

Shark



Software for the simulation of refrigeration equipment and air conditioners

Index

Software for the simulation of refrigeration equipment and air conditioners.....	1
Shark: application description and scope	4
Starting Shark and program layout.....	4
Performing the simulation	7
Air water chiller.....	7
Creating a new project	7
Adding components to the unit	9
Linking components together	16
Using Copy/Paste to shorten the process	17
Performing calculation in chiller mode.....	19
Performing calculation in heat pump mode.....	24
Performing partial calculation	27
Completing the project with design details	28

Water / Water chiller with fluid hydraulic inversion.....	29
Creating a new project	29
Adding components to the unit	31
Calculation with inverse fluid cycle.....	36
Complete indoor Close Control (Air / Air) unit with water condenser	39
Creating a new project	39
Adding components to the unit	41
Output of the program.....	47
Datasheet of the unit.....	47
Excel tables	48
Projects management	53
Saving a project.....	53
Loading a project	54
Creating a series	55
Functionalities specific of series	57
Advanced simulations	58
Partialization of Air / Water chillers with Scroll Compressors.....	58
Partialization with Screw compressors:.....	64
ESEER and IPLV	65
Factors usage in SHARK.....	68
Factors at component level	68
Factors at unit level, relative to the component.....	69
Rating Example.....	71
Global Factors.....	72
Rating Example.....	73
Archive management.....	75
The two database archive of SHARK	75
How to insert a geometry	75
How to insert a coil	87
How to insert Axial Fans, single tension or EC type	90
Single Tension Fan Insertion	90
Insertion of a EC fan	98
How to insert a Centrifugal Fan	108
How to insert an Airflow regulator	116
How to insert the points in the chart.....	119
Example of application	123
How to add an air filter.....	127
How to insert a Plate Heat Exchangers.....	132
The window insertion of a new heat exchanger plates.....	132
Insertion of a new Plate Heat Exchanger.....	135
Calibration of a heat exchanger.....	142
How to insert a compressor	145
Multiple Envelopes in SHARK.....	153
Practical Example.....	153
Choice of the descriptions.....	154
Association of a new envelope	158
Calculation	161
How to insert a tube.....	164
Shell and Tube Insertion.....	170

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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.

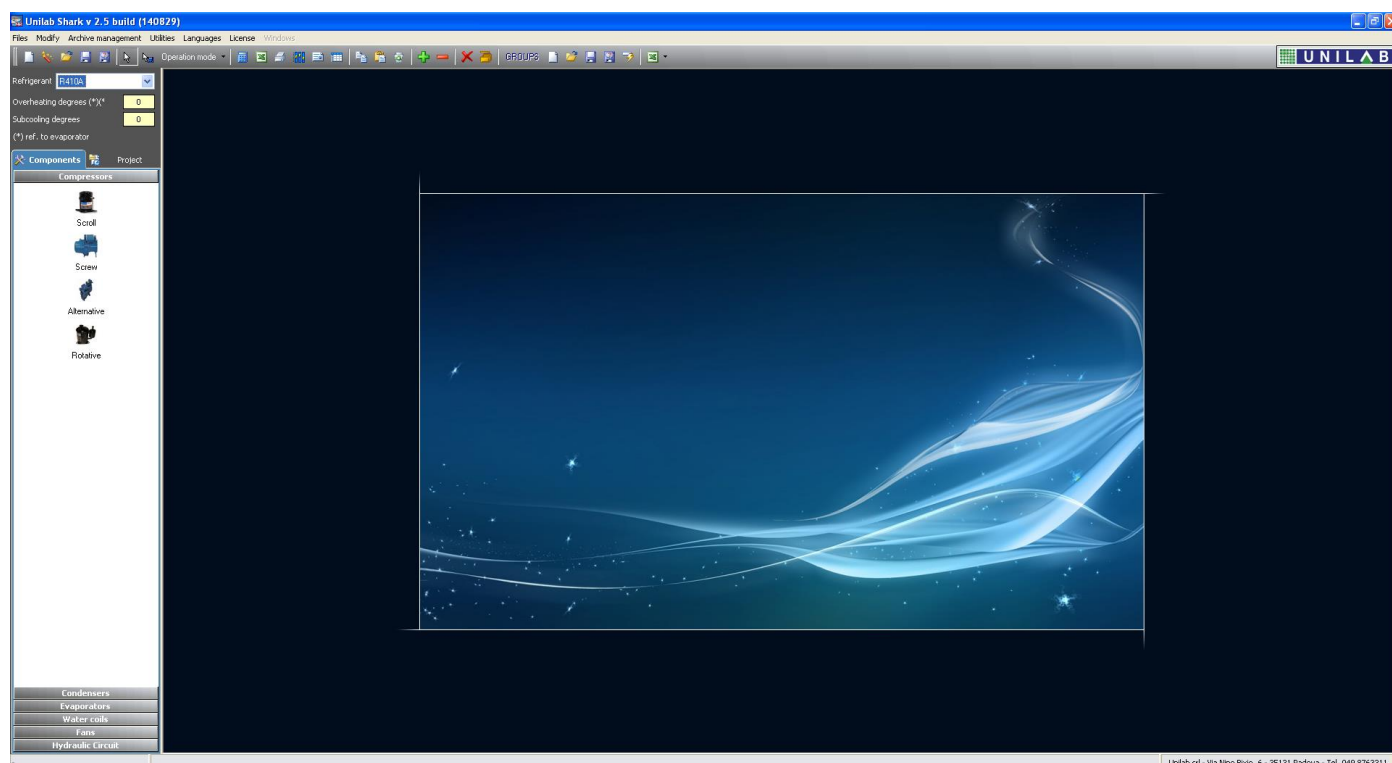
Shark is mainly a simulation program. Its aim is to allow the designer to specify the components of a unit, specify the working thermal conditions and perform a simulation of the unit's operating conditions. Once the simulation is done, it allows the user to create performances tables and datasheet, 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:

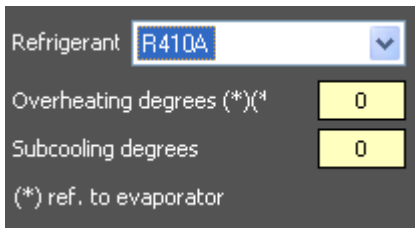


The main program's window is arranged in three different parts.

The top part contains the main tools:



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



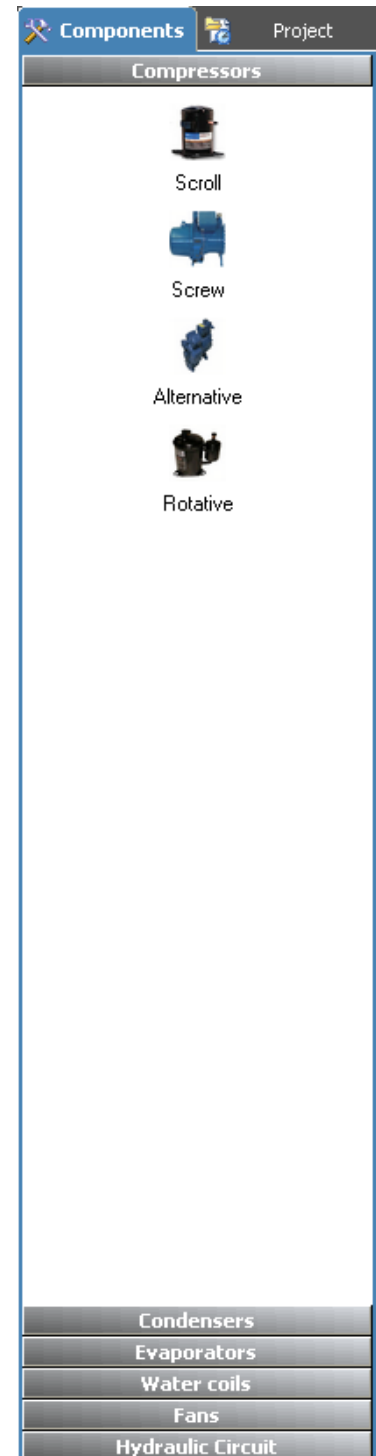
Overheating degrees in this mark is referred to the evaporator (if present). Condenser overheating will be requested during calculation.

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

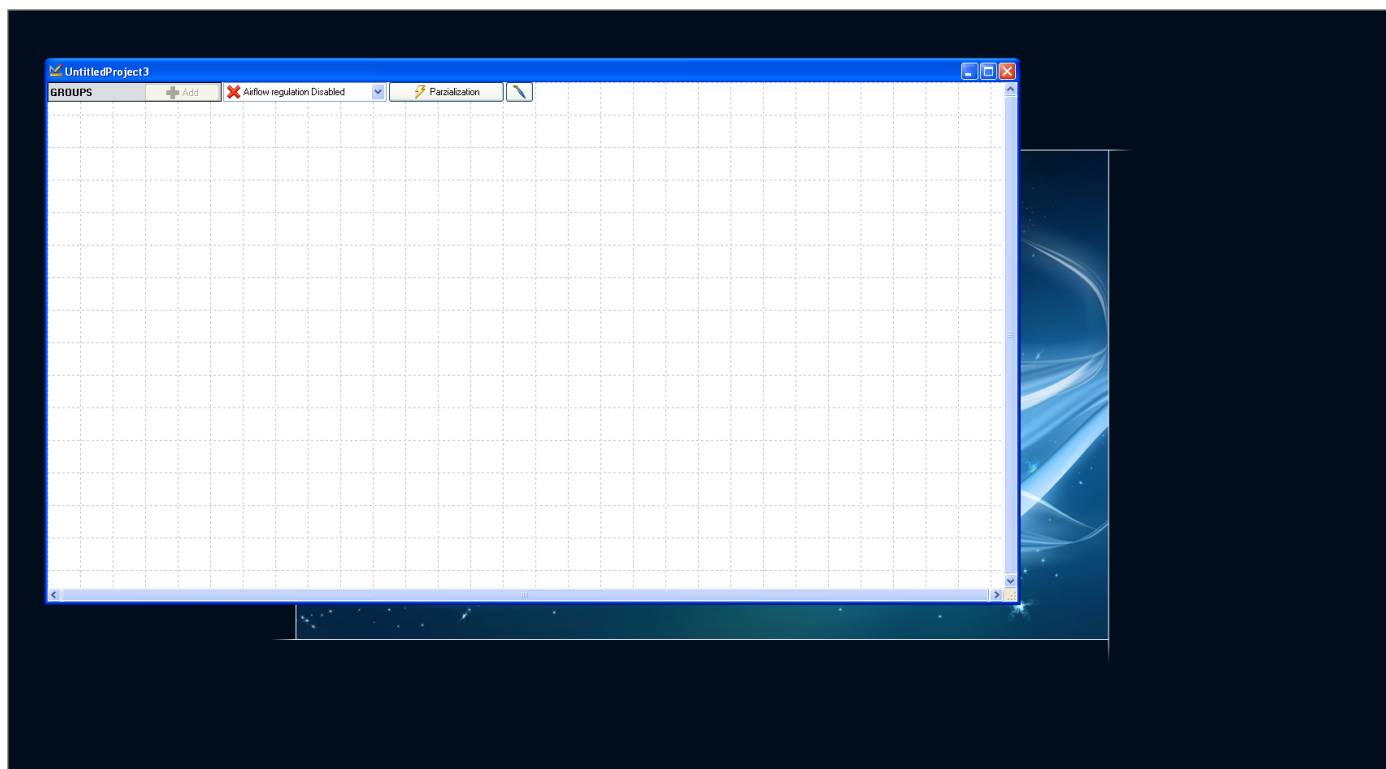
By clicking one of these icons, the corresponding component will be added to the project.

PLEASE NOTE:

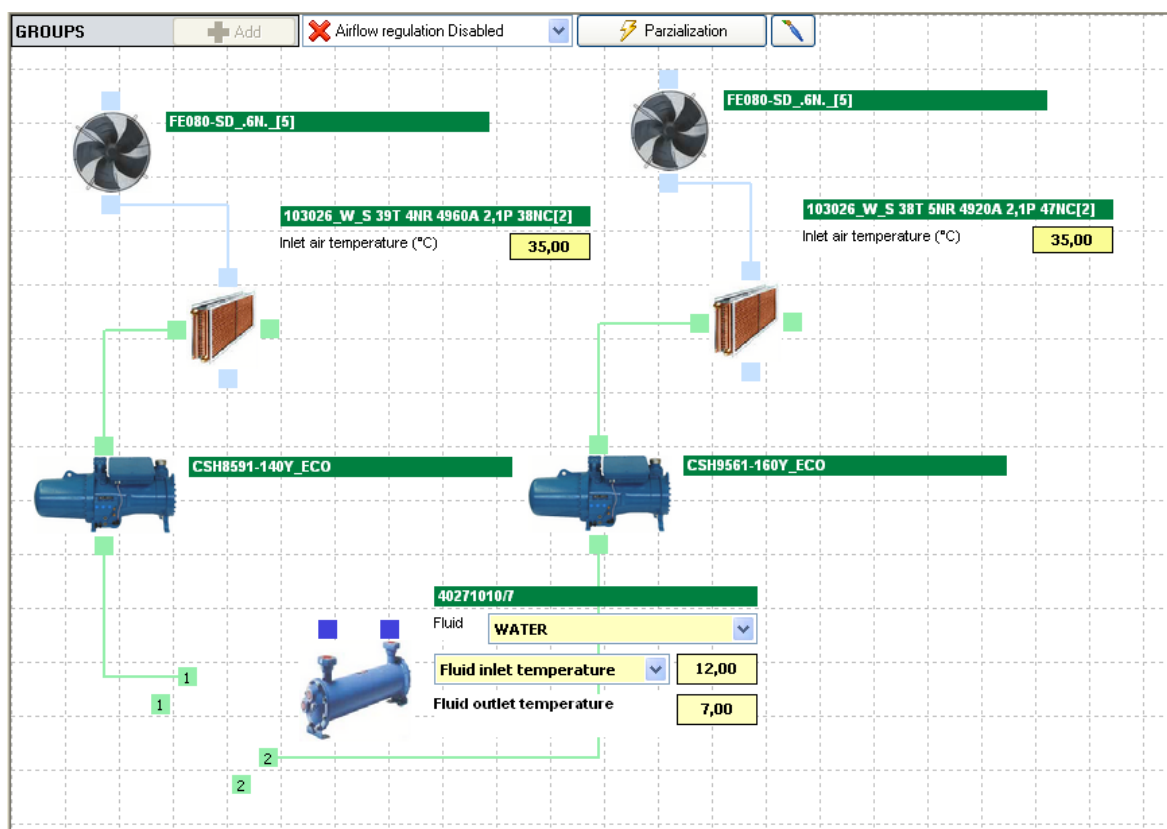
Each icon represents a GROUP of components of the same type, not a sole component.



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:



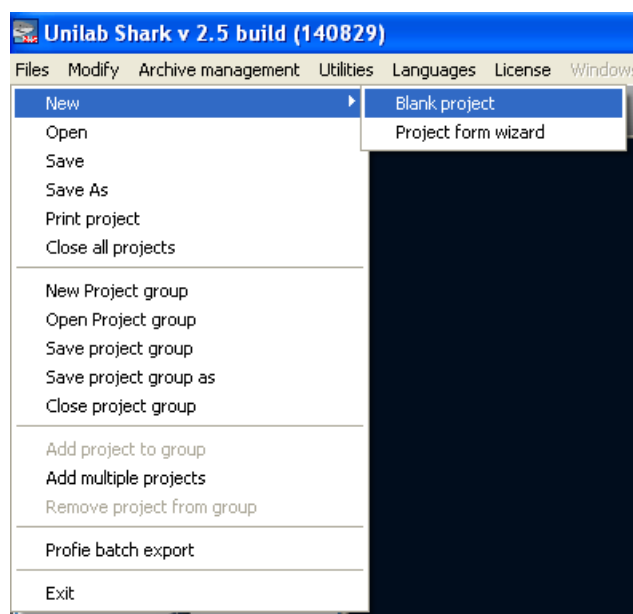
Performing the simulation

Air water chiller

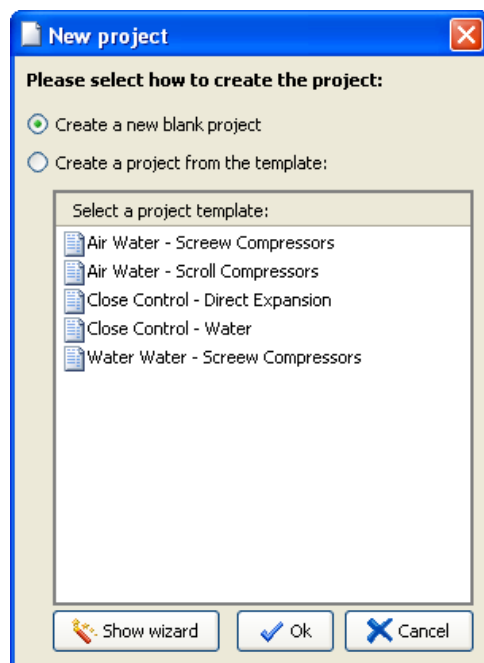
For a better understanding of the main functionalities of the software Shark, let's start with creating an Air Water chiller project.

Creating a new project

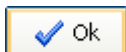
Now we can create a blank project:



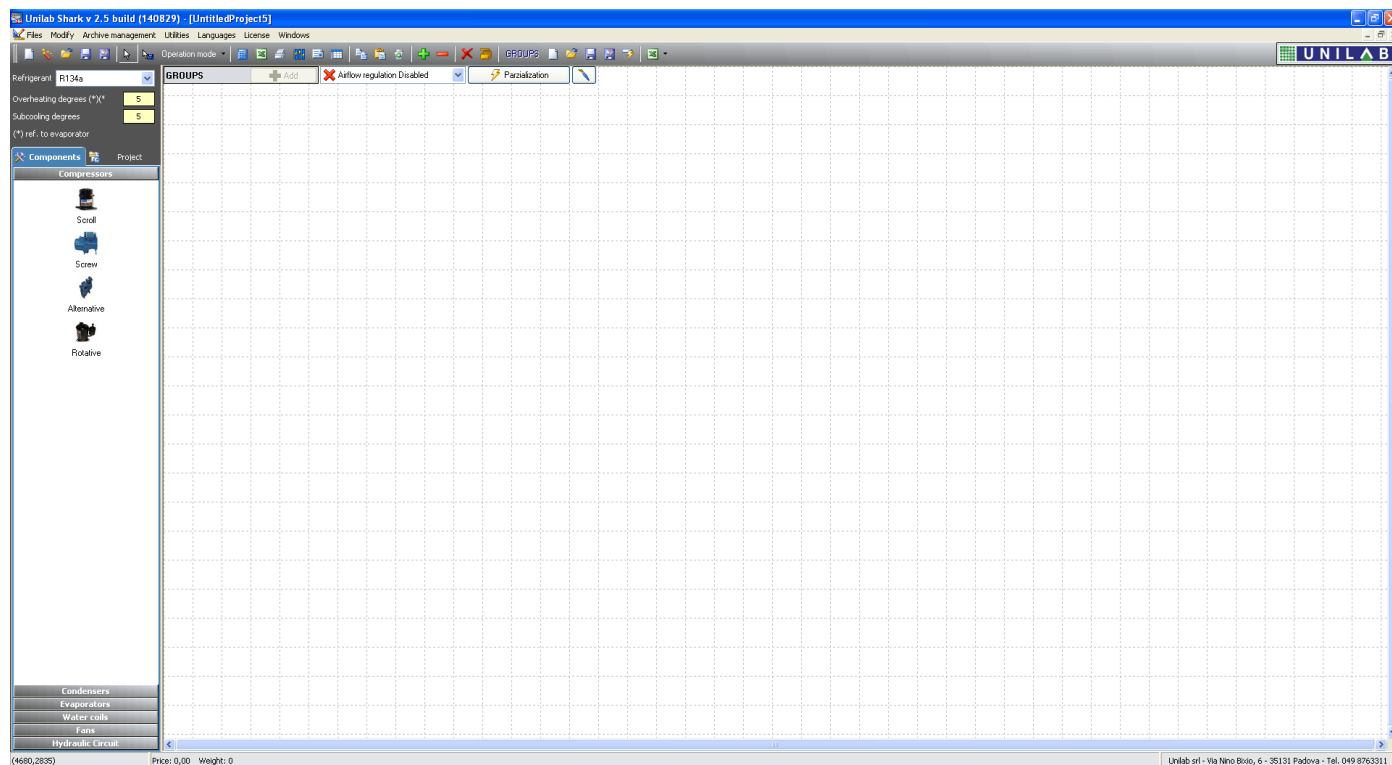
A new window will appear, that lets you load a project template. Select again "Create a new project":



Now click "OK" to continue:



A new blank project will appear:



Now we should set the main settings of the project:

