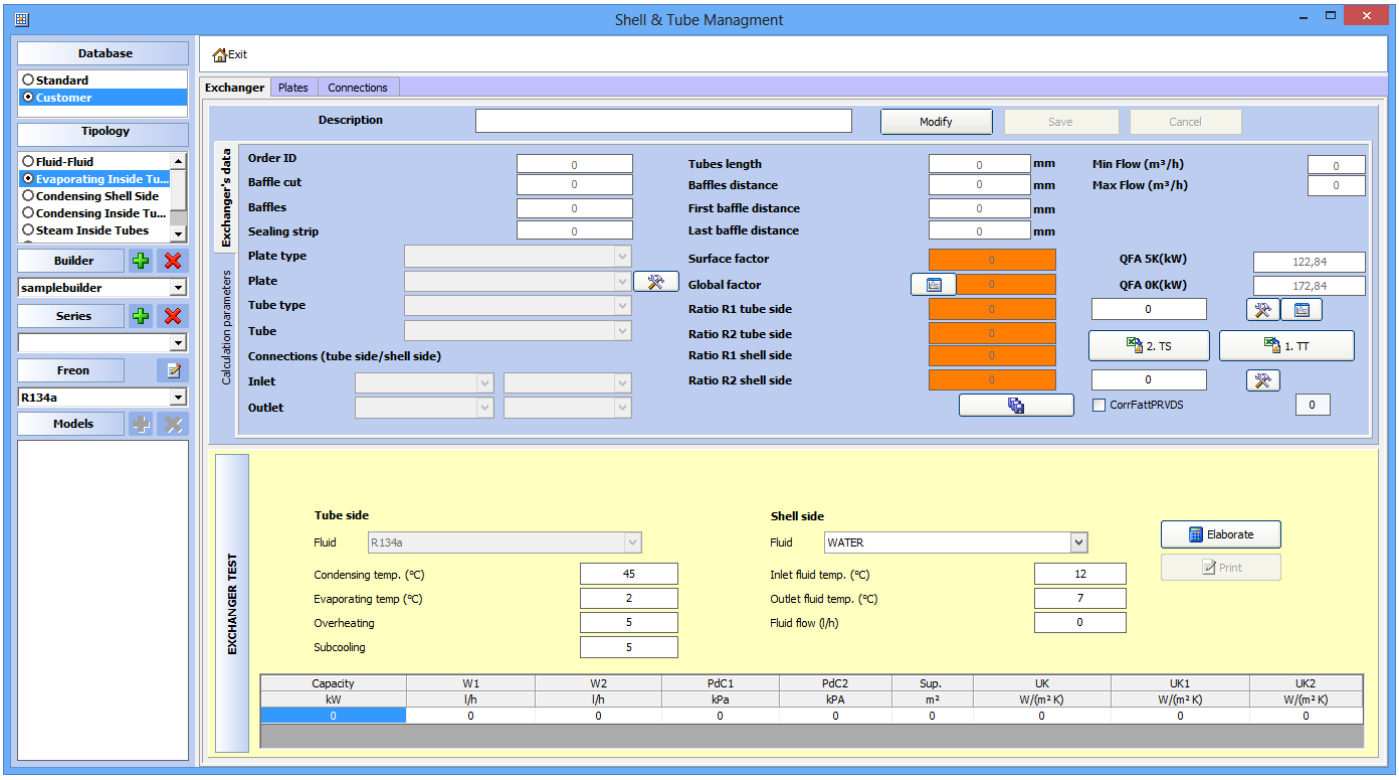
Click on the "+" button next to the field "Builder":



Let's insert the name of the new builder:

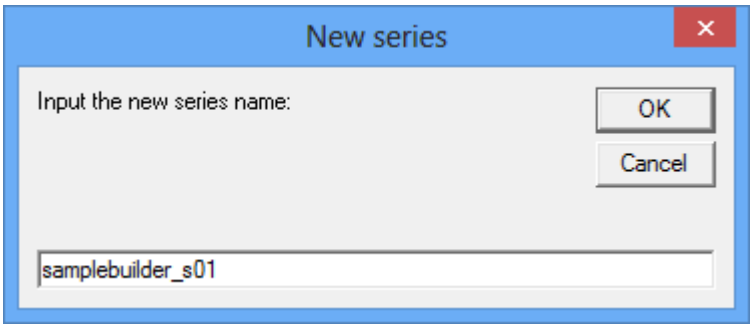


After clicking "Ok", the manufacturer will be added to the list:

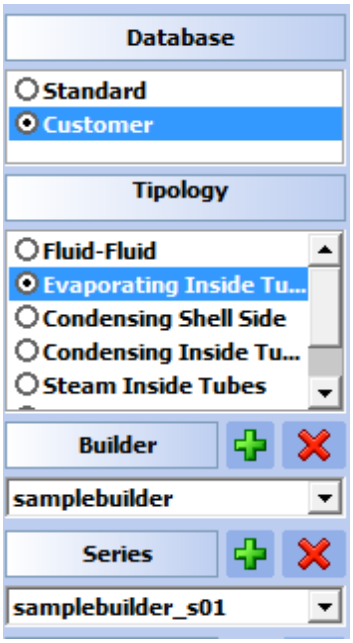


We continue by inserting the series the same way. Click on the "+" button next to the field "Series":

Specify the name of the new series

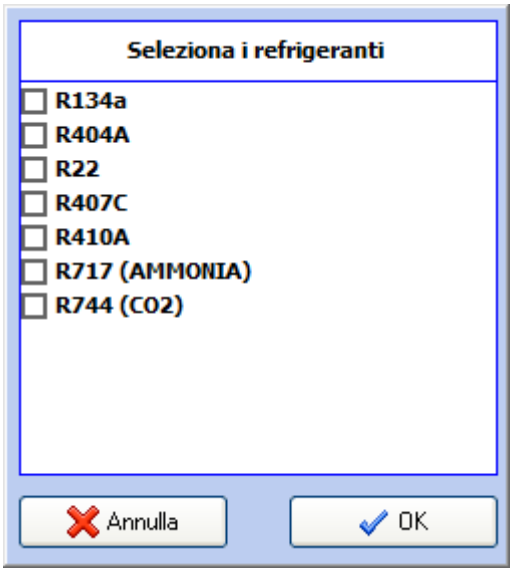


We click "OK".