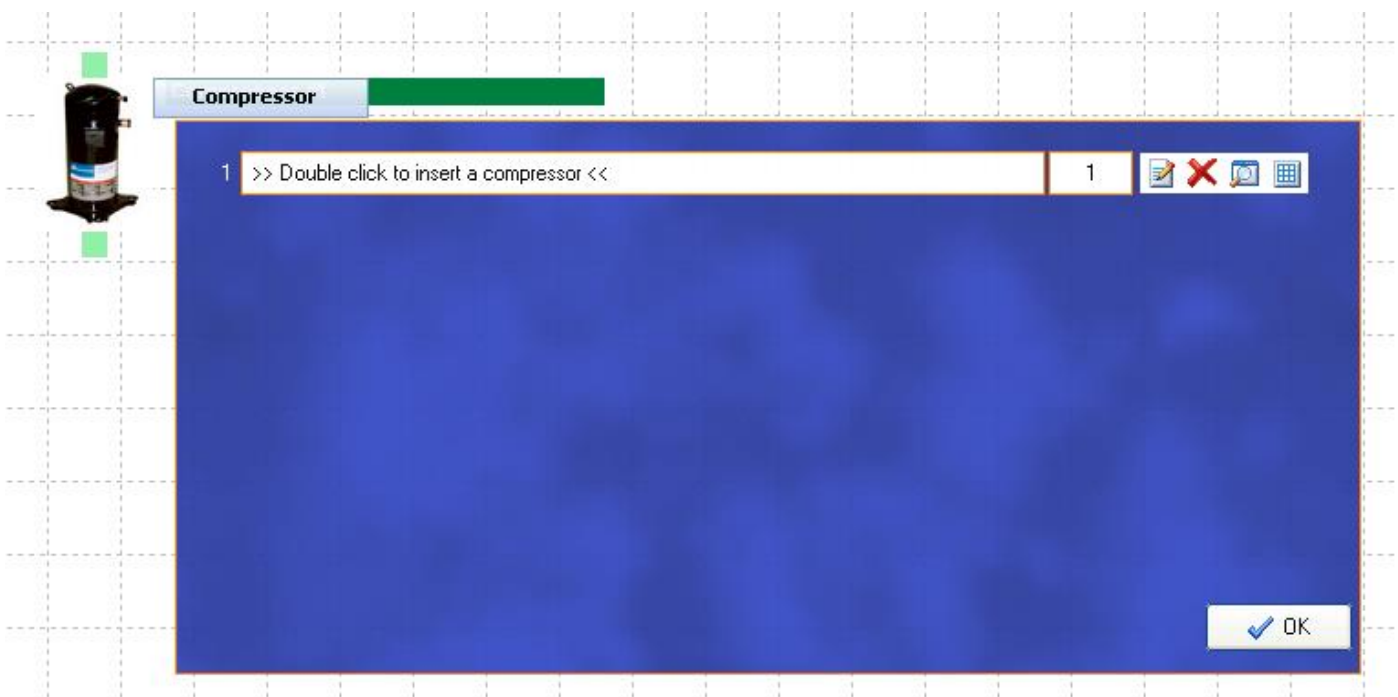
Refrigerant	<input type="text" value="R410A"/>
Overheating degrees (*) (*)	<input type="text" value="5"/>
Subcooling degrees	<input type="text" value="5"/>
(*) ref. to evaporator	

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:

Compressor

1	ZP103KCE-TFD	2	
2	<div style="border: 1px solid black; padding: 2px;"> ZP36KSE-TFM [NC: 8,80 kW] ZP42KSE-TFM [NC: 10,40 kW] ZP54KSE-TFM [NC: 13,40 kW] ZP61KCE-TFD [NC: 15,10 kW] ZP67KCE-TFD [NC: 16,50 kW] ZP72KCE-TFD [NC: 17,60 kW] ZP83KCE-TFD [NC: 20,30 kW] ZP90KCE-TFD [NC: 22,20 kW] ZP103KCE-TFD [NC: 25,80 kW] ZP120KCE-TFD [NC: 30,60 kW] </div>	1	

OK

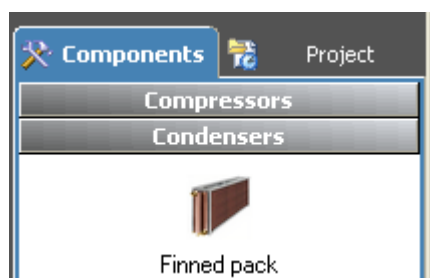
After selecting the compressor model wanted, we should set the number of compressors in tandem of the same type, by specifying its quantity in the field next to the model:

Compressor

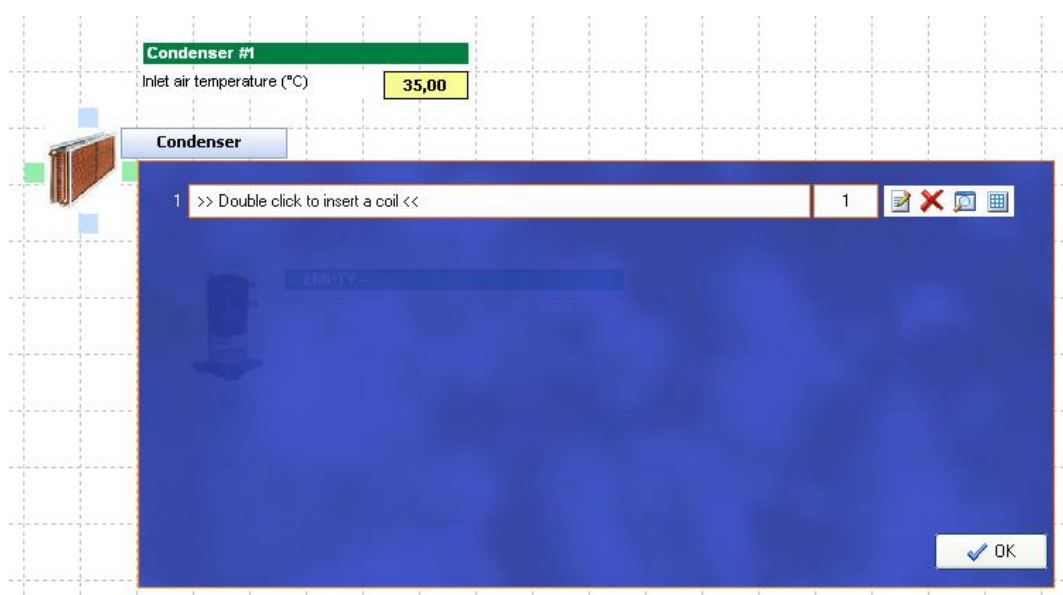
1	ZP103KCE-TFD	2	
2	>> Double click to insert a compressor <<	1	

OK

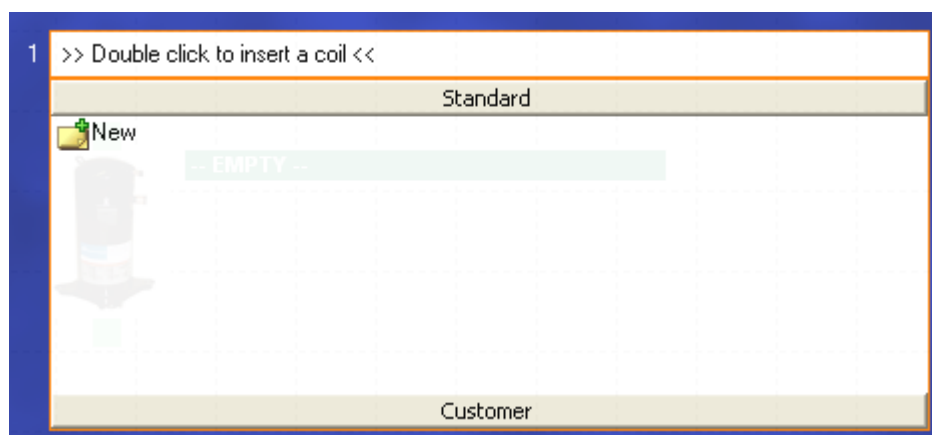
Let's now add the condenser of finned pack type:



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:

Coil Data

Coil model

J5_3R_1.8Pa_R410a

Create

Geometry

072522_C_5

Details

Finned length

1100,00

mm (2

Height

1200,00

mm (2

Fin spacing

1,8

mm (2

Tubes per row

48,00

Number of rows

3

Number of circuits

12

Fin material

Aluminium

Tube material

Copper

Save

Exit

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

Coil Data

Coil model

J5_3R_1.8Pa_R410a

Create

Geometry

Customer

Details

Finned length

1100,00

mm (2

Height

1200,00

mm (2

Fin spacing

1,8

mm (2

Tubes per row

48,00

Number of rows

3

Number of circuits

12

Fin material

Aluminium

Tube material

Save

Exit

Customer

ACM

DELTA COILS

UNILAB

072522_C_C

102519_C_S

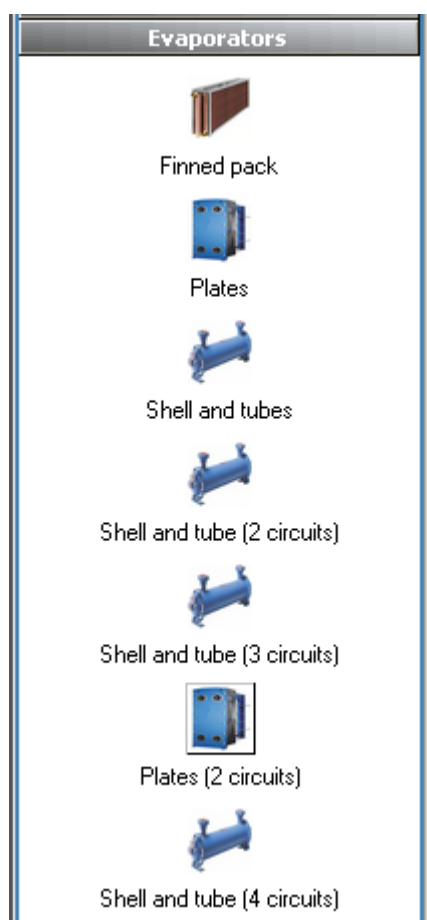
102522_C_C

102522_C_S

102522_L_S

Once ready, click "Save" to continue.

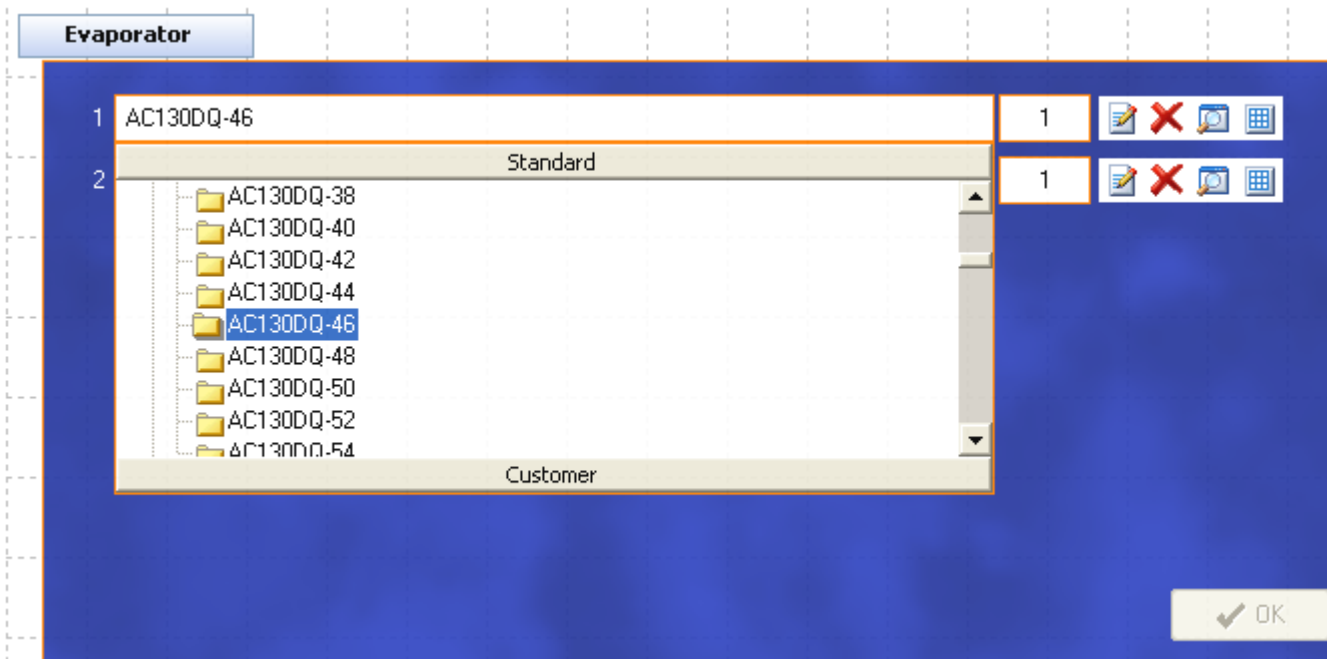
Now let's select the evaporator, which will be a plate heat exchanger. We will develop a new double circuit unit, so we have to select a "2 circuits plate heat exchanger":



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



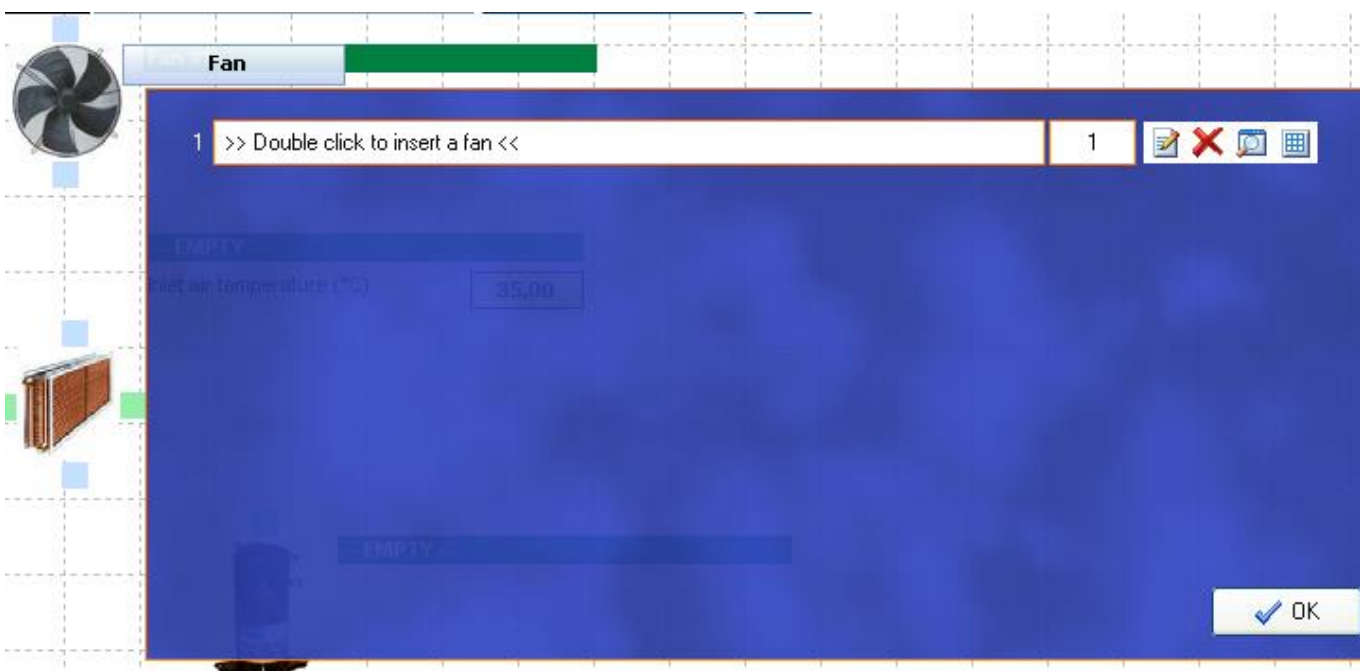
In the usual model field, double click to select the model that we want for this project:



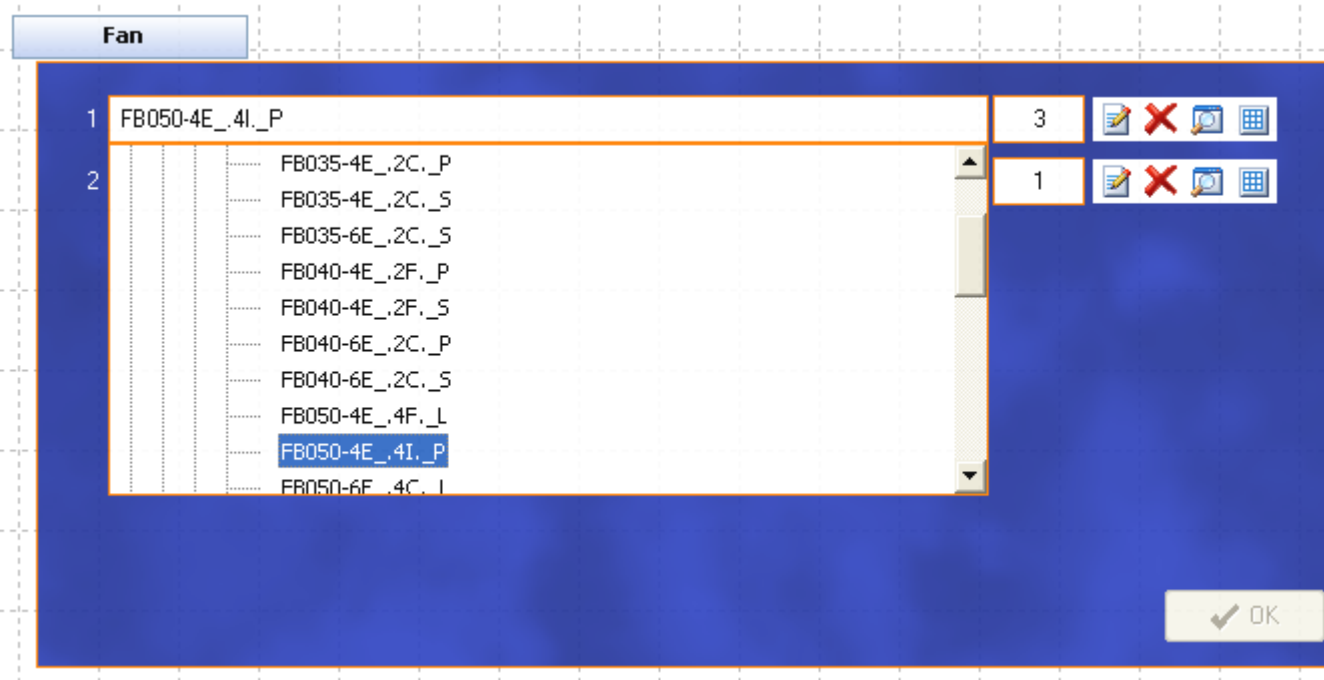
Let's now add a fan to the project. We will use a monophase axial fan:



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



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

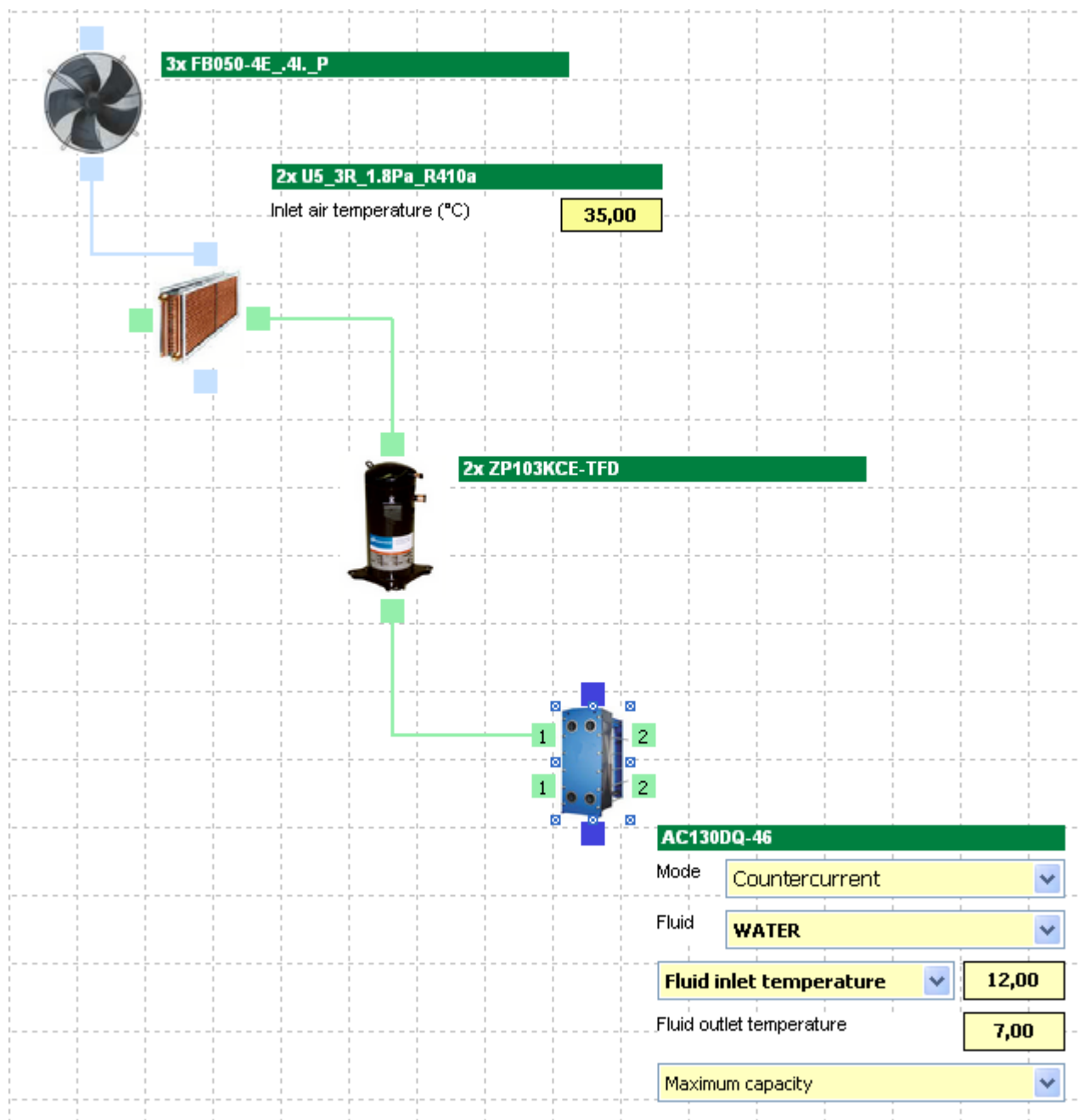


And we specify 3 fans for the same coil:



Linking components together

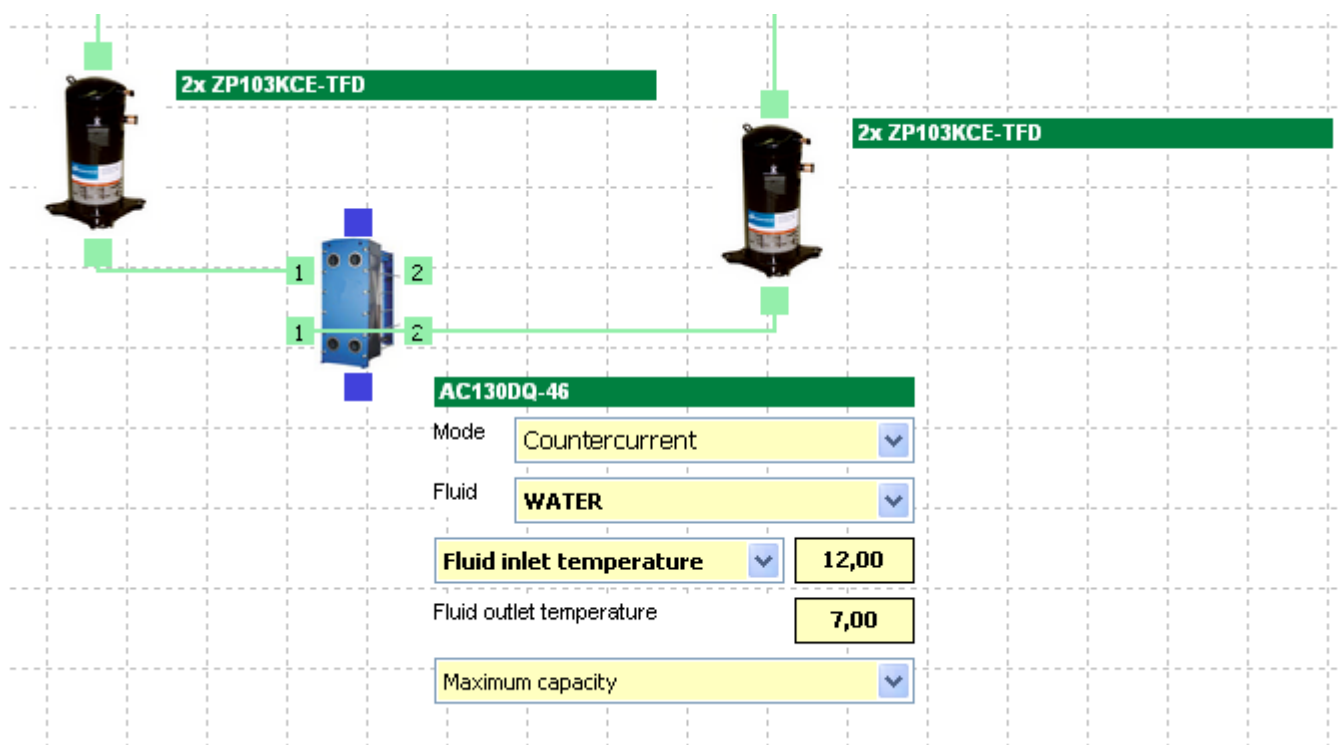
Now we should link the components together so that the program can understand how they are working. This is simply obtained by dragging a line between the link boxes of the same colors, independently from their position. The result should be like this:



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:

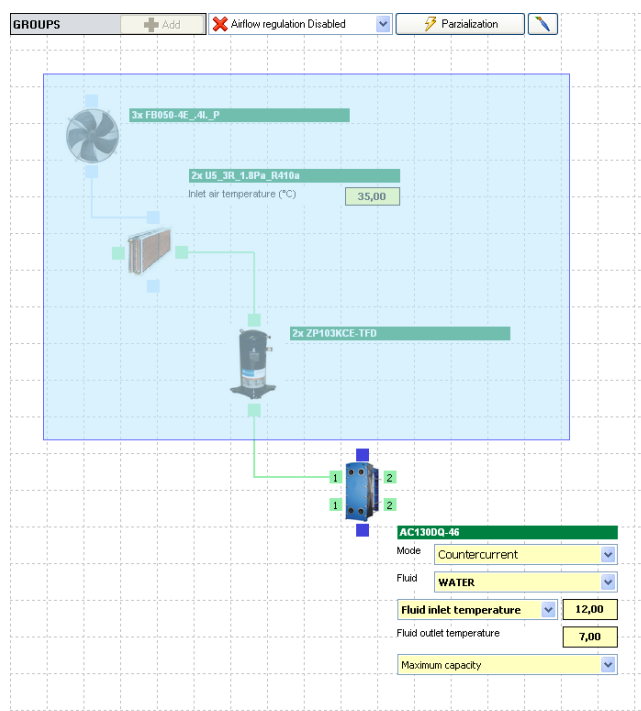


This is wrong, because the program will misunderstand the circuiting of the unit.

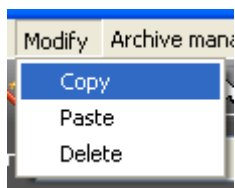
Using Copy/Paste to shorten the process

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

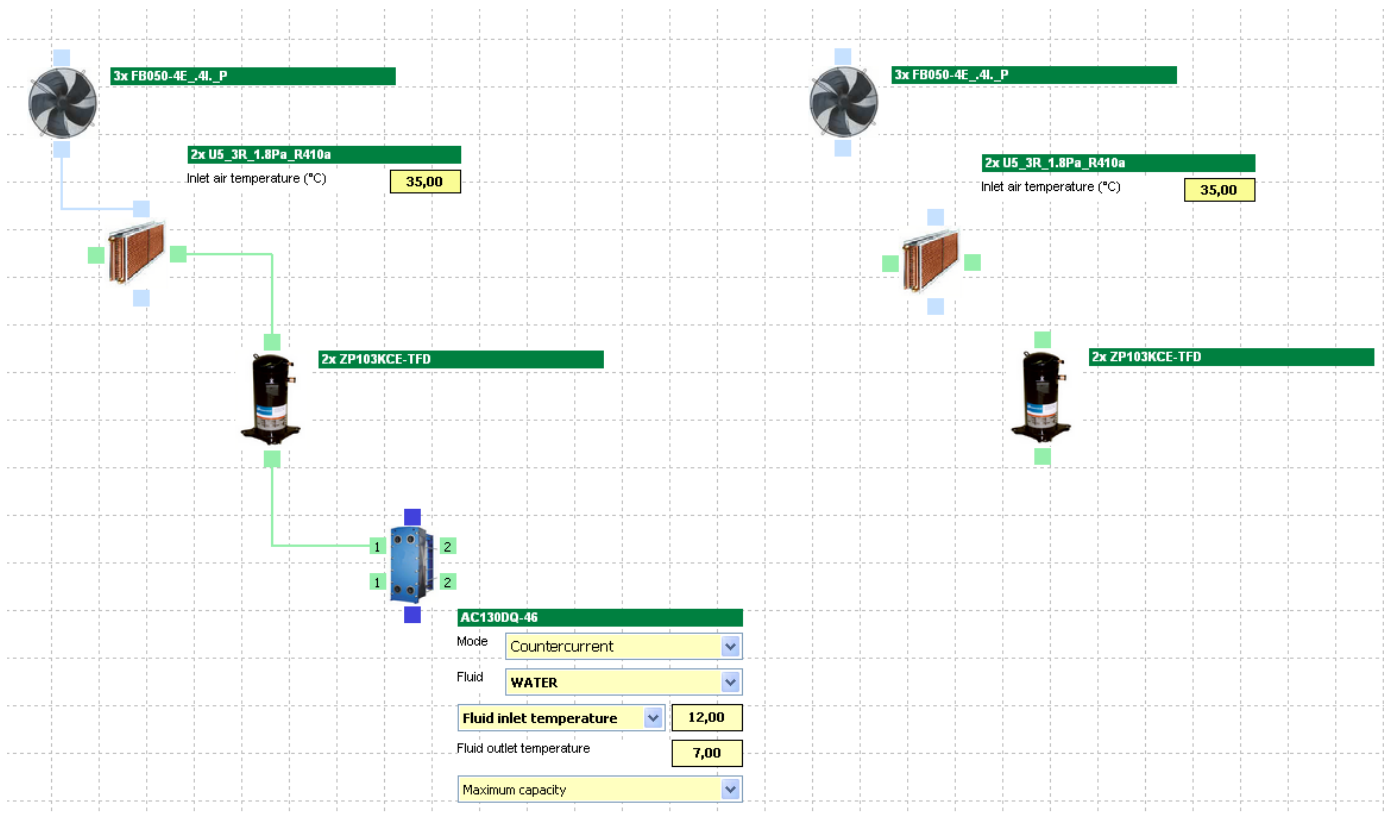
First we just draw a rectangular selection over the three components that we want to duplicate:



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



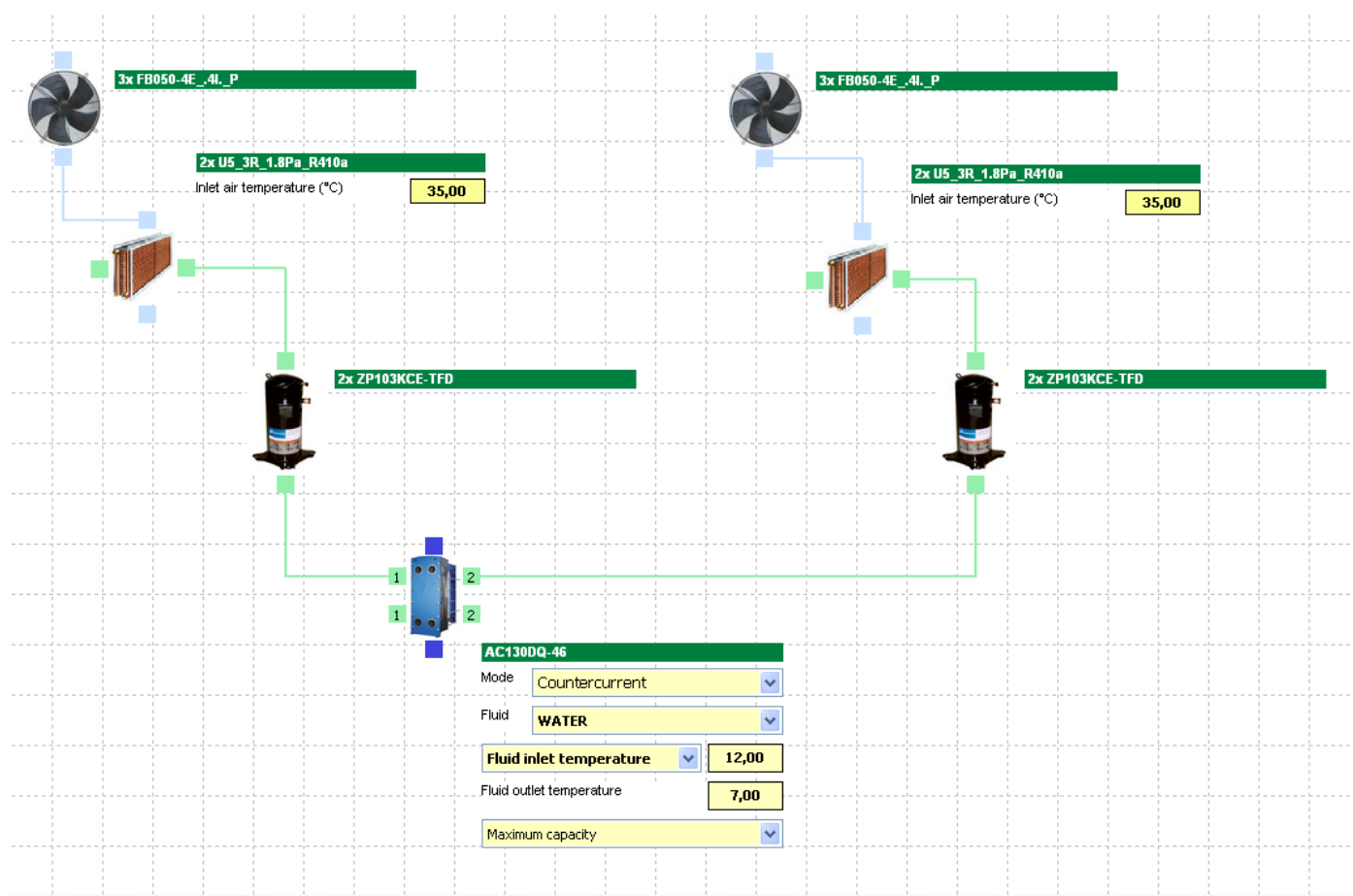
Then we click on "Paste" on the same menu and we will get this result:



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:

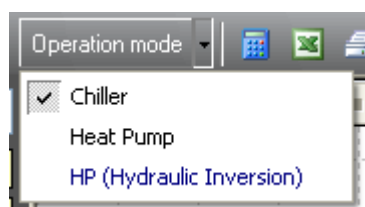


Performing calculation in chiller mode

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

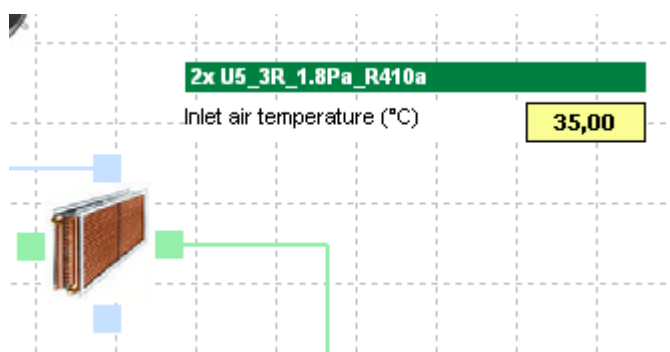


And the operation mode is set to "Chiller":

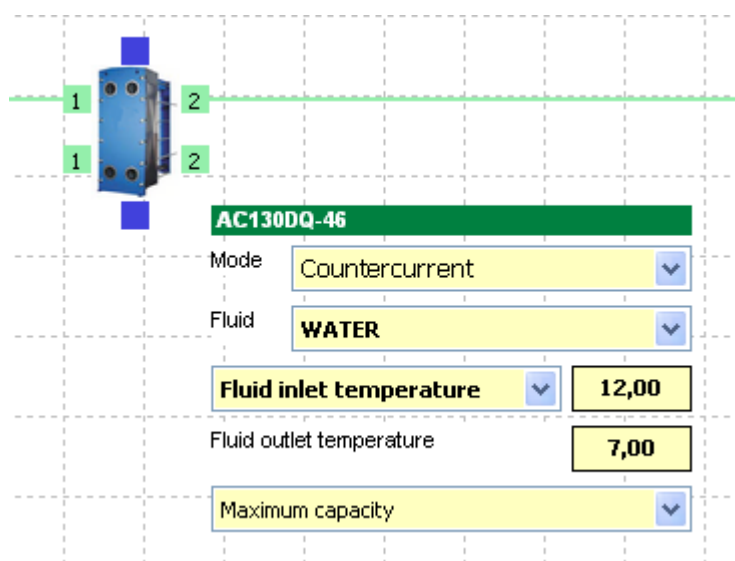


Now we shall check the exchanger's fluids conditions.

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



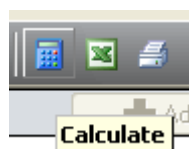
Then the fluid / calculation conditions for the evaporator (please note the Countercurrent mode is selected):



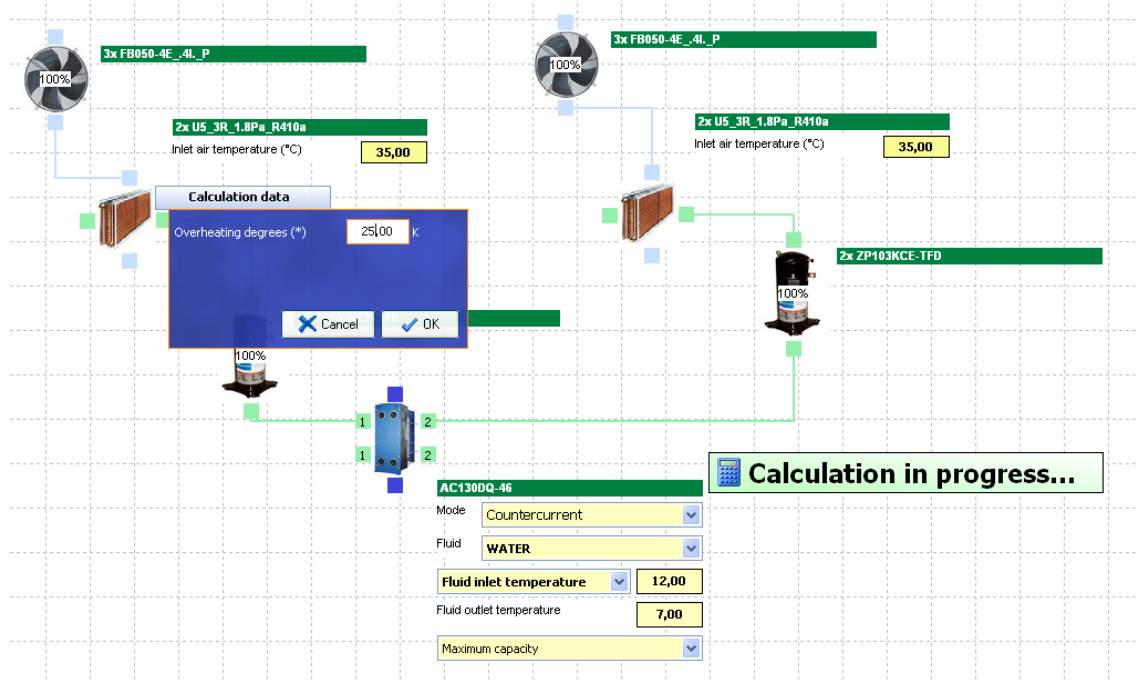
PLEASE NOTE:

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.

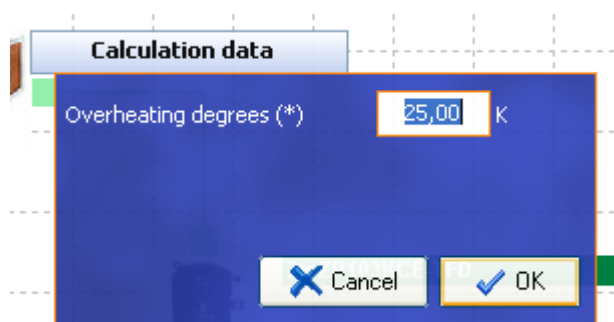
Finally we can click on the calculate button:



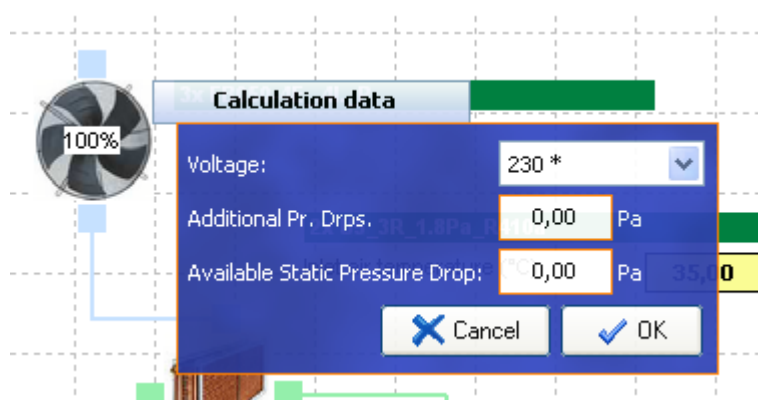
Now the program will see the variables that we specified, and the ones that are missing, and will show small input windows like the following for us to specify the missing parameters:



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

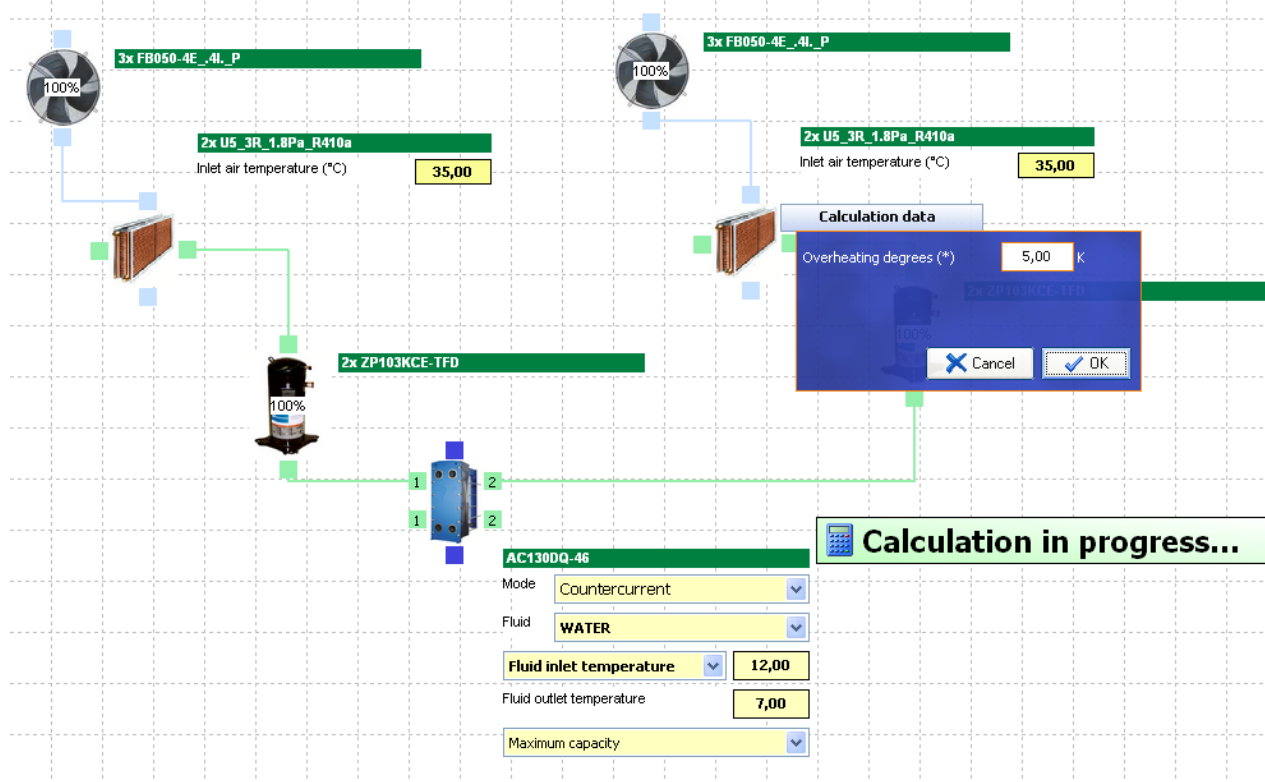


The second is to specify the fan selected voltage and if we want we can add some pressure drop to be considered:

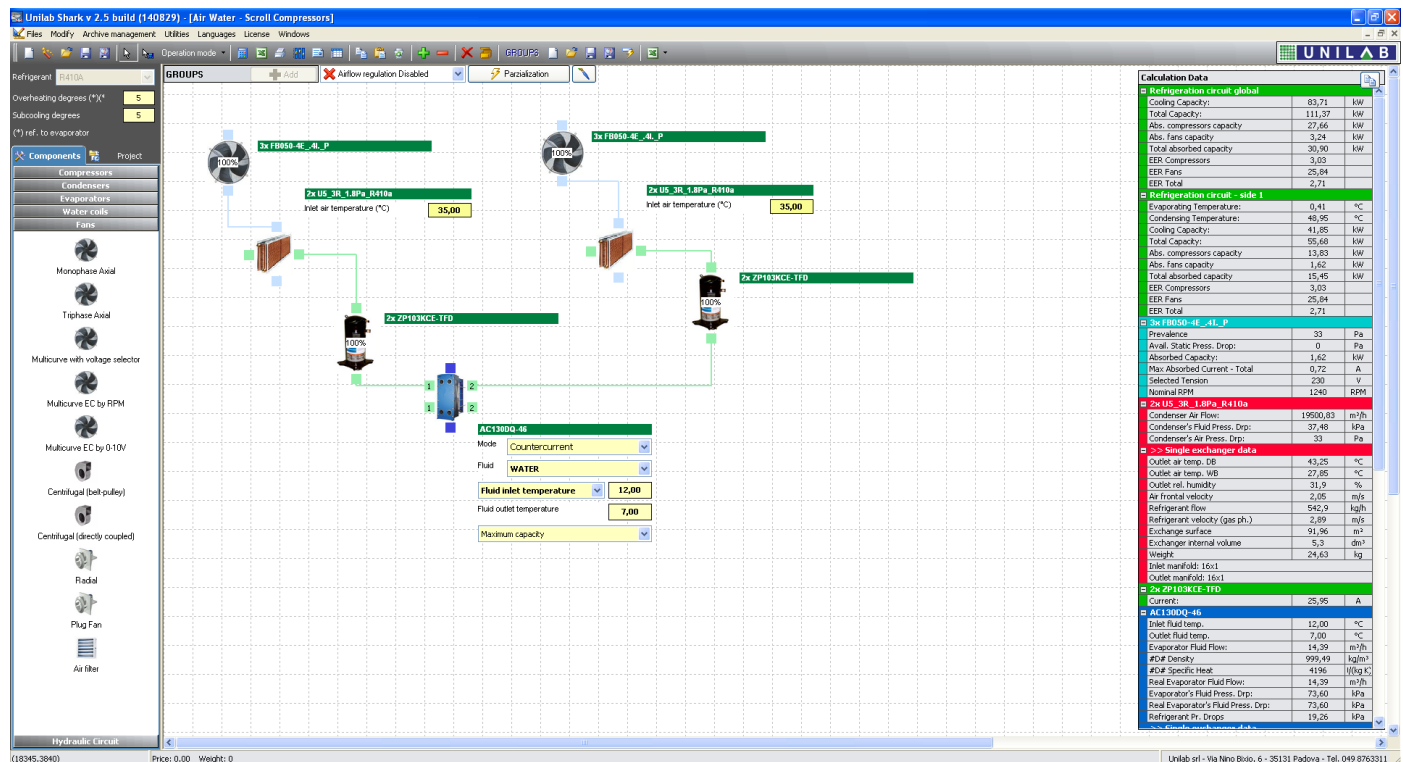


Additional pressure drops can be used to specify the pressure drop of the grid, and the Available static pressure drop is to specify a requested ESP.

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_4L_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

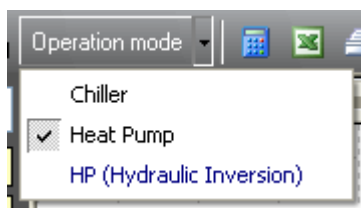
The button above lets you export this table in the Clipboard (copy/paste into Excel for example).

Performing calculation in heat pump mode

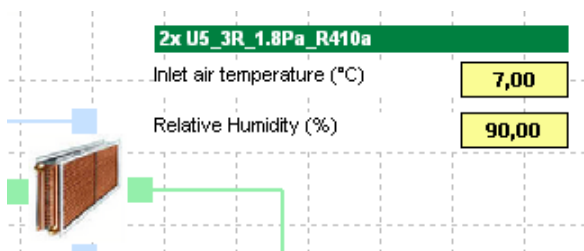
First of all, we have to check the calculation options. Firstly that we have selected the whole unit calculation mode:



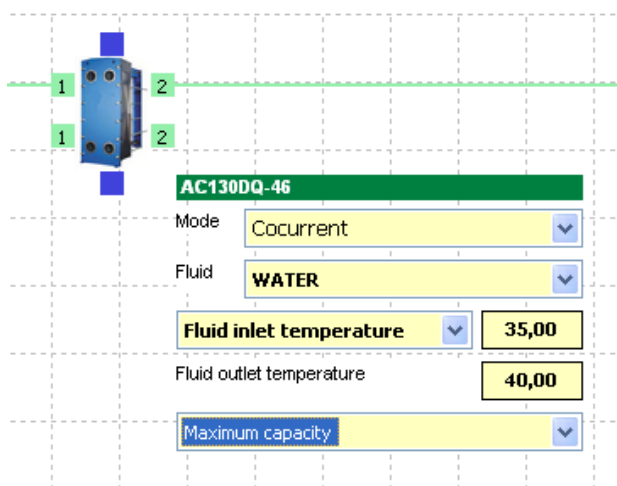
And the operation mode is set to "Heat Pump":



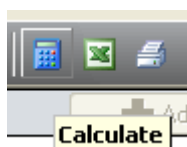
When we change the operating mode in Heat Pump, the input parameters will be changed for each exchanger. For example the air condenser (that now is working as an evaporator) will require:



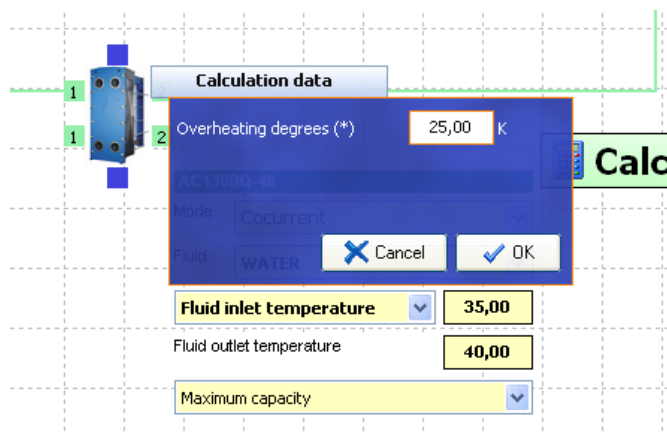
And the plate evaporator (that now is working as a condenser) will require:



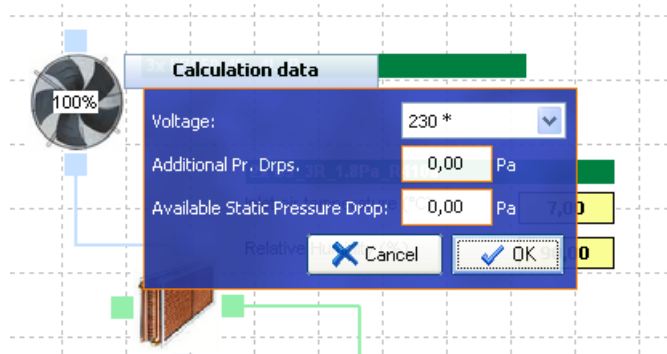
Please notice that the mode is now set to "Cocurrent". Finally we can click on the calculate button:



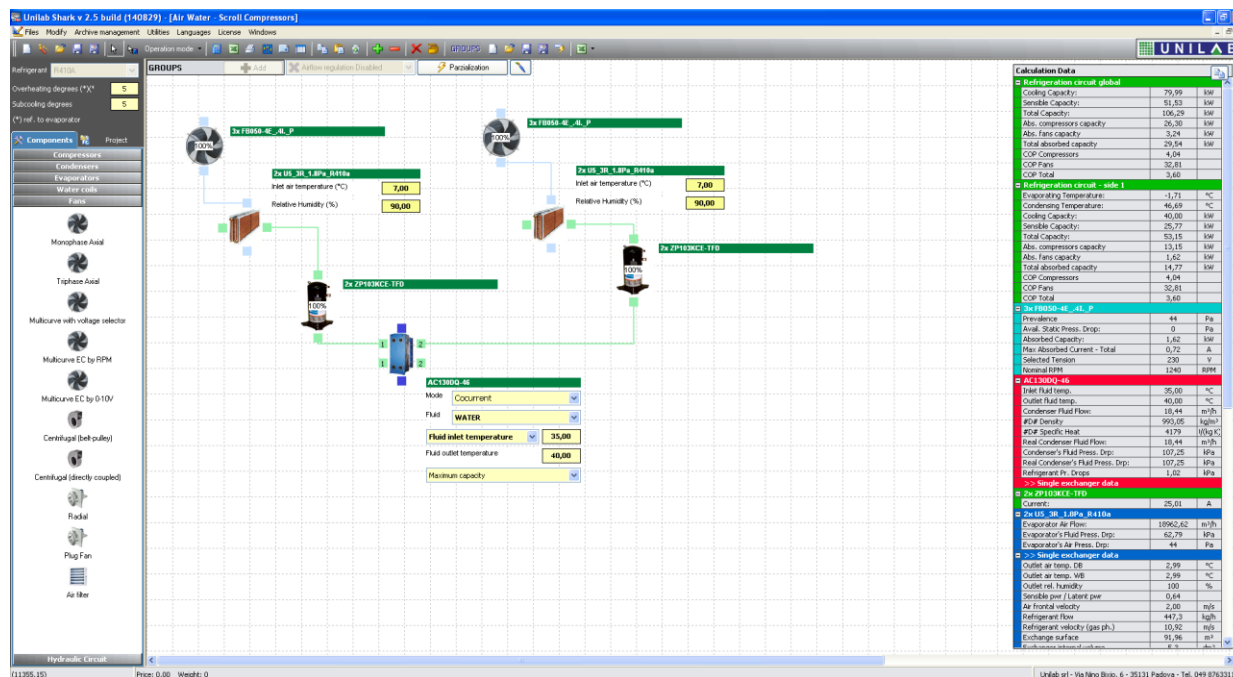
And the program will start to ask the missing parameters like for the chiller mode. The first is the condenser:



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_4L_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	5,2	dm³

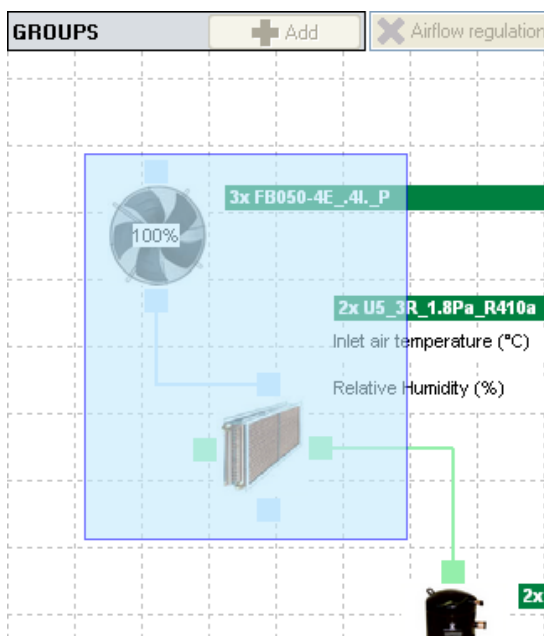
Performing partial calculation

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

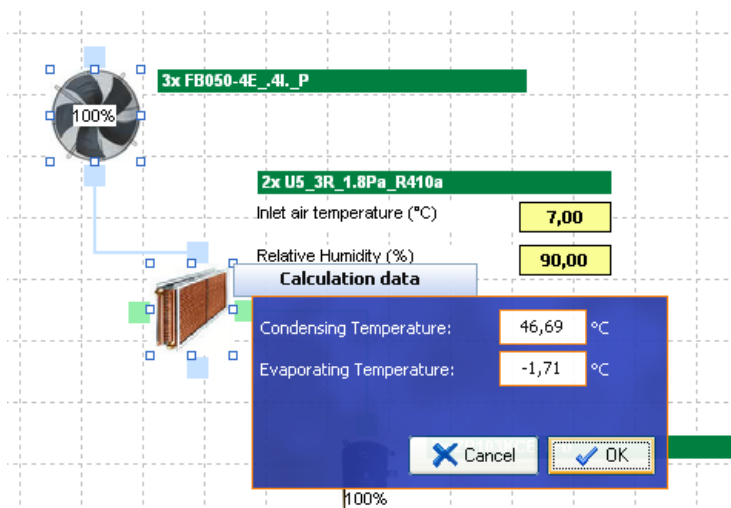
For example, let's see the balance point between the fans and the coils. Click on the "Selection with calculation" tool:



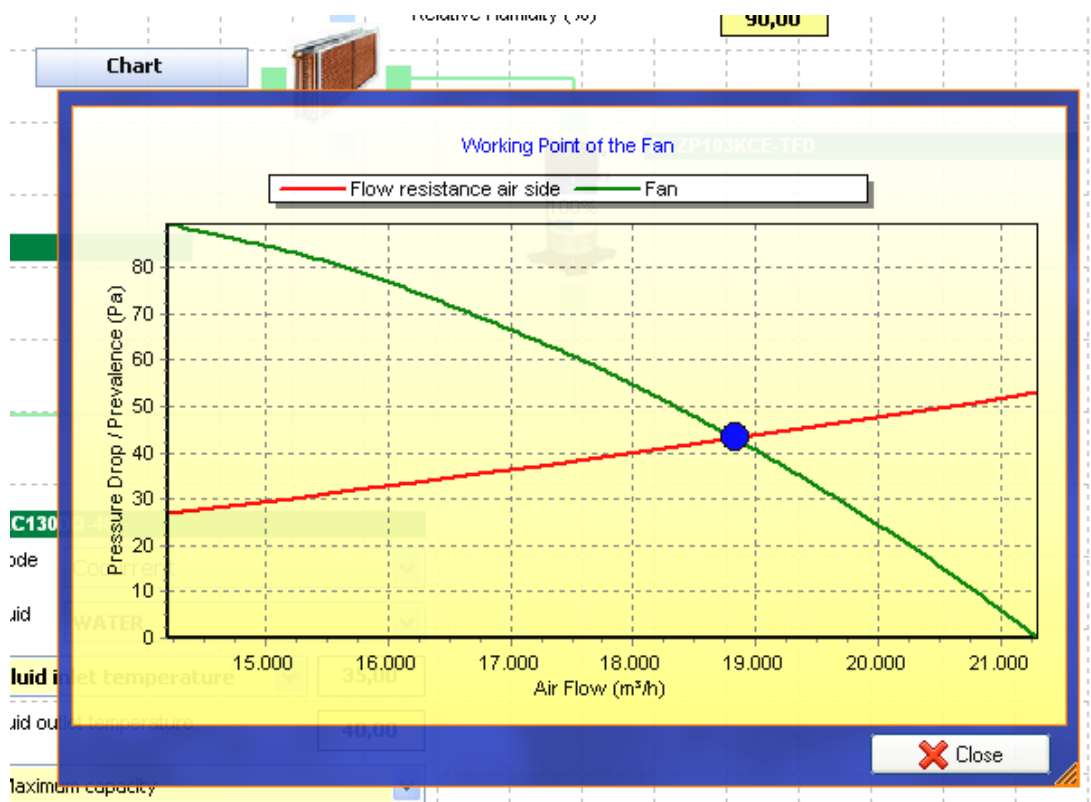
Now we have to draw a selection rectangle around the components that we want to consider, in this case the fan and the condensers:



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:



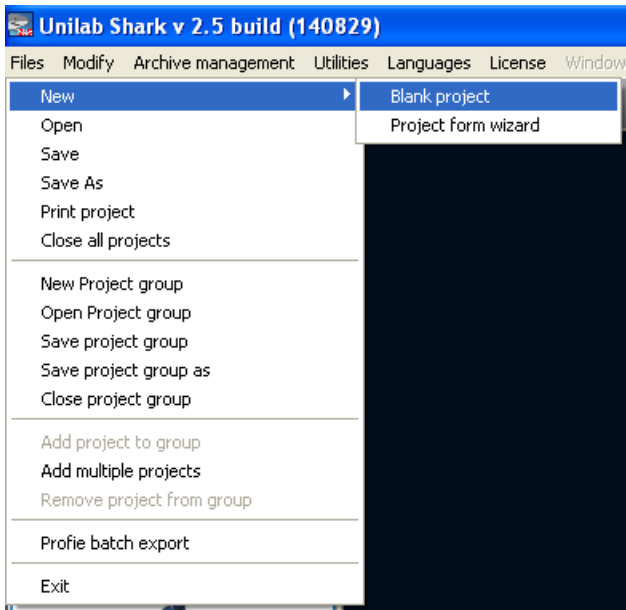
The following input form will appear in the design area, on the bottom:

Designer:			
Apporved by:			
Begin date:	20/11/2007	Release date:	20/11/2007
Model:	40 P2	Rev.:	
Series:			
Notes :			

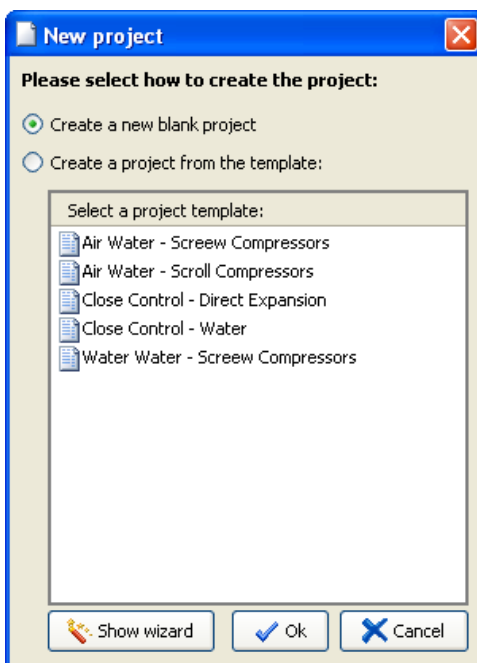
Water / Water chiller with fluid hydraulic inversion

Creating a new project

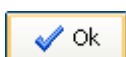
Now we can create a blank project:



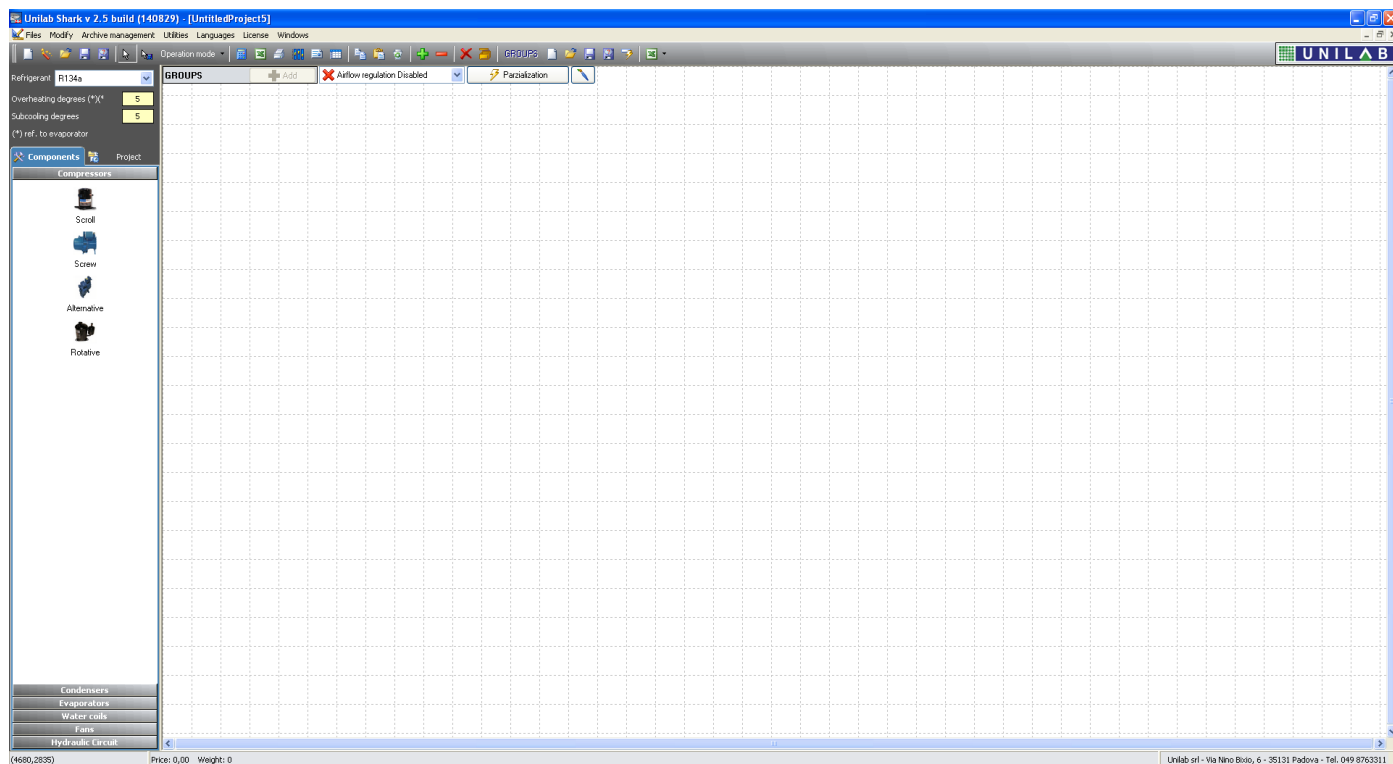
A new window will appear, that lets you load a project template. Select again "Create a new project":



Now click "OK" to continue:



A new blank project will appear:



Now we should set the main settings of the project:

Refrigerant

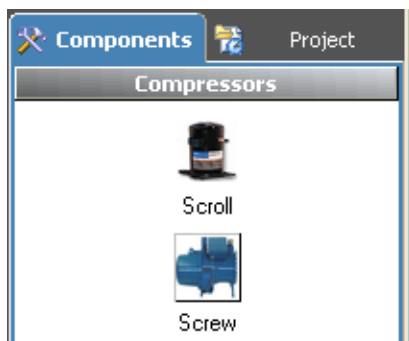
Overheating degrees (*)

Subcooling degrees

(*) ref. to evaporator

Adding components to the unit

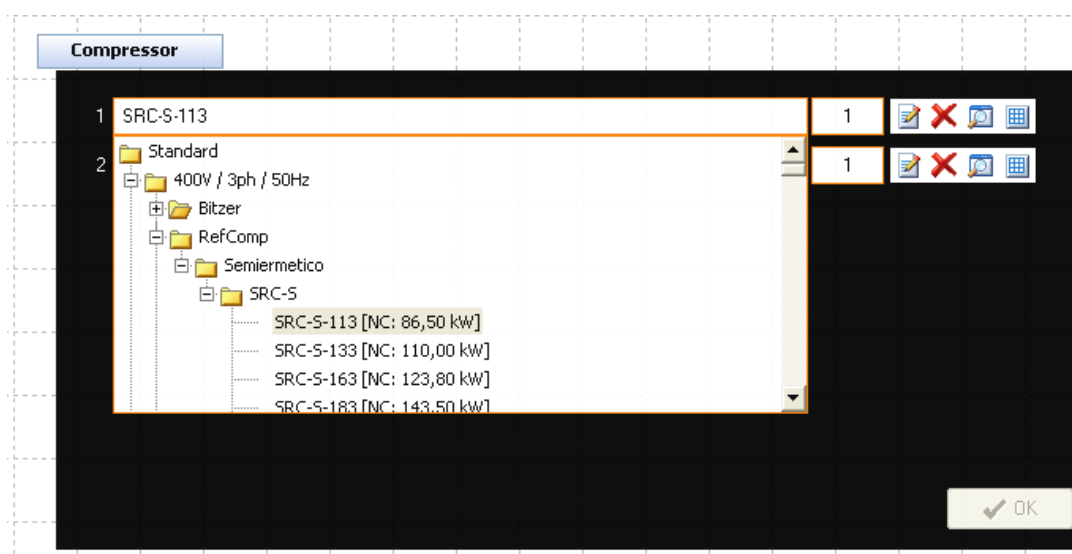
Let's now start by adding the components to the project. We will start with the screw compressor:



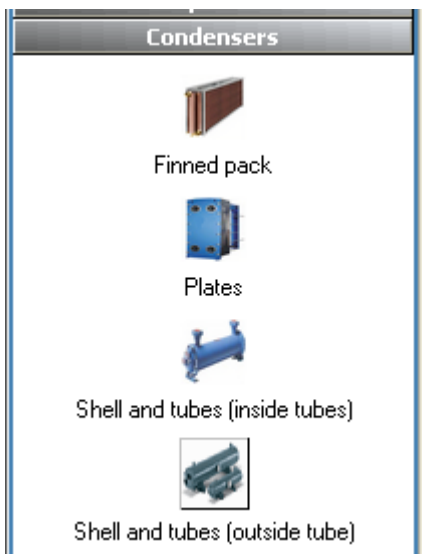
The new group has been added:



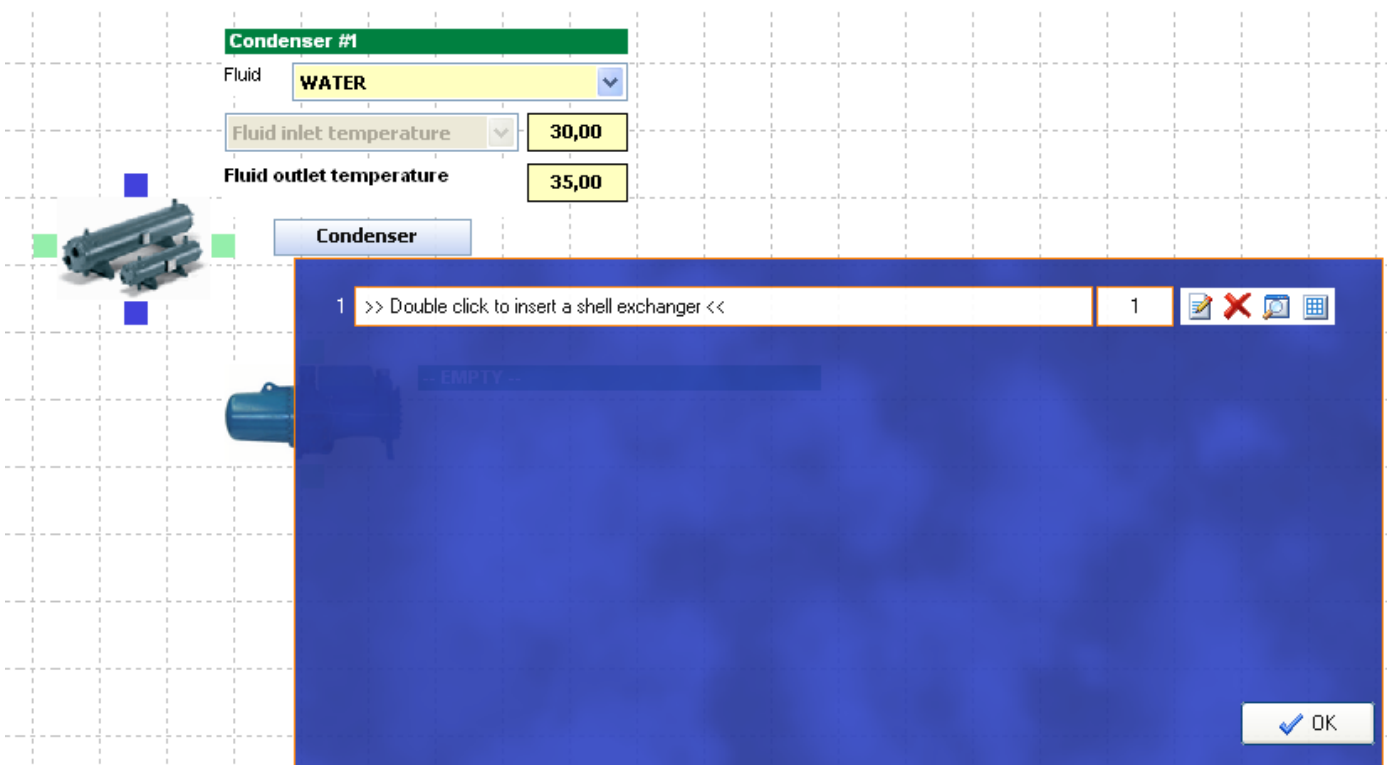
We select now the model that we want to use:



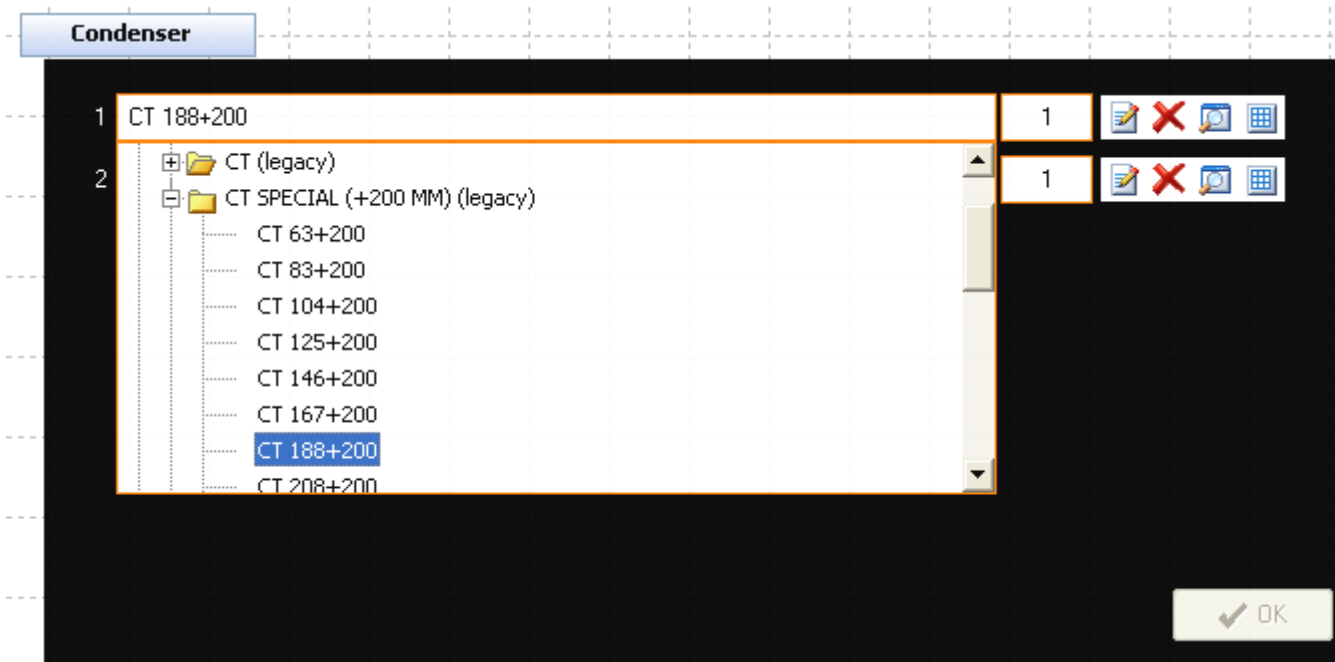
Then we add a new condenser. This time will be a Shell & Tube, with condensation Outside the Tubes:



The component group has been added to the project:



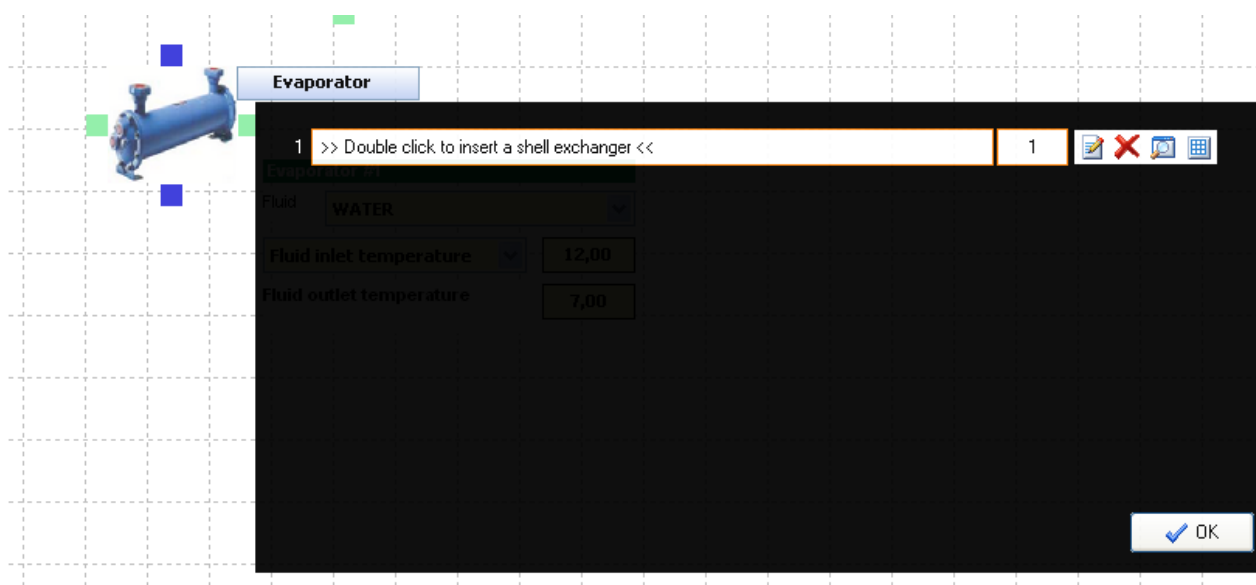
And we select the desired model:



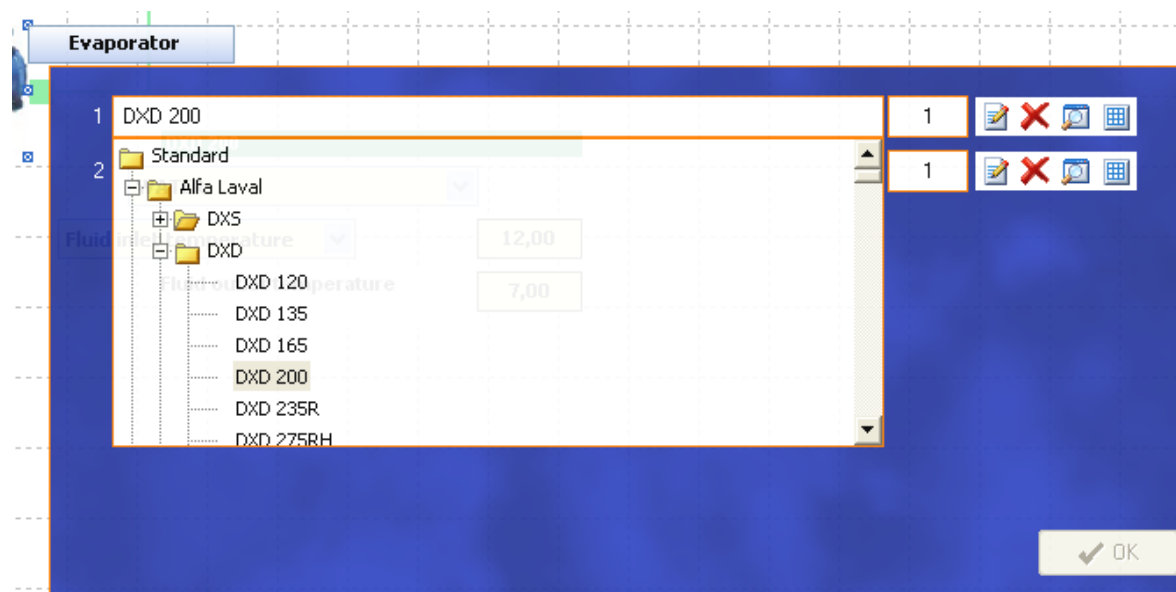
Finally we proceed with the Shell & Tube evaporator:



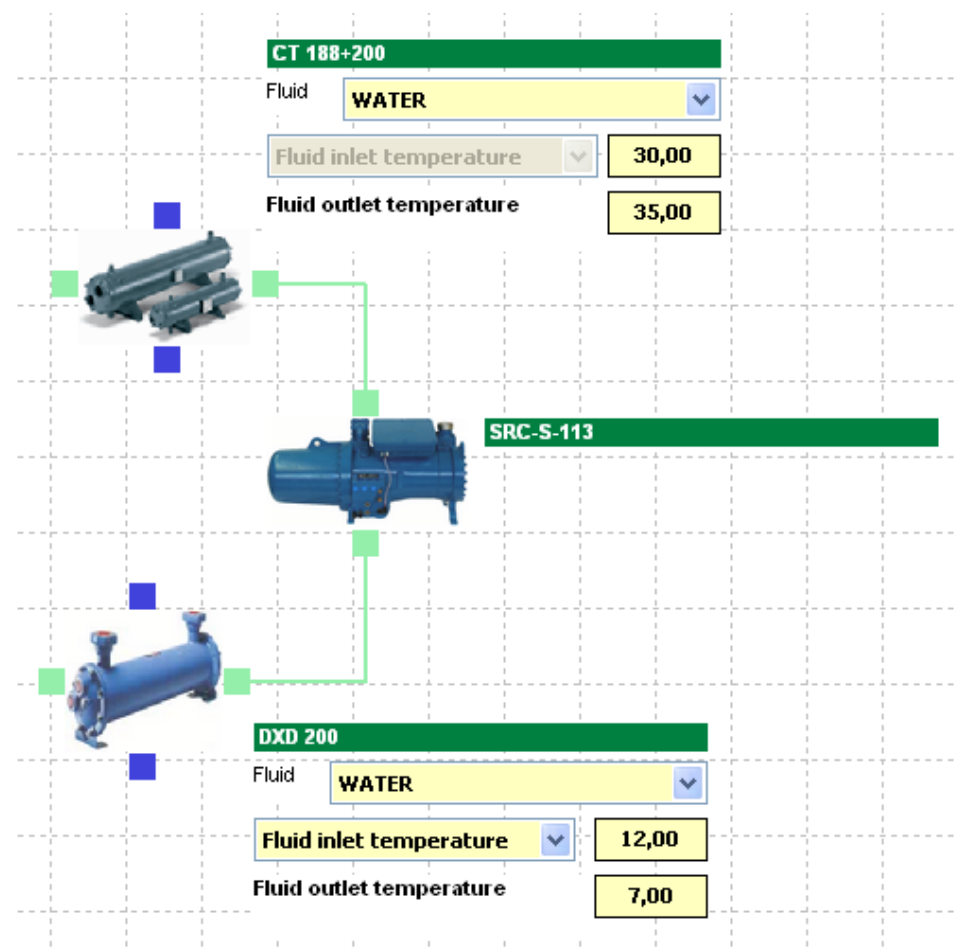
It has been added to the project:



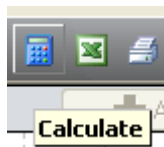
And now we can select the chosen model:



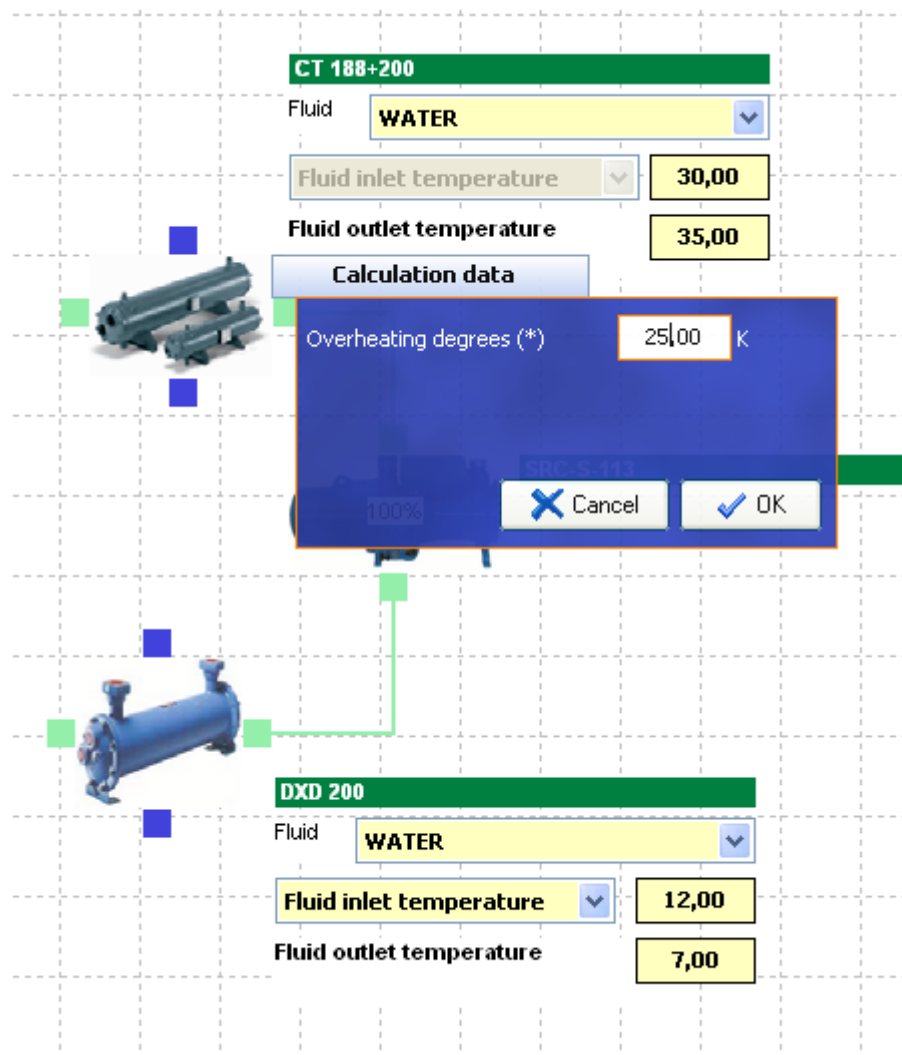
Now we should link together the components like the following:



And proceed with the calculation



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



CT 188+200

Fluid: **WATER**

Fluid inlet temperature: **30,00**

Fluid outlet temperature: **35,00**

Calculation data

Overheating degrees (*) **25,00** K

DXD 200

Fluid: **WATER**

Fluid inlet temperature: **12,00**

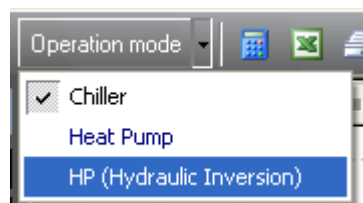
Fluid outlet temperature: **7,00**

And quickly the results of the calculation will be shown:

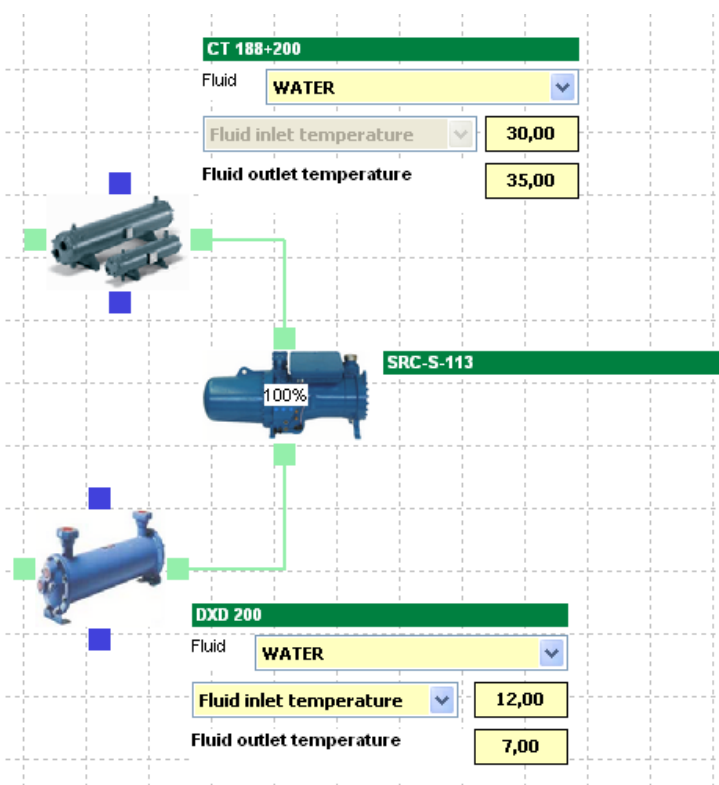
Calculation Data		
Refrigeration circuit - side 1		
Evaporating Temperature:	4,49	°C
Condensing Temperature:	43,07	°C
Cooling Capacity:	127,35	kW
Total Capacity:	157,09	kW
Absorbed Capacity:	29,74	kW
EER	4,28	
CT 188+200		
Inlet fluid temp.	30,00	°C
Outlet fluid temp.	35,00	°C
Condenser Fluid Flow:	27,23	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

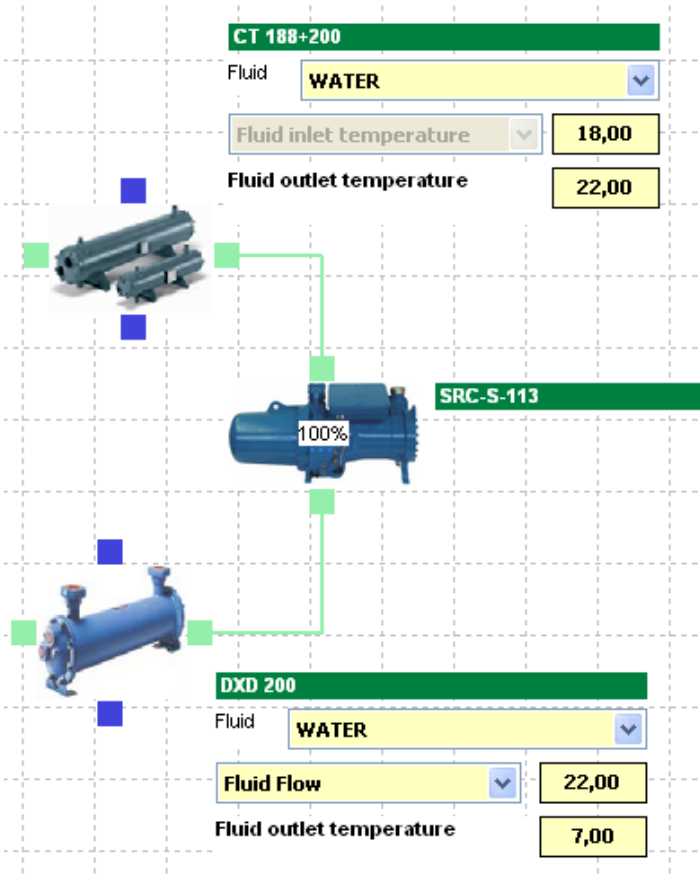
To set this type of calculation, we have to click on the "Operation mode" button, and then "HP Hydraulic Inversion" mode:



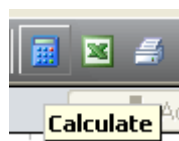
In this case the temperatures on the components won't change, because each component is still working in its native modality. Is an external valve that switches the fluids flow:



Let's set differently the temperature:



And perform the calculation:



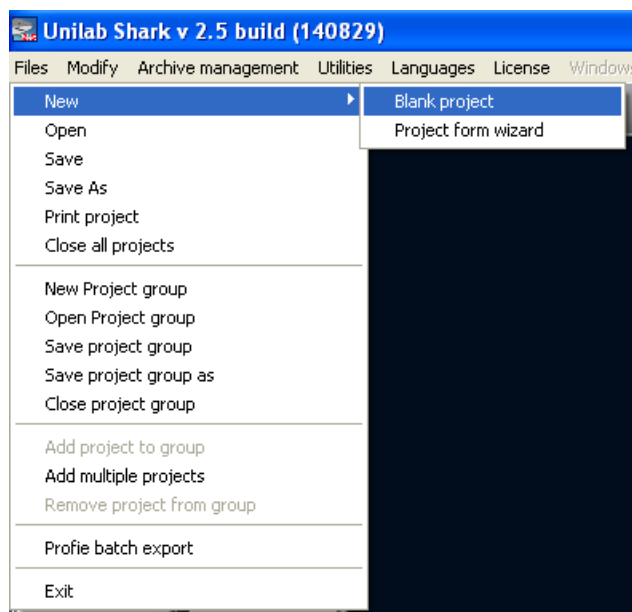
The result table will be shown:

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

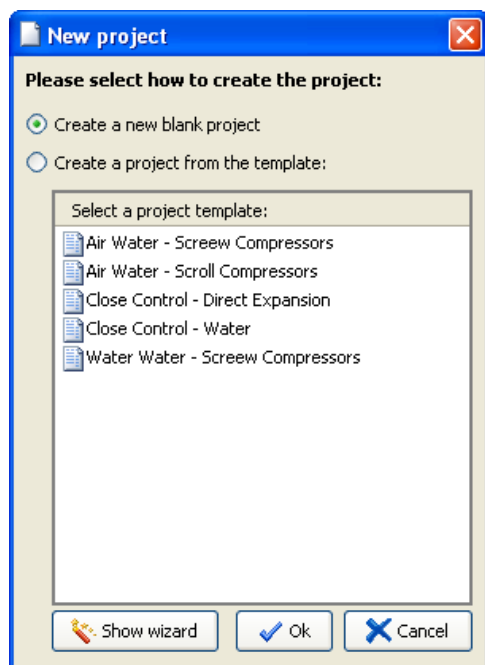
Complete indoor Close Control (Air / Air) unit with water condenser

Creating a new project

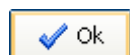
Now we can create a blank project:



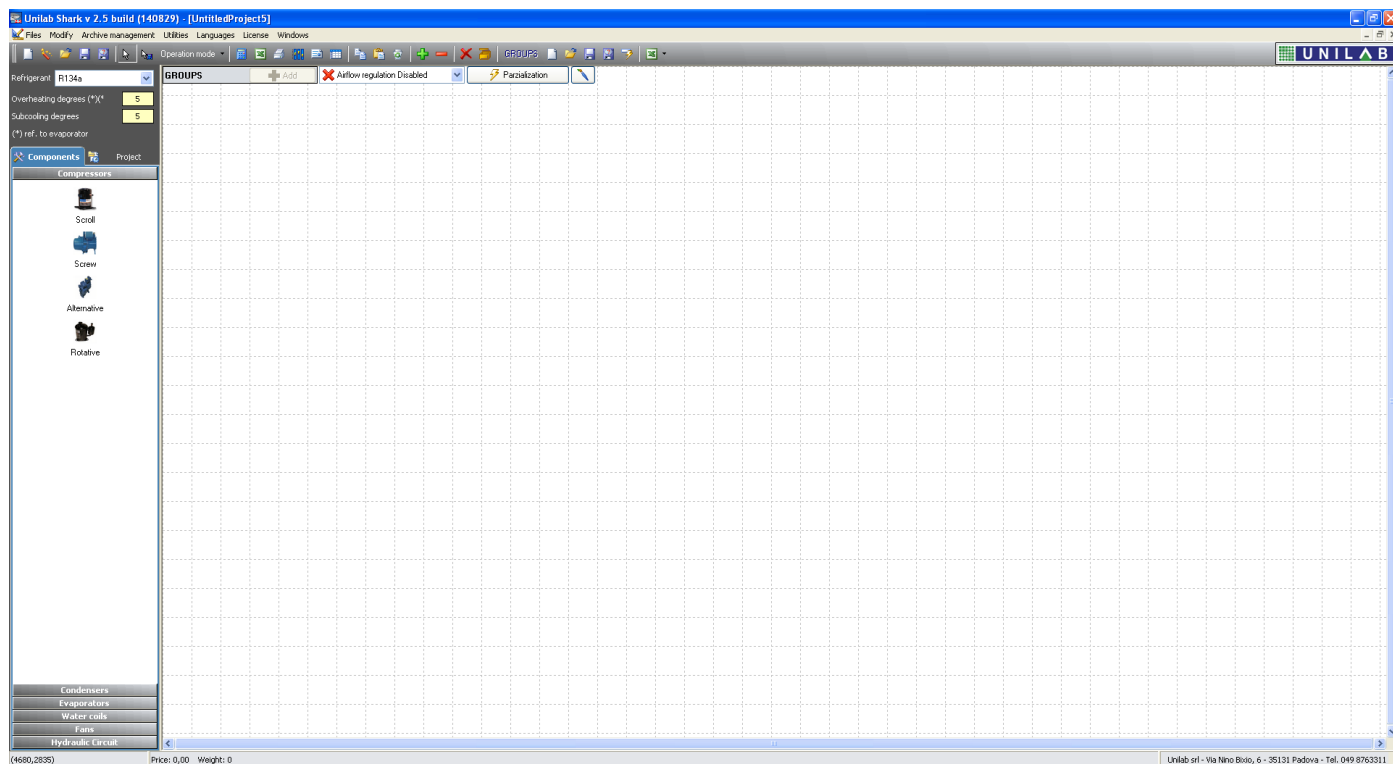
A new window will appear, that lets you load a project template. Select again "Create a new project":



Now click "OK" to continue:



A new blank project will appear:



Now we should set the main settings of the project:

Refrigerant

Overheating degrees (*)

Subcooling degrees

(*) ref. to evaporator

Adding components to the unit

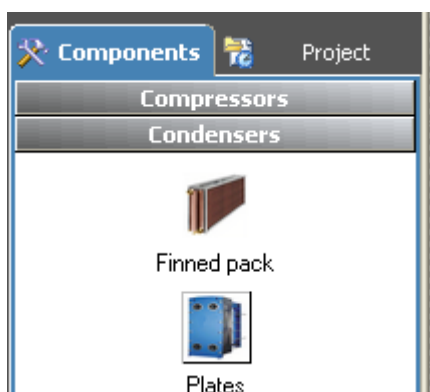
Let's start from the Compressor:




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:



Mode: **Countercurrent**


Fluid: **WATER**

Fluid inlet temperature: **30,00**

Fluid outlet temperature: **35,00**

Maximum capacity:

Now we can select the model:



Fluid outlet temperature: **35,00**

Condenser capacity:

1	AC70XM-90	1				
2	Standard	1	<td> <td> <td> </td></td></td>	<td> <td> </td></td>	<td> </td>	

- AC70XM-82
- AC70XM-84
- AC70XM-86
- AC70XM-88
- AC70XM-90**
- AC70XM-92
- AC70XM-94
- AC70XM-96
- AC70XM-98

Customer

OK

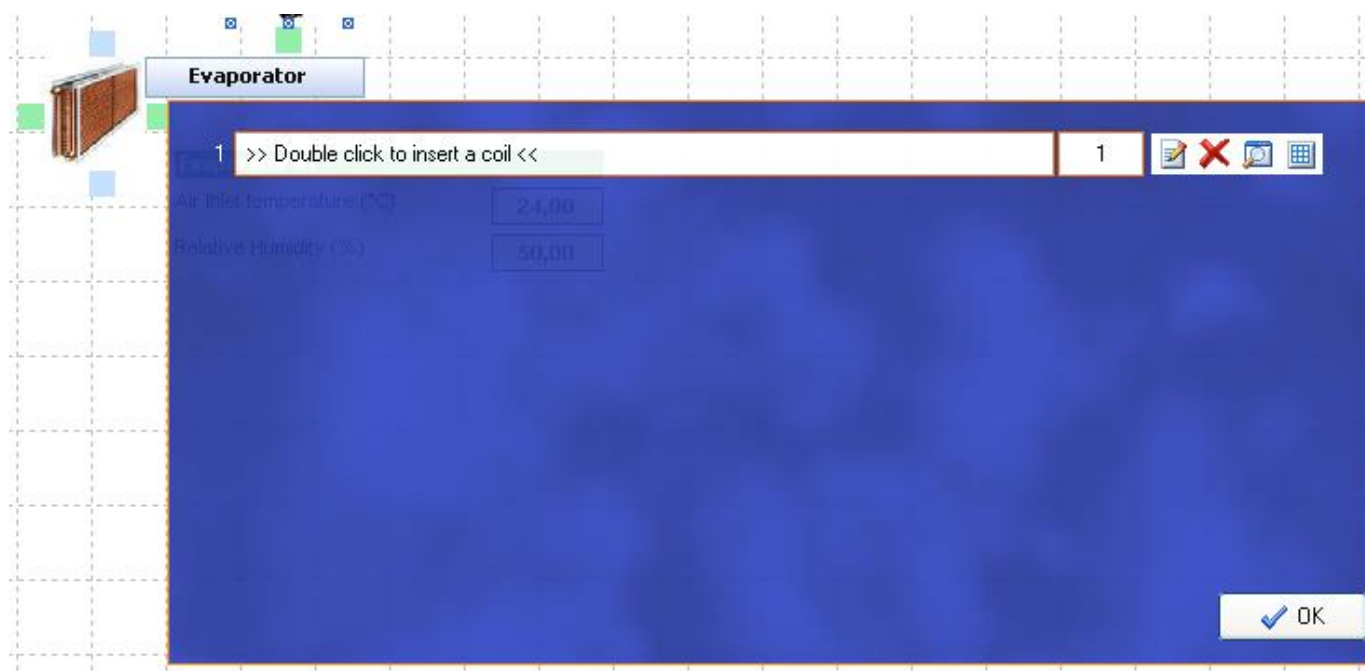
Now we can add the finned pack evaporator:

Evaporators



Finned pack

The group will be added to the design area:



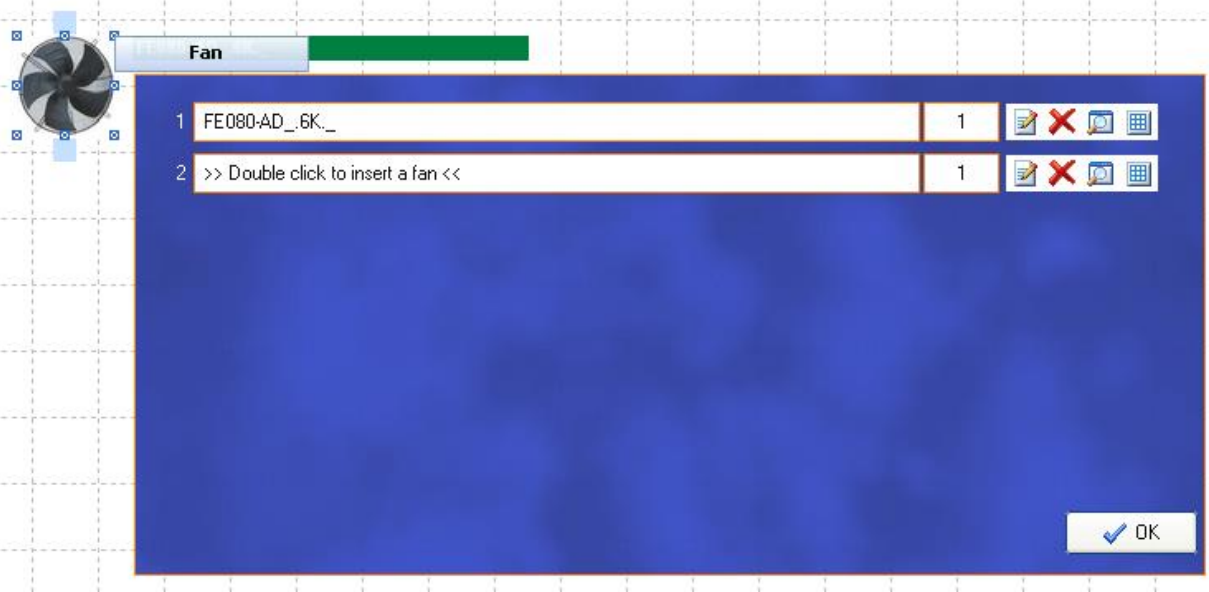
And we can either select a model from the list of coils, or add a new coil with the method seen before:



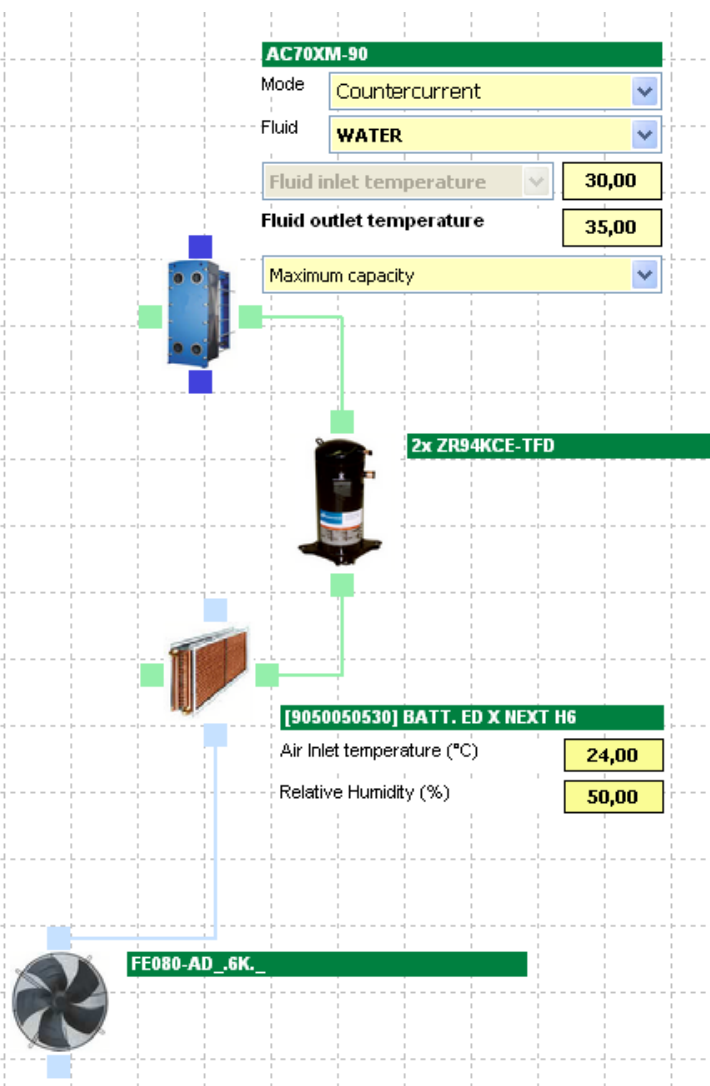
Now we can add the fan:



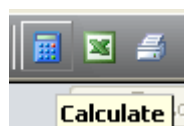
And select the appropriate model from the list:



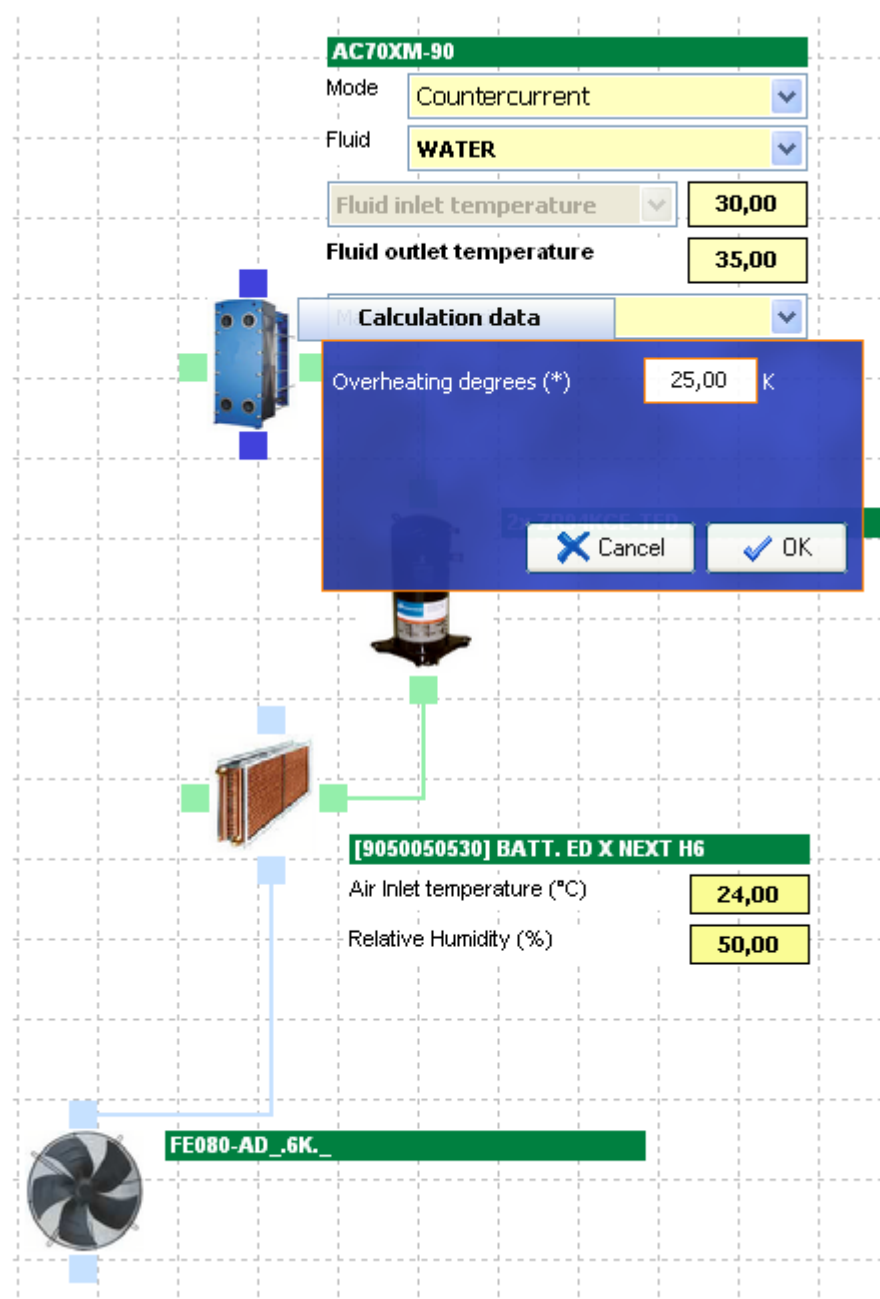
Finally we can link together the components like below:



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

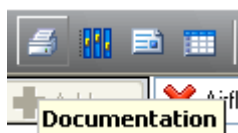
>> Single exchanger data

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		

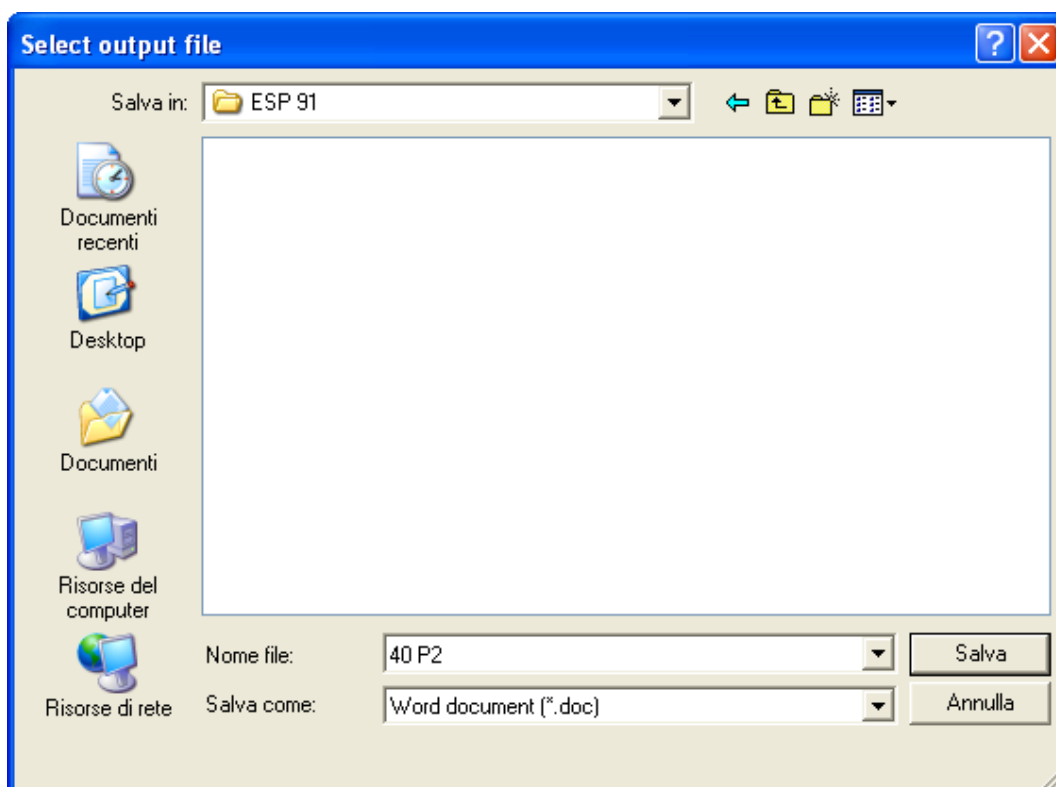
Output of the program

Datasheet of the unit

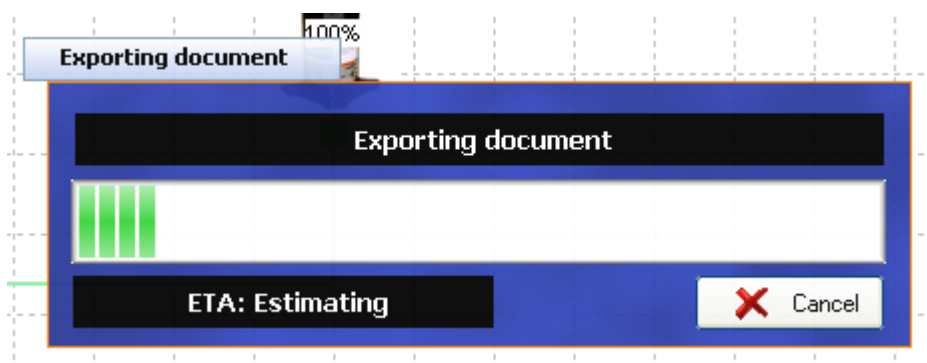
Shark is able to export a datasheet of the unit in MS Word format. To do this, click on the Documentation button on the tool bar:



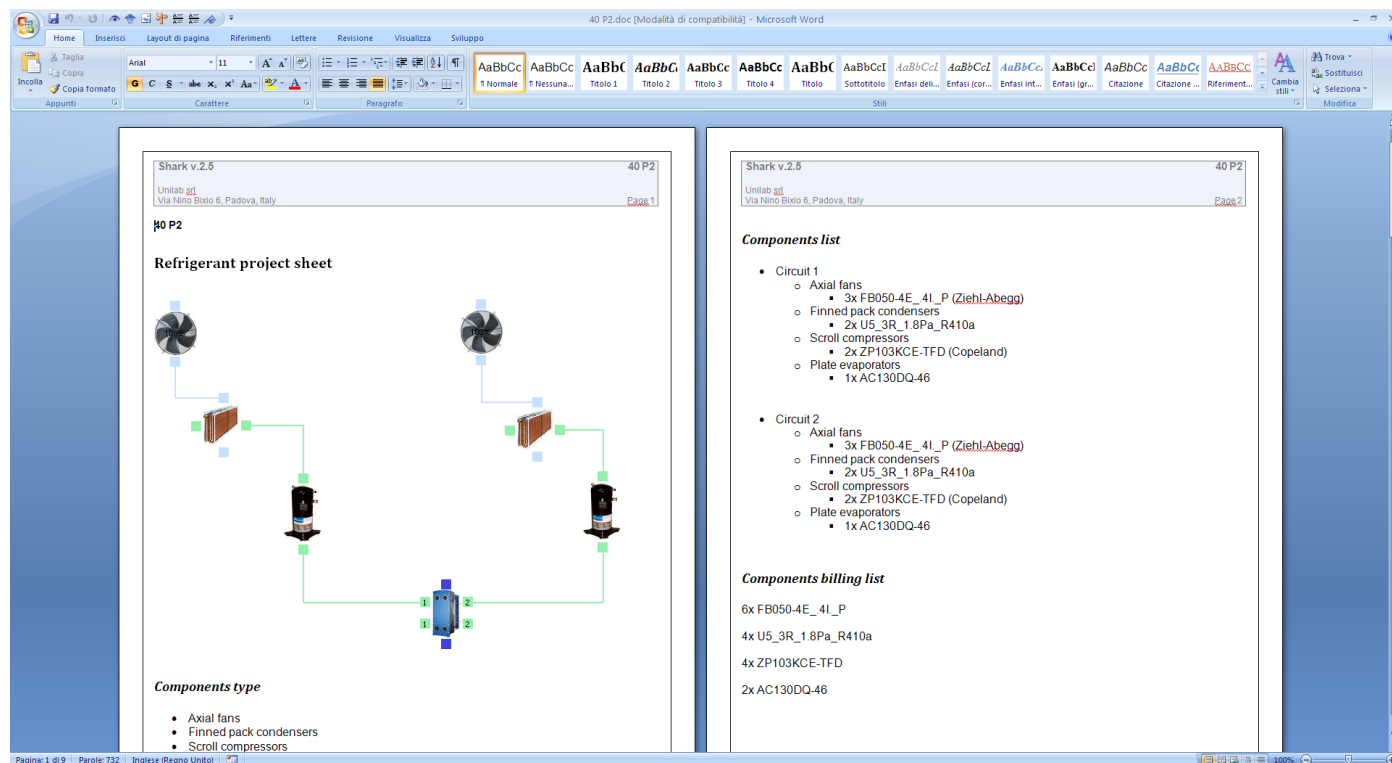
Now you have to specify where to save the .doc file:



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.

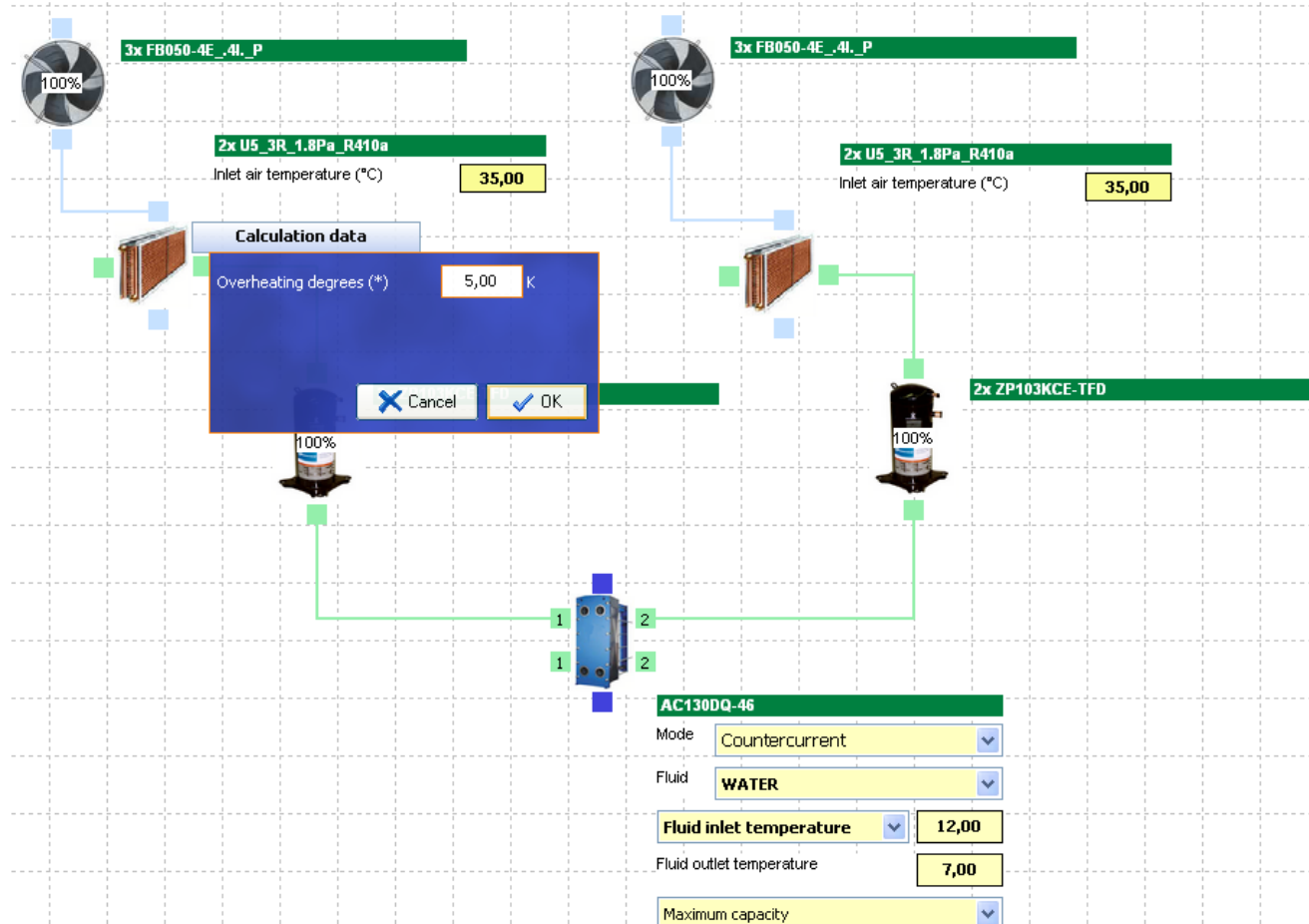


Excel tables

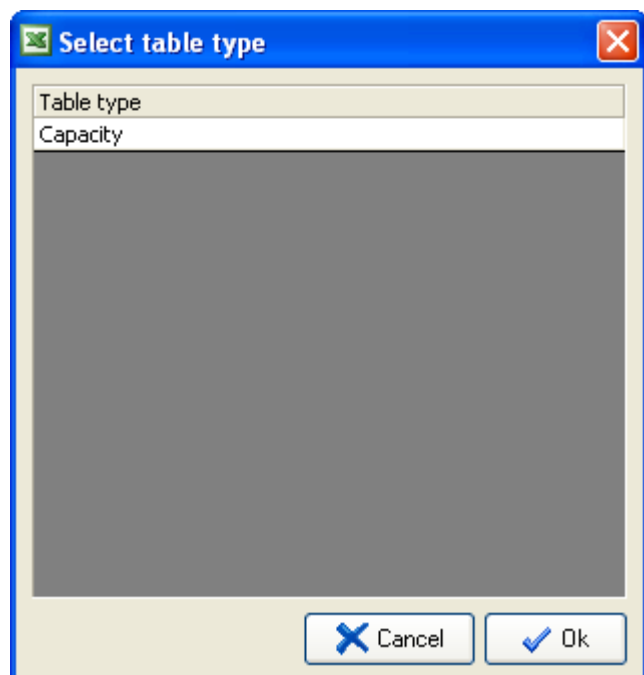
Shark is also able to export performances tables of the unit. To do so, click on the "Create Tables" icon in the tool bar:



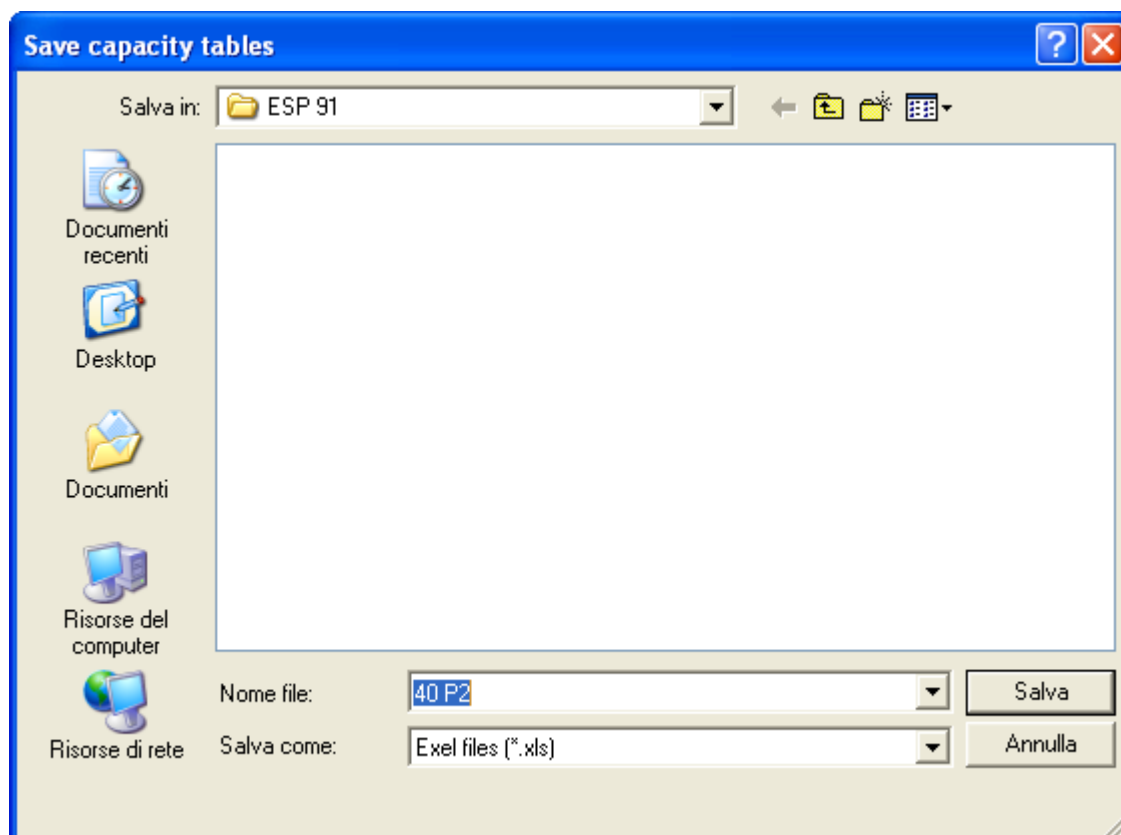
The program will start calculating the unit, and eventually asking for the input missing parameters:



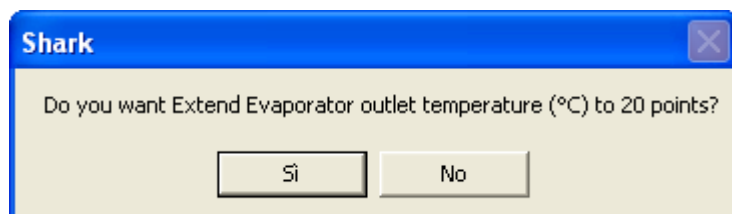
Once done the calculation, it will ask for the type of table that we want to export. This list depends on the typology of the unit. In this case we can create only Capacity tables:



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:

2X05_3R_1.8Pa_R410a

Power tables Inlet air temperature (°C) **35,00**

Refrigeration power

External air temperature (°C)

27	32	35	40	43
----	----	----	----	----

Evaporator outlet tempera

4
6
7
8
9
10

2x ZP103KCE-TFD

100%

AC130DQ-46

Mode Countercurrent

Fluid WATER

Th. diff.

5

Inlet temperature 12,00

Fluid outlet temperature 7,00

OK

Cancel

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

Power tables

Refrigeration power

External air temperature (°C)

27	32	35	40	43
----	----	----	----	----

Evaporator outlet temper.

4
6
7
8
9
10

100%

AC130DQ-46

Mode Countercurrent

Th. diff.