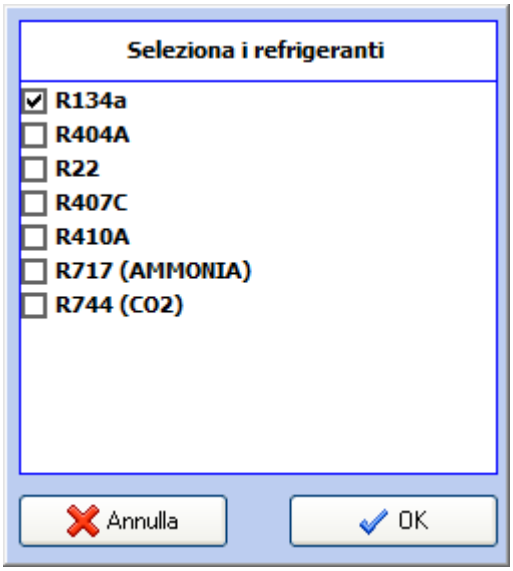


Now we can associate to the heat exchanger, refrigerants for which it is compatible. Click the button next to the field "Freon:

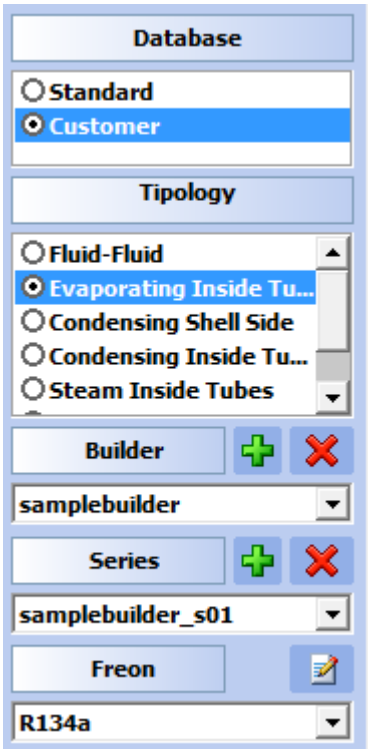
You open a form of association in which we can choose the different refrigerants available from the following:



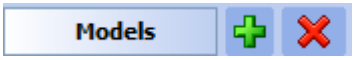
We choose R134a:



Let's click on "Ok", and the refrigerant will be shown in the list below:

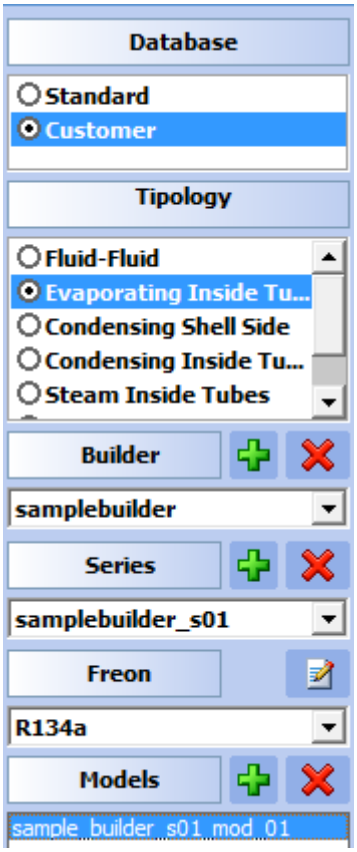


At this point we enter the model of the heat exchanger, by clicking on the "+" button next to the field "Models":

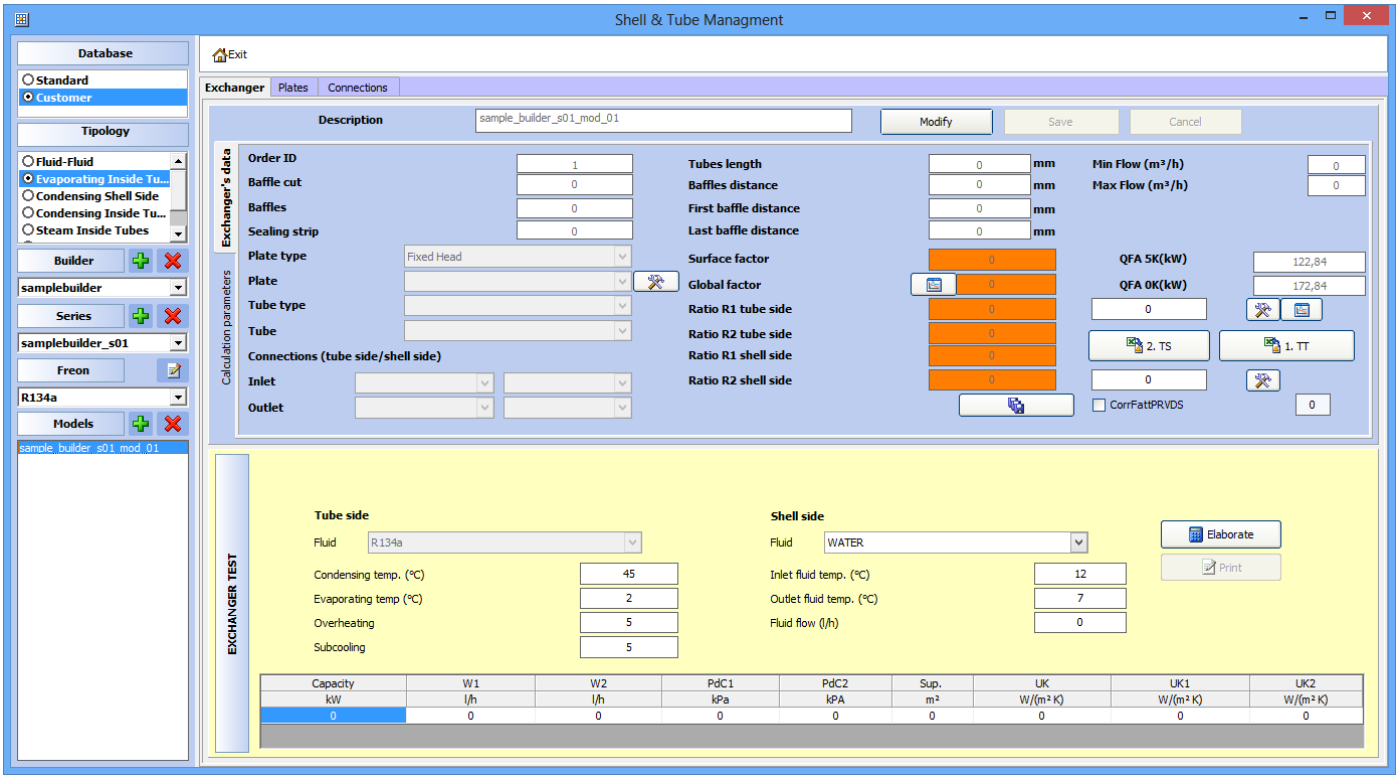


Insert the description of the model, such as:

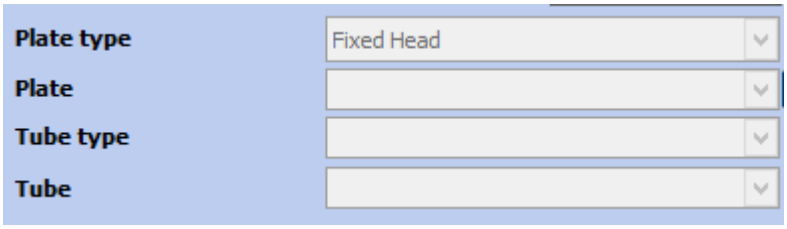
At this point we get the model just specified in the list of models:



Let us now see the screen for entering the heat exchanger:

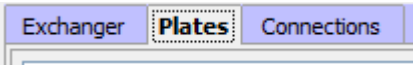


We note that we have to insert the plate model and the model of tube used by the heat exchanger:

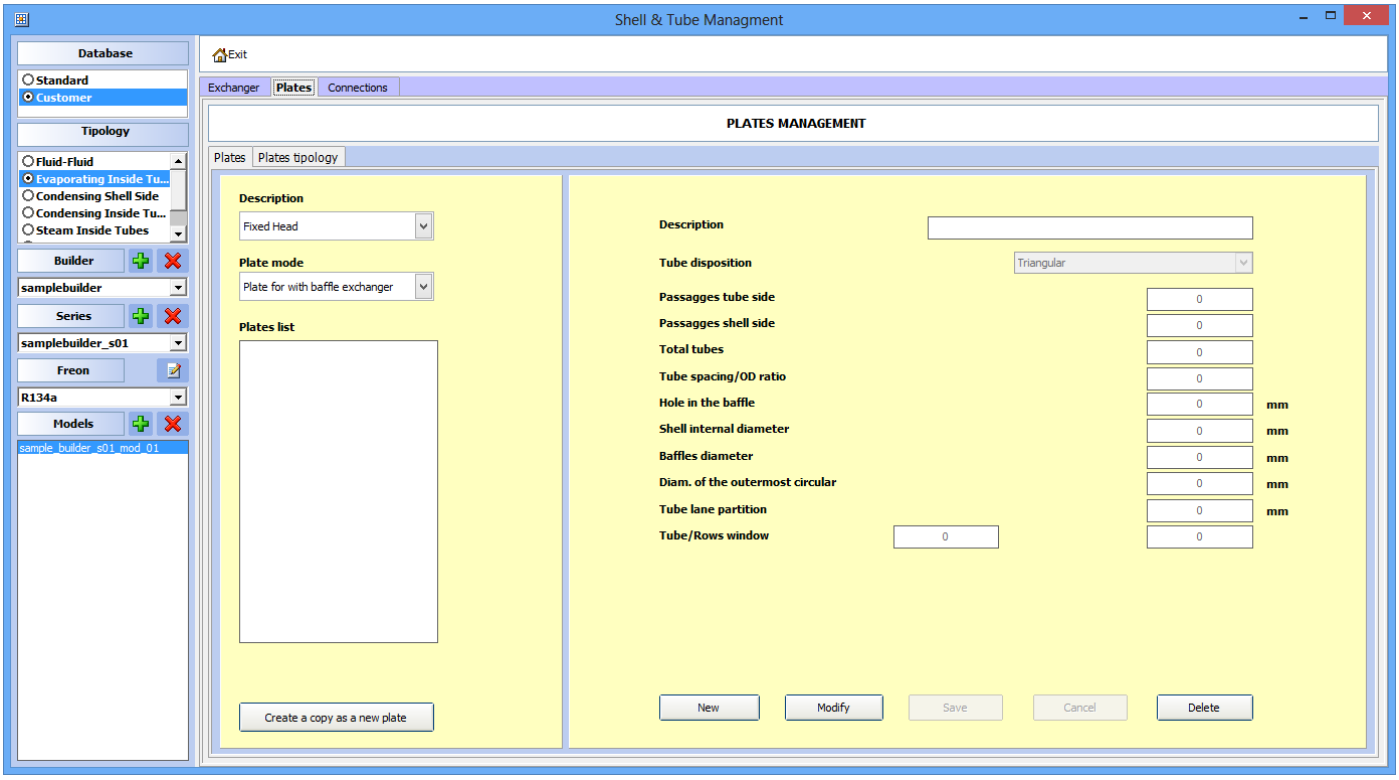


NB: This assumes that the data is already present!

Therefore, we proceed by inserting the tube plate. Let's move on then to the "plates":



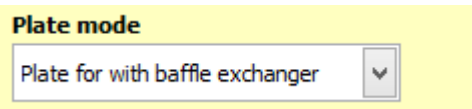
Panel for the management of plates will be displayed:



We can find the type of plate:

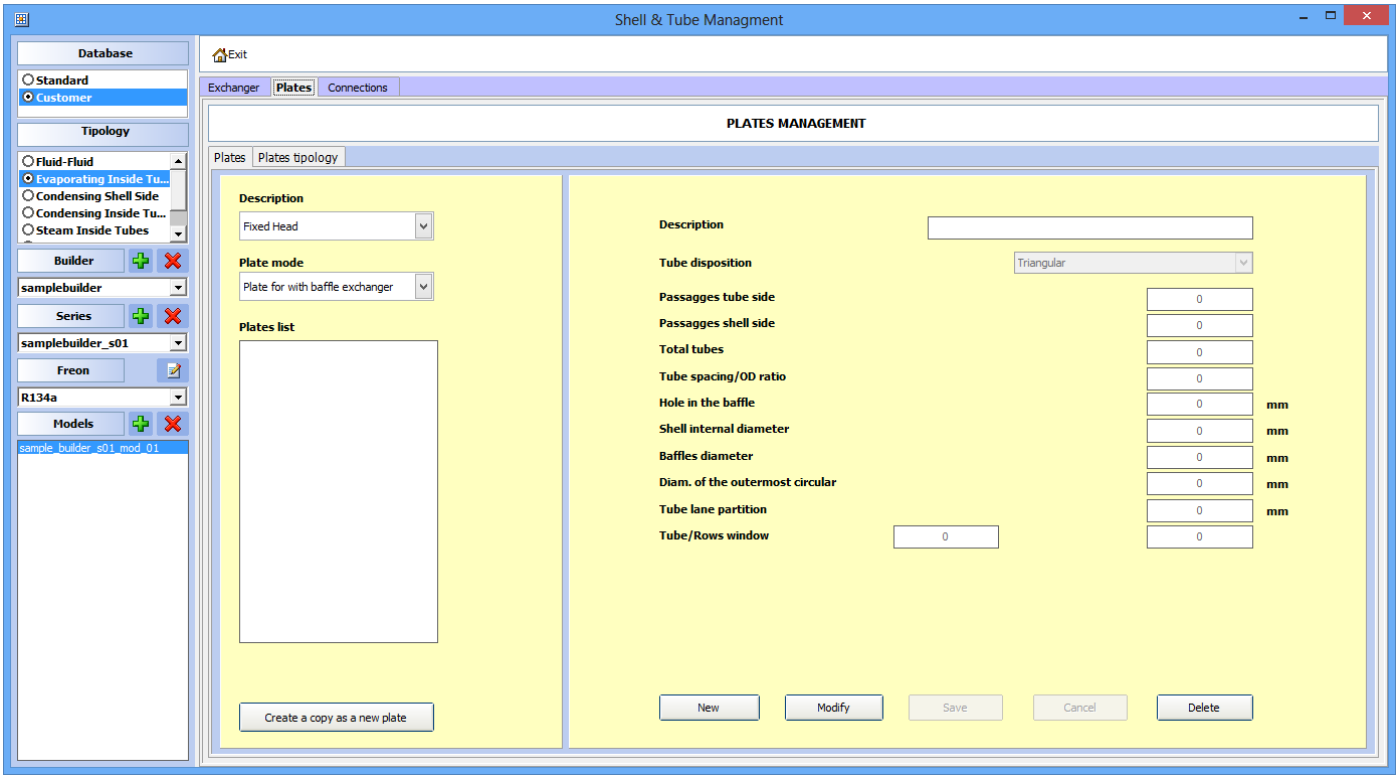
This option includes:
- Plates for heat exchangers with fixed header
- Plate exchanger with "U" tube header
- Plates for heat exchangers with floating header
- Plates for evaporators with "U" tubes header

Then we find the field "Plate mode":

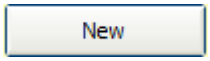


This option includes:
- Plates for heat exchangers with baffles
- Plates for heat exchangers without baffles (e.g. Flooded)

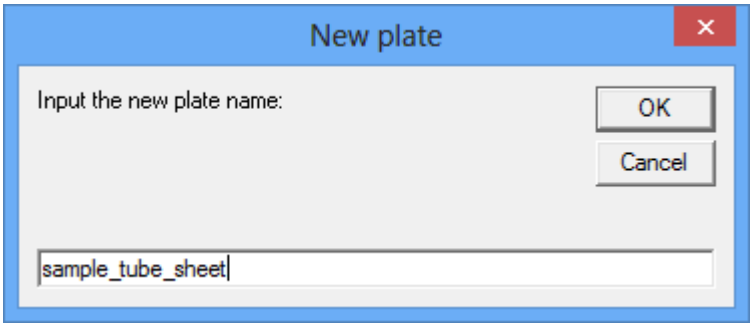
Immediately below are the list of exchangers loaded for the selected type and the relative data:



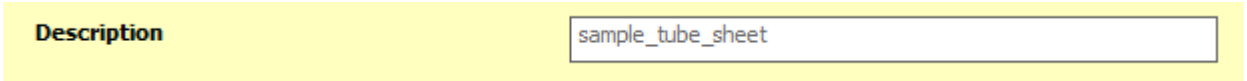
To insert a new plate we click on:



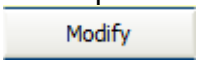
Insert the name of the new plate:



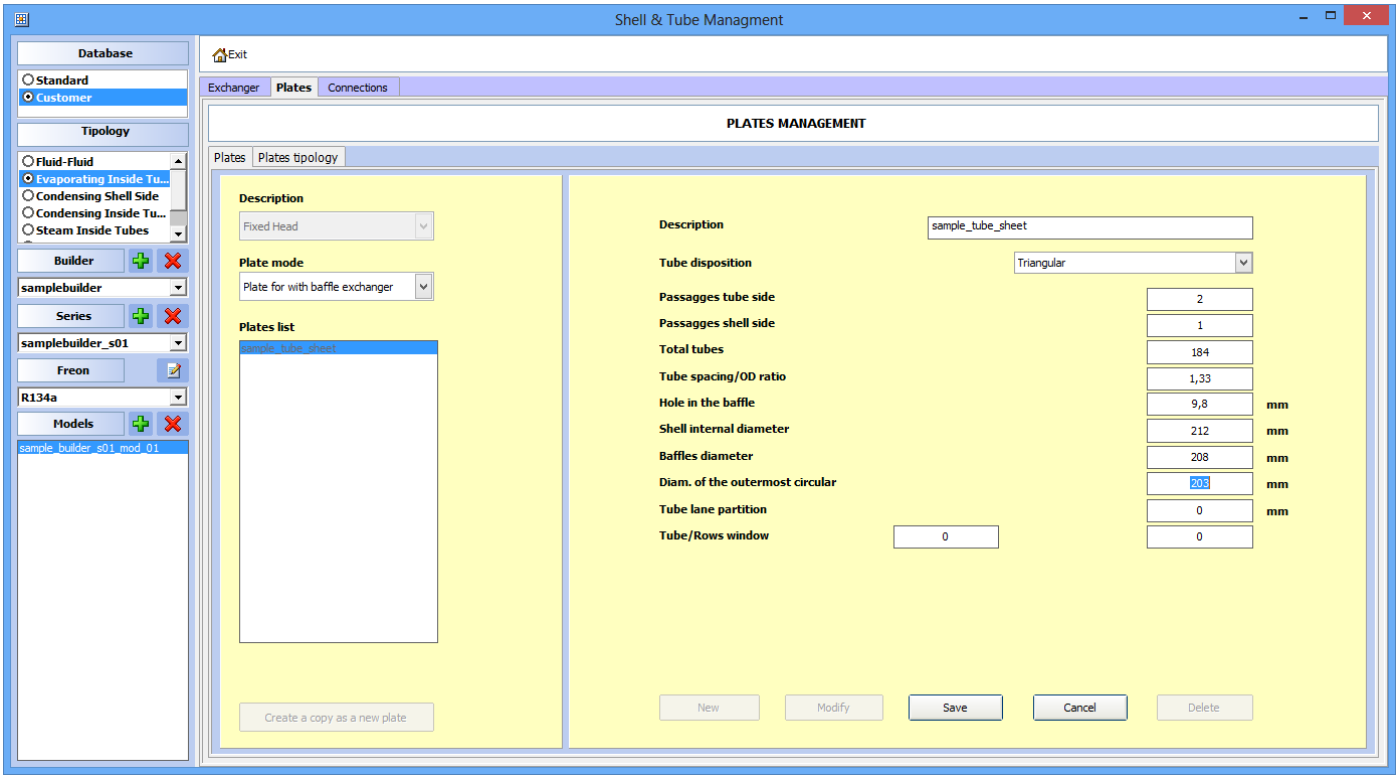
That is placed in the description field:



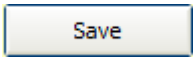
At this point we have to click "Modify" to enter the data:



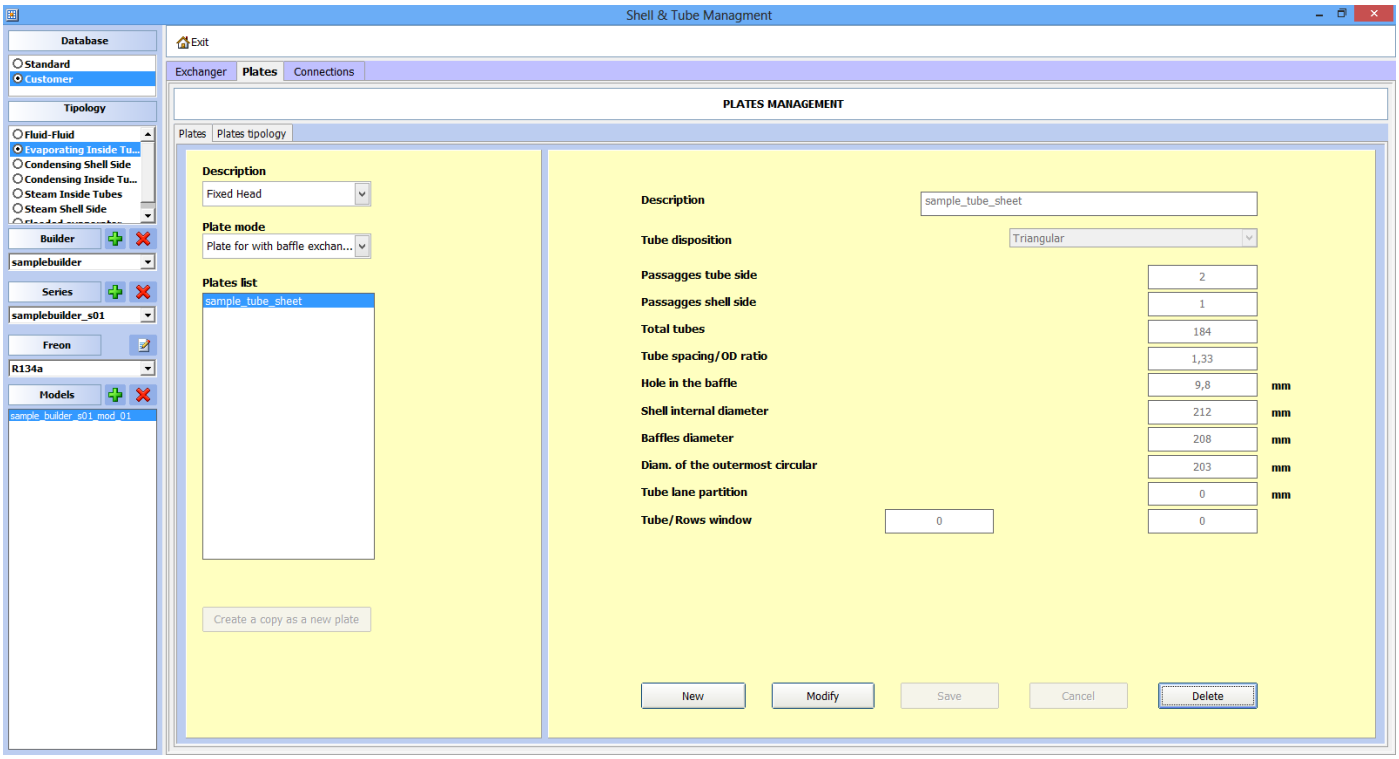
We insert the following sample data:



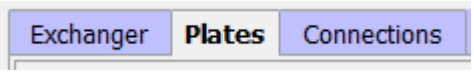
Then we click on Save:



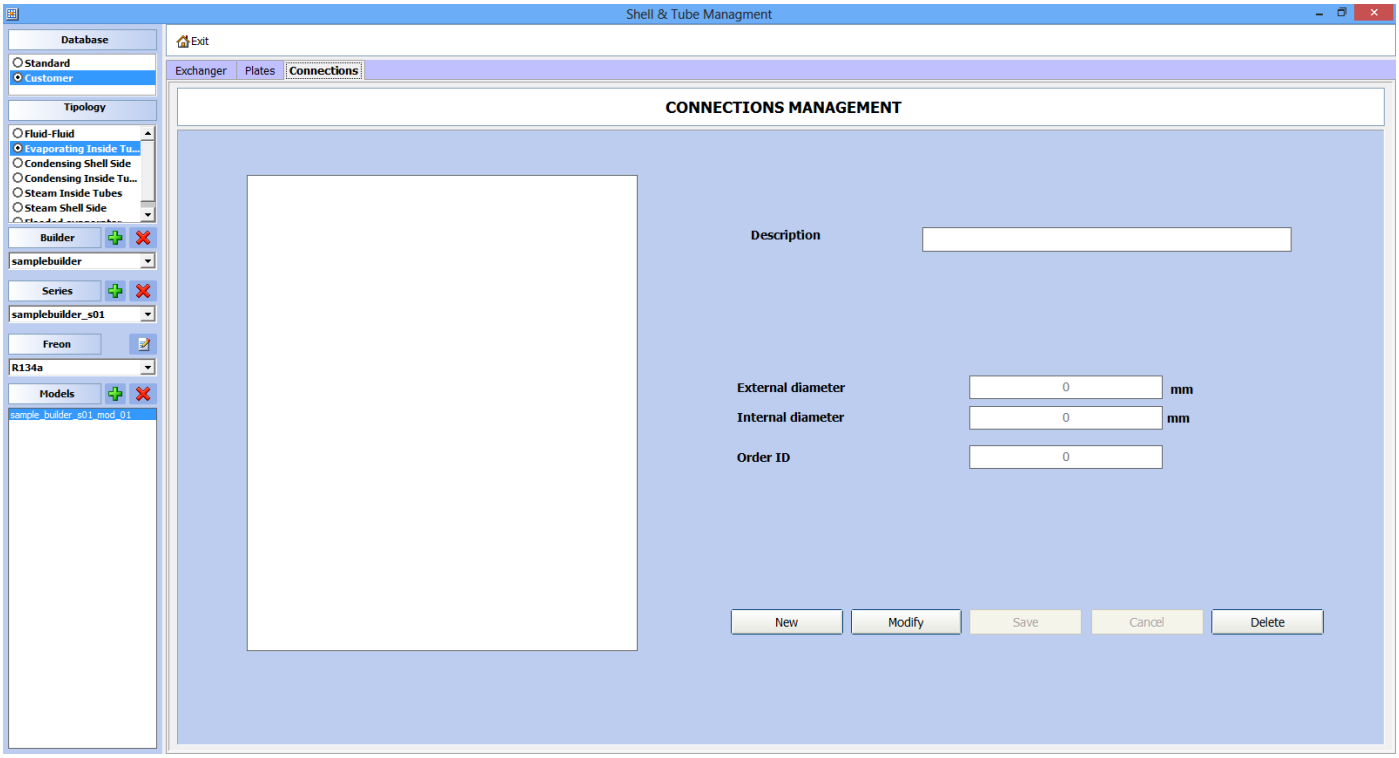
Now the data has been saved in the archive:



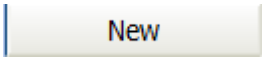
Now let's insert the connections



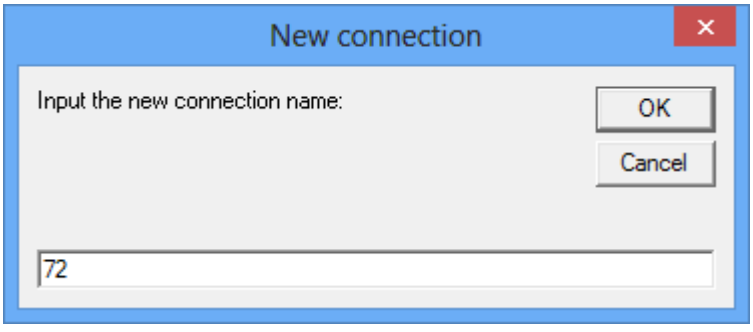
We will see the following connection data



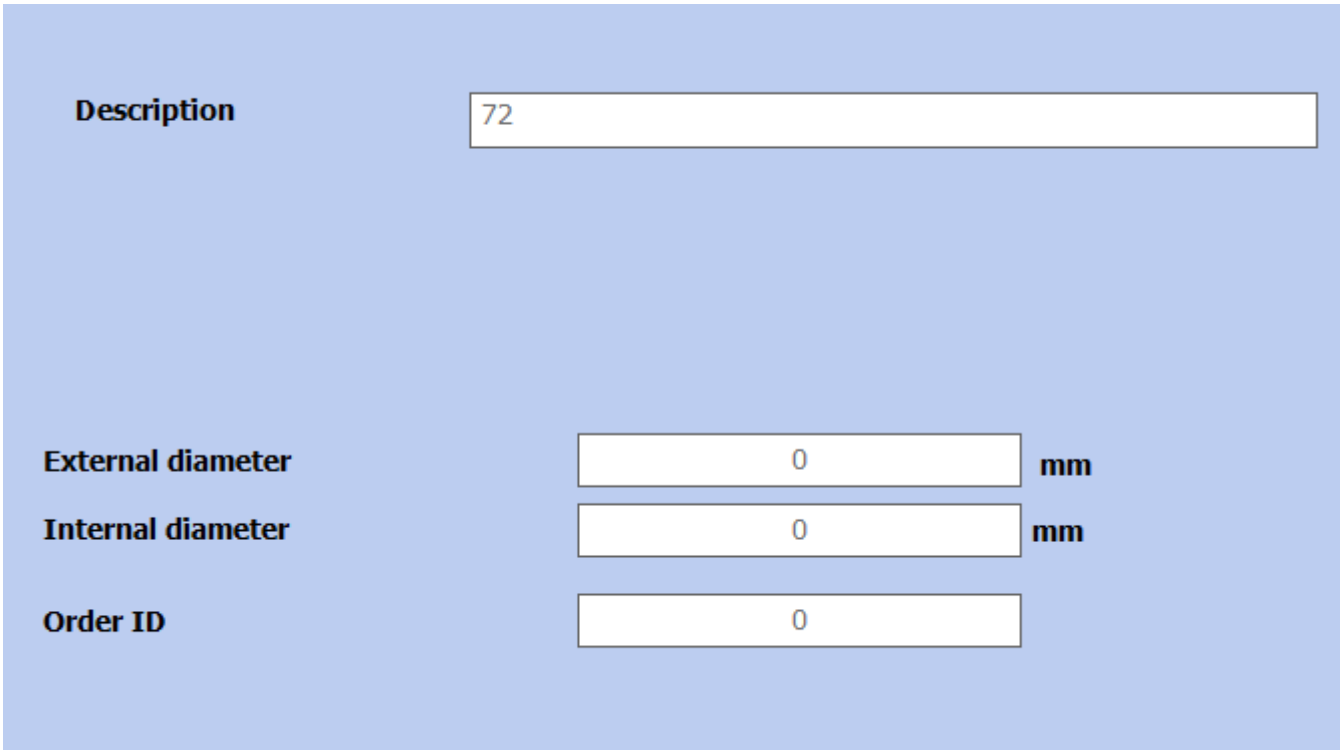
Let's click on "New":



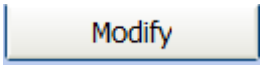
Let's insert the name of the connection:



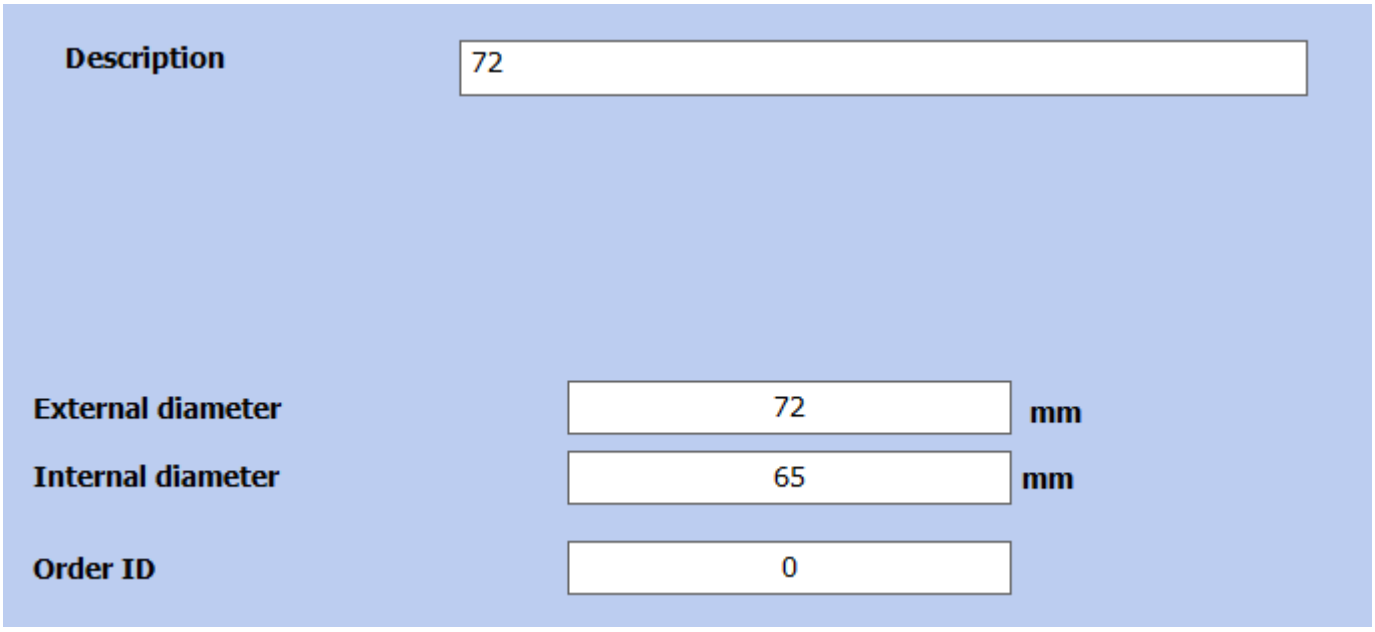
The new value will be added in the archive:



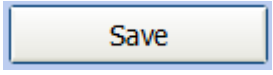
We click on "Modify" to insert the data:



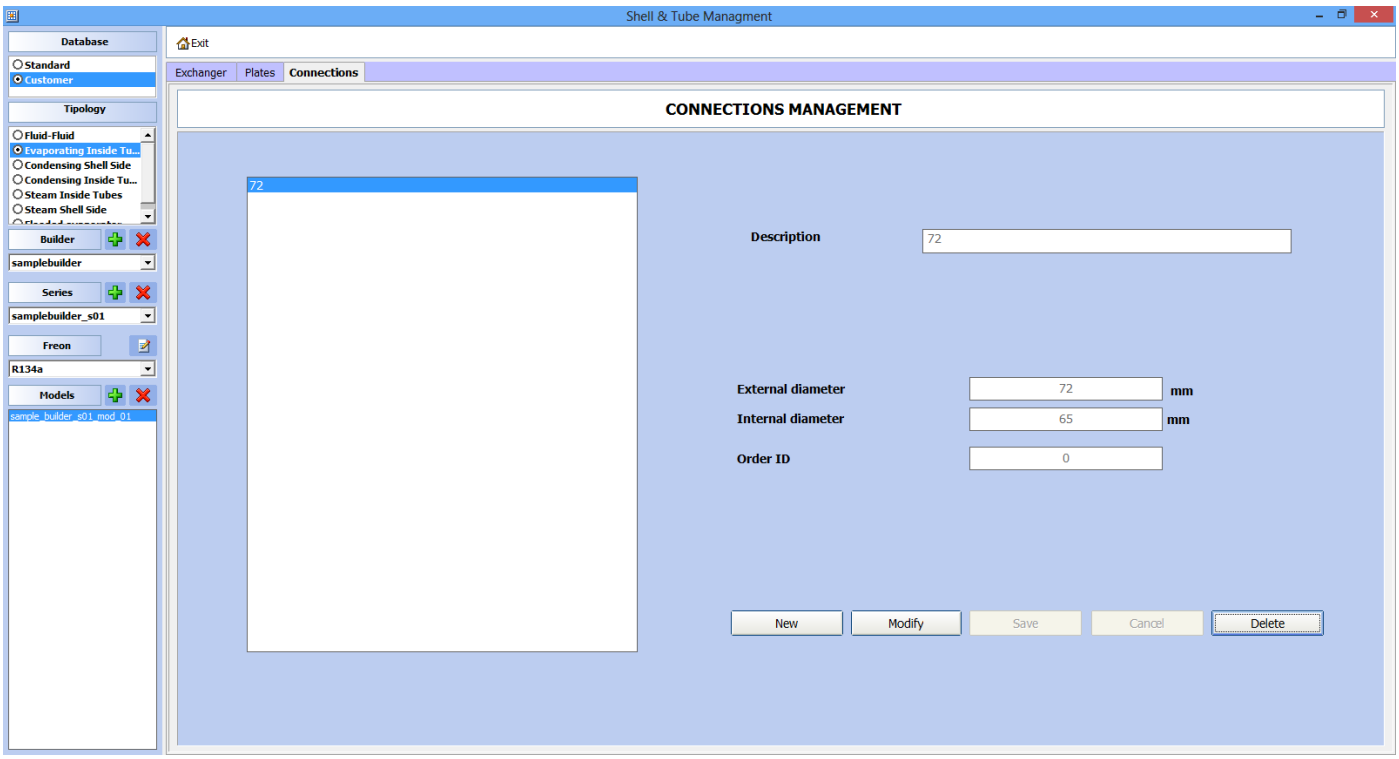
Let us insert the following



Let's click on Save:



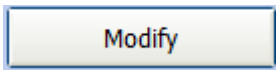
At this point the connection is inserted in the archive:

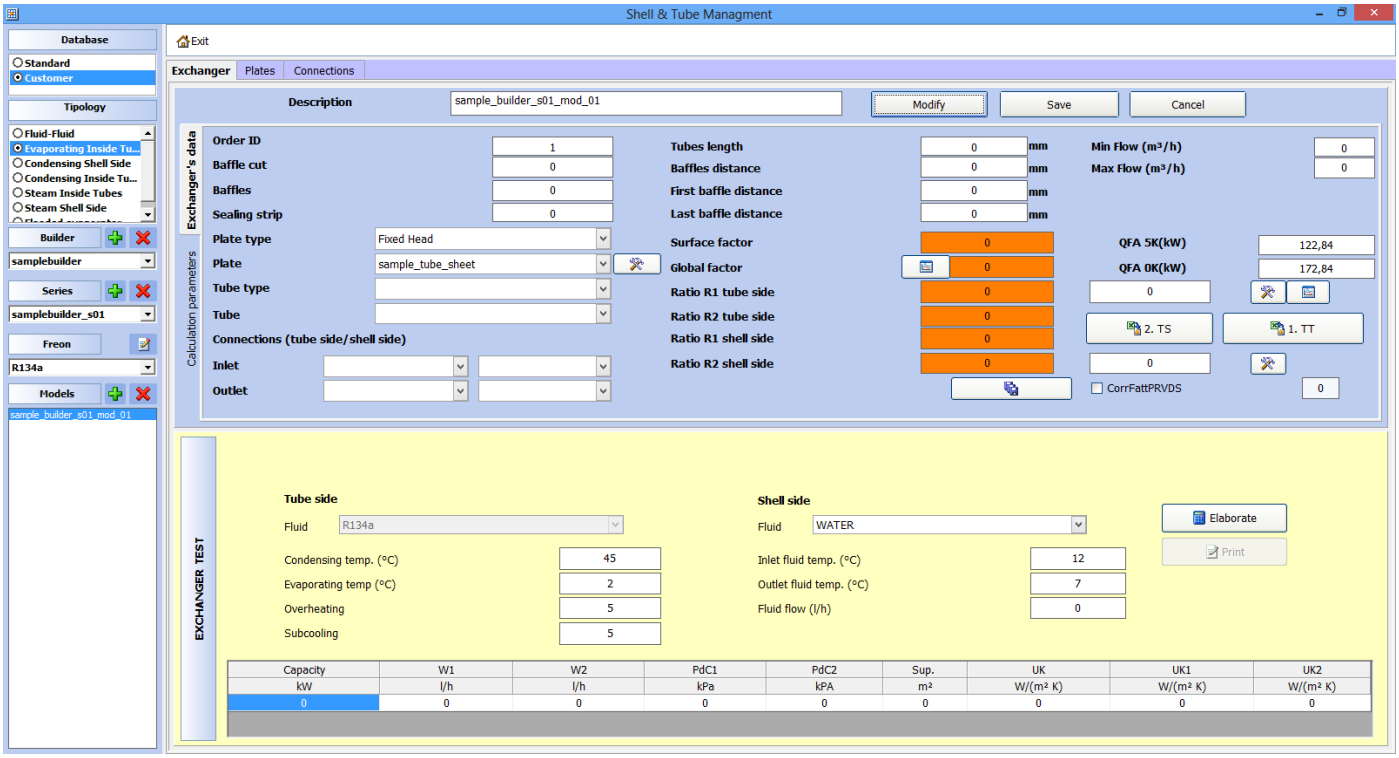


NB: repeat for all models of nozzles required.

Let's go back in the "heat exchanger" to enter the data of the heat exchanger:

We click on "Modify" to insert the data:

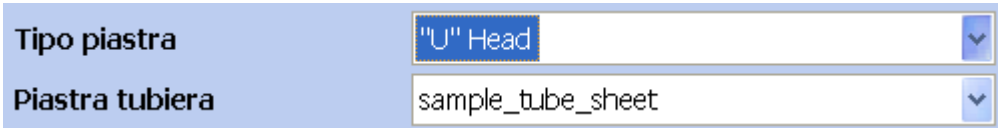




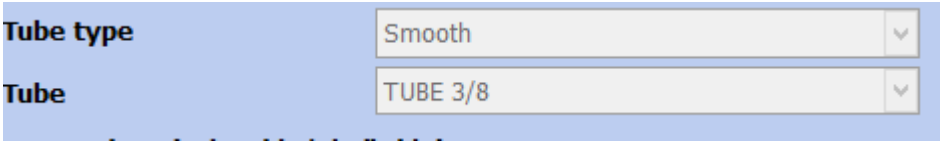
The id field will be compiled automatically.

We change the constructive data:

We insert the type of the plate:

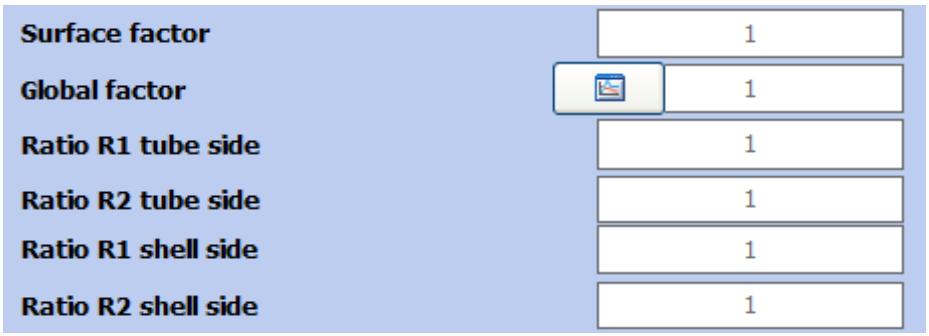


The one of the tube:



And the connections:

We insert the factors:

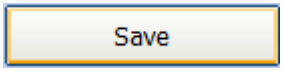


Where:
- The surface factor is a multiplicative factor on total exchange surface
- The global factor is a multiplicative factor on the performance of the heat exchanger
- Factor Ratio R1 tube side influences the heat transfer coefficient on the tube side
- Ratio factor R2 tube side influences the pressure drops on the tube side
- Ratio R1 factor influences the shell side heat transfer coefficient on the shell side
- Ratio factor R2 shell side influence the pressure drops losses on the shell side

NB: All factors have a neutral value such as 1

Optionally we can enter the minimum and maximum supported by the exchanger:

Finally click on the Save button to save the data:



NB: The factors are linked to the refrigerant used before. When you change the refrigerant, the constructive data do not change.