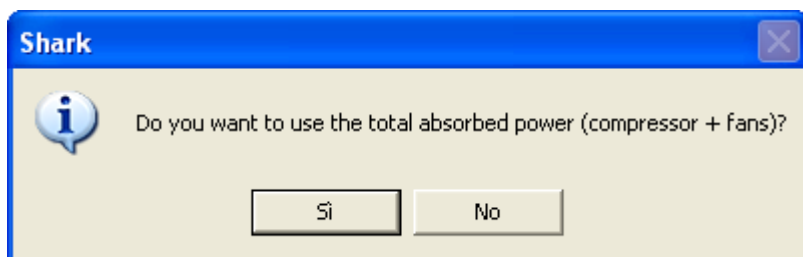
5

OK

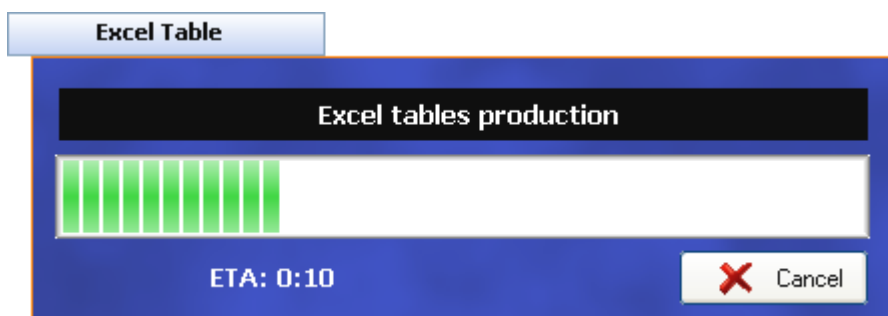
Cancel

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:



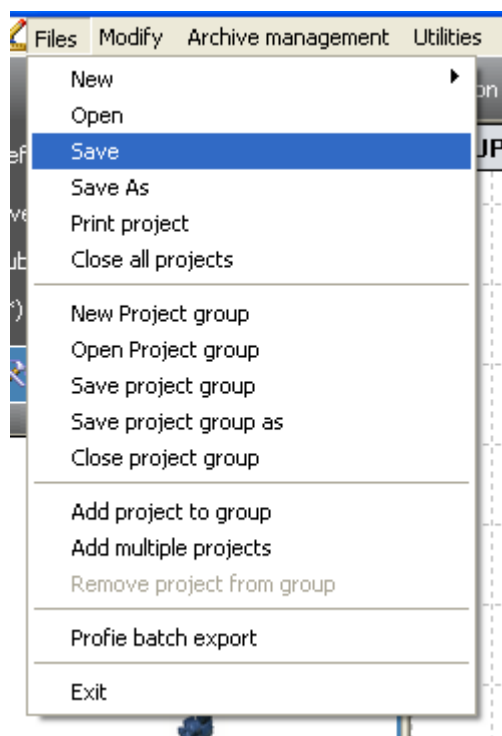
And export the results in the specified excel file:

<div><div><div><div><div></div><div>Home</div></div><div><div></div><div>Inserisci</div></div><div><div></div><div>Layout di pagina</div></div><div><div></div><div>Formule</div></div><div><div></div><div>Dati</div></div><div><div></div><div>Revisione</div></div><div><div></div><div>Visualizza</div></div><div><div></div><div>Sviluppo</div></div><div><div></div><div>Componenti aggiuntivi</div></div></div><div><div><div><div></div><div>Incolla</div></div><div><div></div><div>Taglia</div></div><div><div></div><div>Copia</div></div><div><div></div><div>Copia formato</div></div></div><div><div><div><div>Arial</div><div>10</div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div>Testo a capo</div></div><div><div></div><div>Generale</div></div><div><div></div><div>Formattazione condizionale</div></div><div><div></div><div>Form come ta</div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div>Carattere</div></div><div><div><div><div></div><div></div><div></div><div></div></div><div>Allineamento</div></div><div><div><div><div></div><div>Unisci e centra</div></div><div>Numeri</div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div>Formattazione 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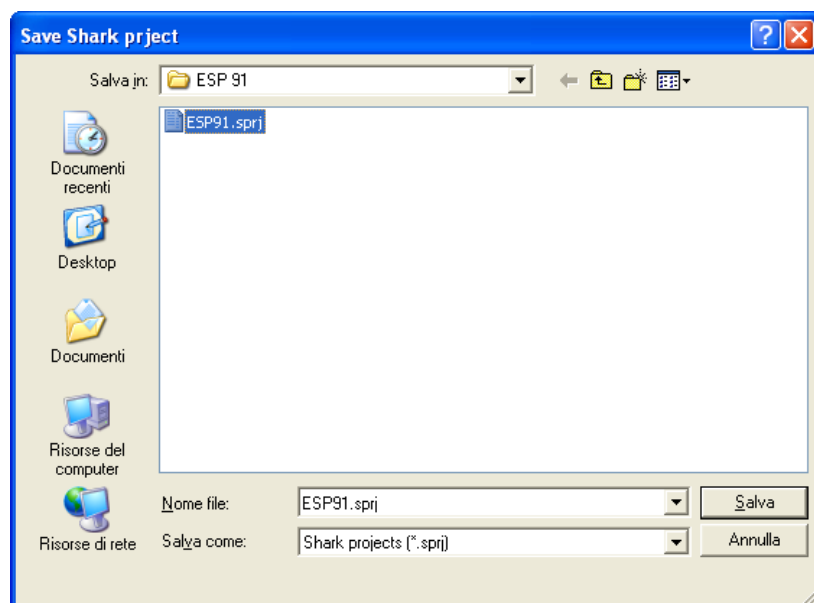
Projects management

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:



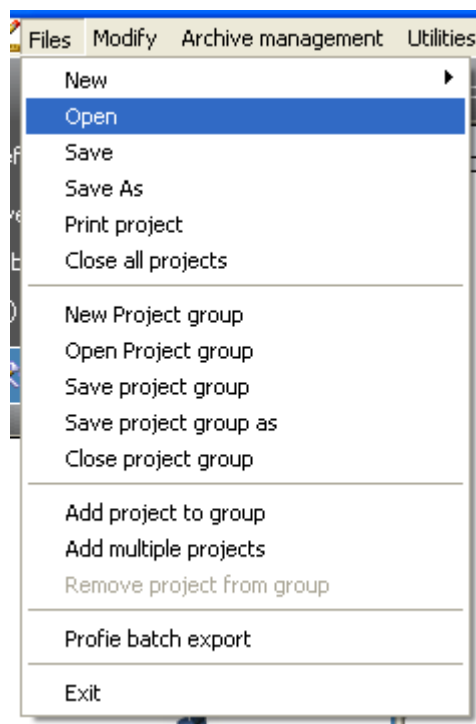
The program will ask the path where to save the project that can be any ware:



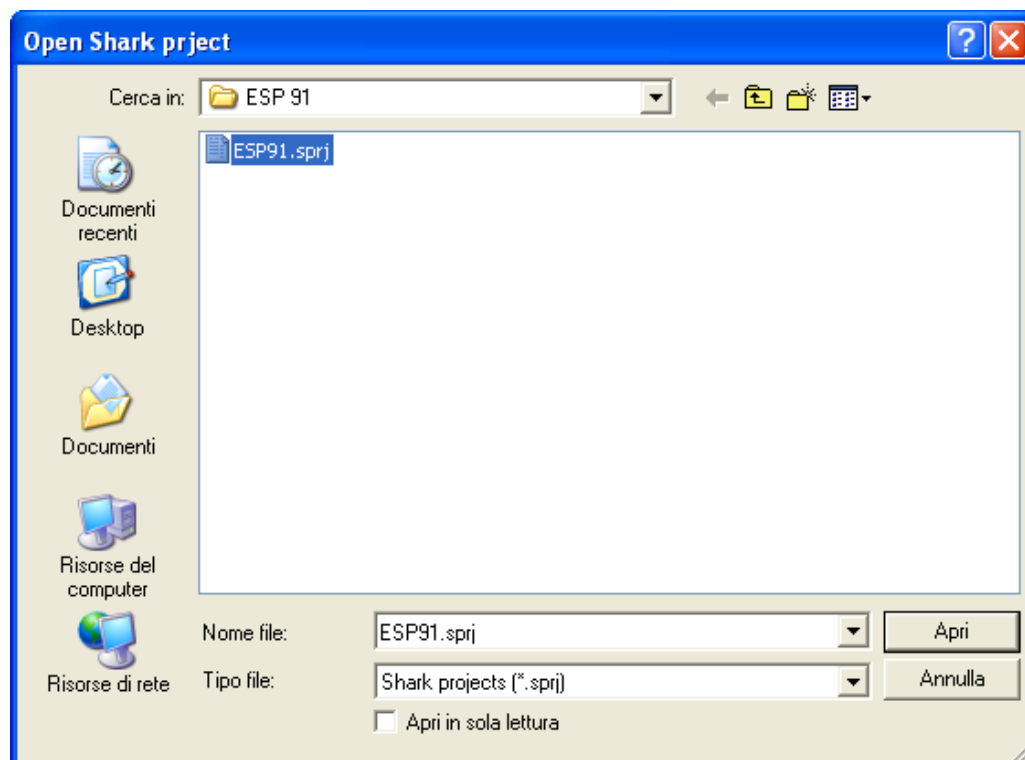
Once we click on the "Save" button, the file will be created or overwritten if necessary.

Loading a project

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



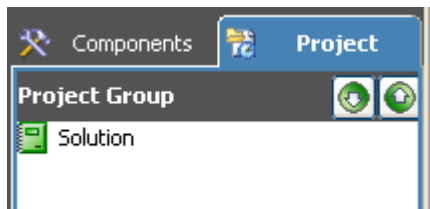
The program will ask the path where to open the project that can be any ware:



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

Creating a series

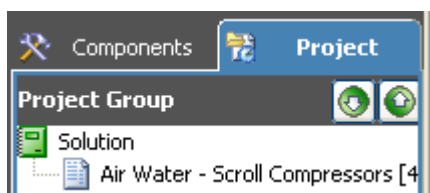
Shark lets you handle multiple projects in a series. This can be accessed on the left panel, in the "Project" tab:



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:

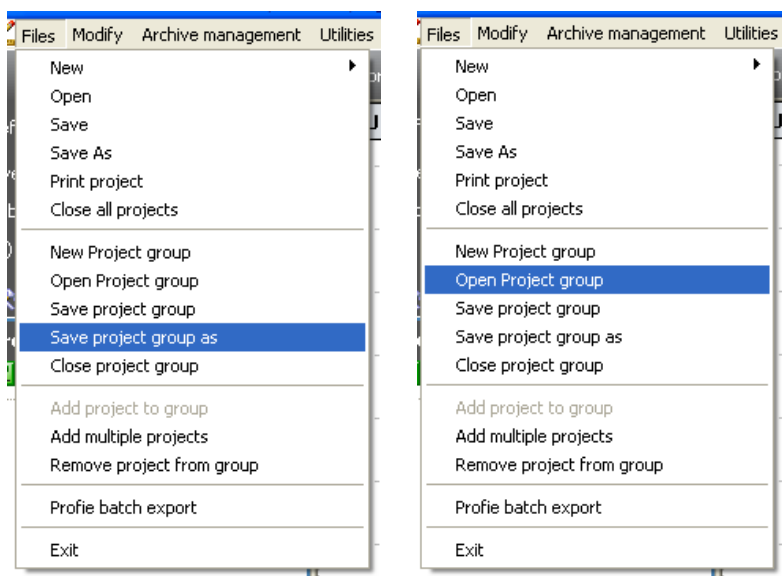


And the unit will be added to the series:

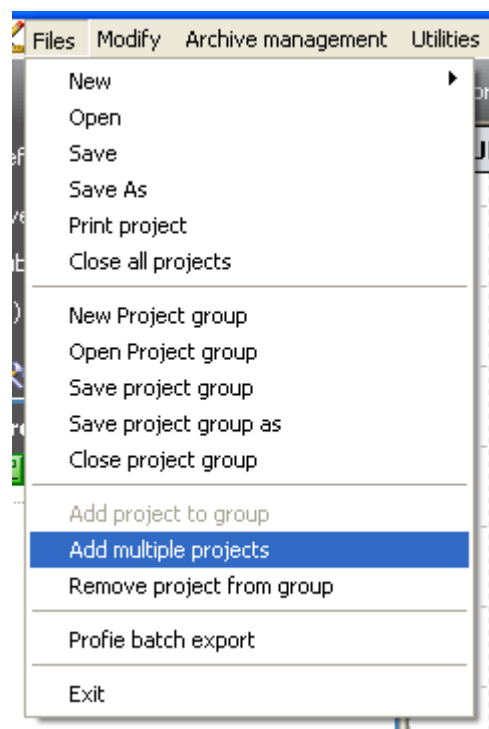


This can be repeated any number of time to create a complex series with no limitation on the number of units.

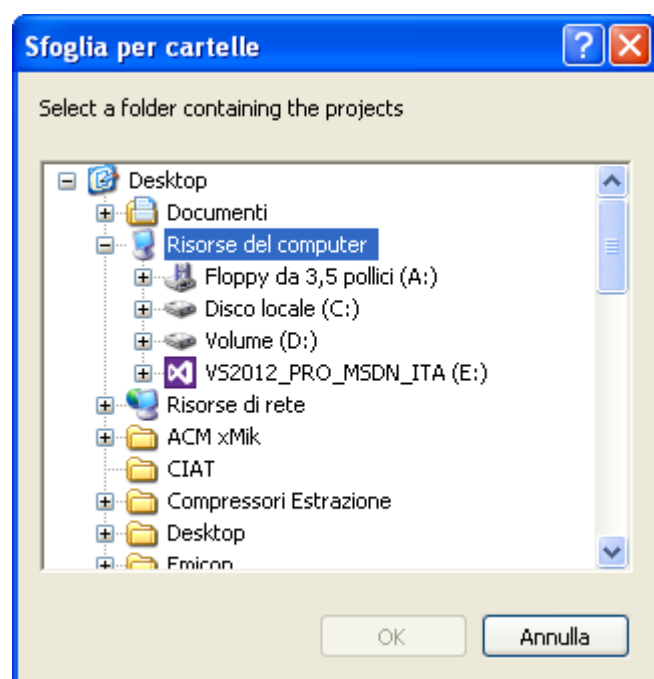
The group (or series) can be saved into a file for later use, and handled like a small file:



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:

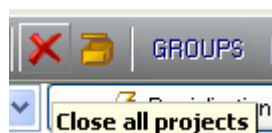


As a result, the series with all the units will be created and can be handled like group file.

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):

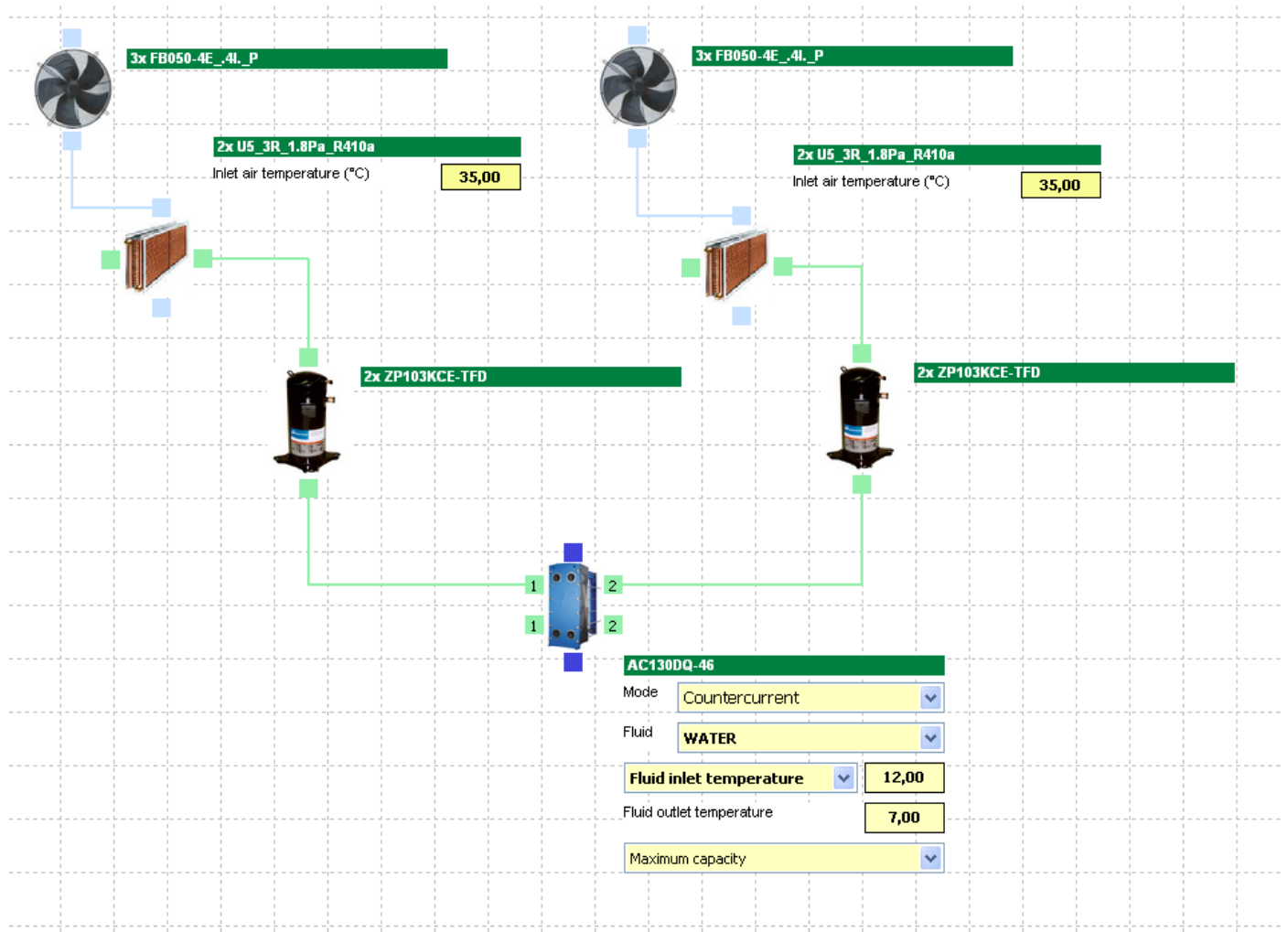
- Create a new series
- Load a series
- Save a series
- Save a series with a different name
- Calculate the ESEER (not used anymore)
- Create Excel performances table of the whole series.

Advanced simulations

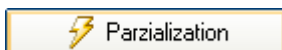
Partialization of Air / Water chillers with Scroll Compressors

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:

Partialization

Partialization Matrix Components Identification

Compressors **Fans**

%	Circuit 1		Circuit 2		%	Circuit 1			Circuit 2			PATot kW
	1	2	1	2		1	2	3	1	2	3	

Set ☒ R ☐ C

Set ☒ R ☐ C ☐ T

 Use absorbed capacity manually set on the calculation. ☐

Partialization calculation

ESEER
Calculated value: 0.00

☐ Use correction factor for compressor abs. cap.

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

Compressors **Fans**


%	Circuit 1		Circuit 2		%	Circuit 1			Circuit 2			PATot kW
	1	2	1	2		1	2	3	1	2	3	

Set ☒ R ☐ C

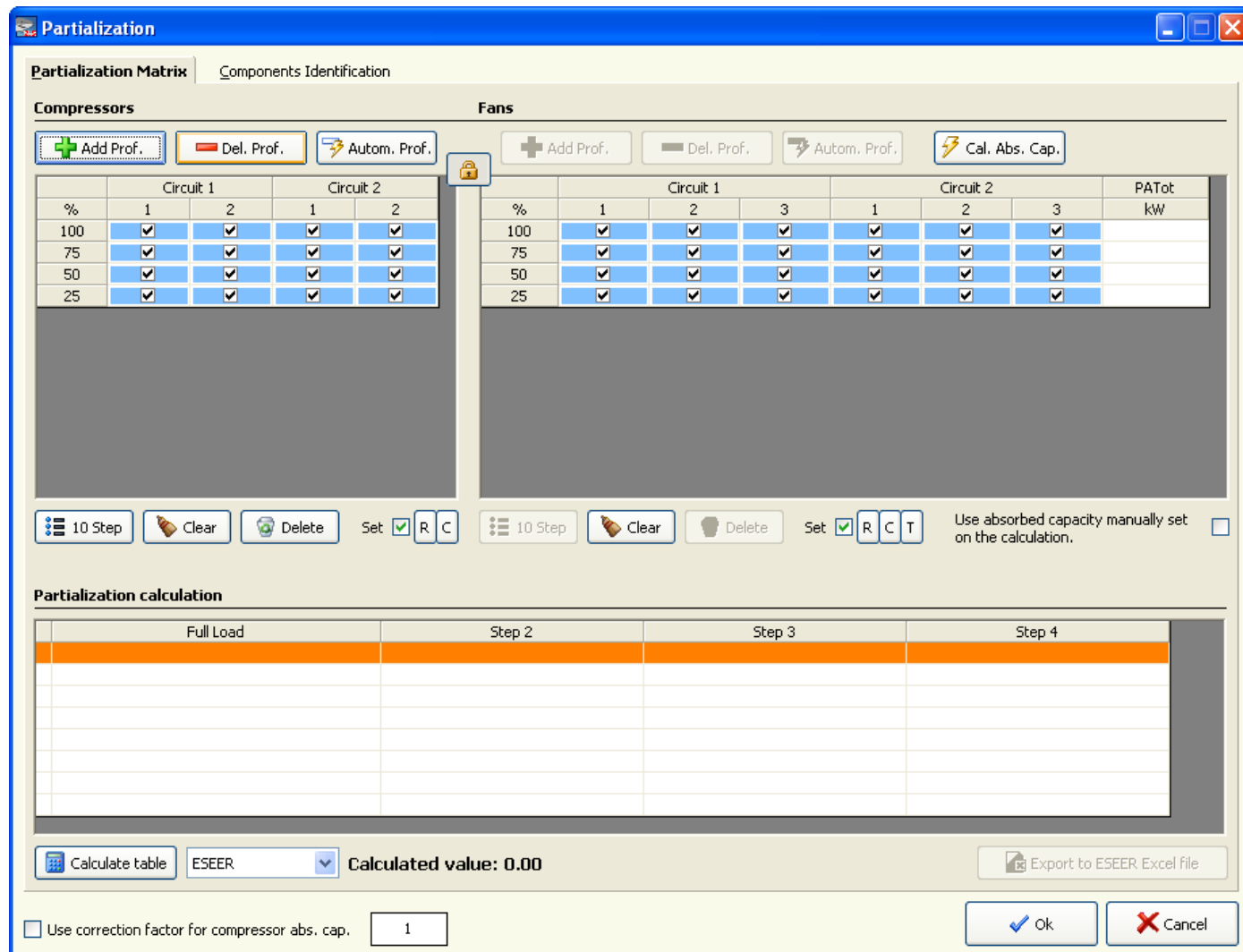
Set ☒ R ☐ C ☐ T

 Use absorbed capacity manually set on the calculation. ☐

Let's now add a new partialization profile:

 Add Prof.

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



The screenshot shows the 'Partialization' software window. It has two tabs: 'Partialization Matrix' and 'Components Identification'. The 'Partialization Matrix' tab is active, showing two main sections: 'Compressors' and 'Fans'. Each section has a table with columns for percentage (%) and circuit numbers (1, 2, 3). The 'Compressors' table has 4 rows (100, 75, 50, 25) and 4 columns (1, 2, 3, 4). The 'Fans' table has 4 rows (100, 75, 50, 25) and 6 columns (1, 2, 3, 4, 5, 6). All cells in these tables are checked. Below the tables are buttons for 'Add Prof.', 'Del. Prof.', 'Autom. Prof.', and 'Cal. Abs. Cap.'. At the bottom, there is a 'Partialization calculation' section with a table for 'Full Load', 'Step 2', 'Step 3', and 'Step 4'. Below this table are buttons for 'Calculate table', 'ESEER', 'Calculated value: 0.00', and 'Export to ESEER Excel file'. At the very bottom, there is a checkbox for 'Use correction factor for compressor abs. cap.' and 'Ok'/'Cancel' buttons.

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

Partialization

Partialization Matrix Components Identification

Compressors

%	Circuit 1		Circuit 2	
	1	2	1	2
100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
75	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
50	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
25	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Fans

%	Circuit 1			Circuit 2			PATot kW
	1	2	3	1	2	3	
100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
75	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
50	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
25	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Set ☒ R ☒ C

Set ☒ R ☒ C ☒ T
 Use absorbed capacity manually set on the calculation. ☐

Partialization calculation

Full Load	Step 2	Step 3	Step 4

ESEER
Calculated value: 0.00

☐ Use correction factor for compressor abs. cap.

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%):

50	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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

Partialization

Partialization Matrix Components Identification

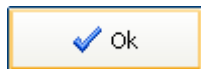
Compressors

%	Circuit 1		Circuit 2	
	1	2	1	2
100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
75	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
50	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
25	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

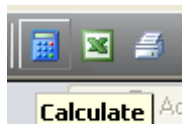
Fans

%	Circuit 1			Circuit 2			PATot kW
	1	2	3	1	2	3	
100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
75	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
50	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
25	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

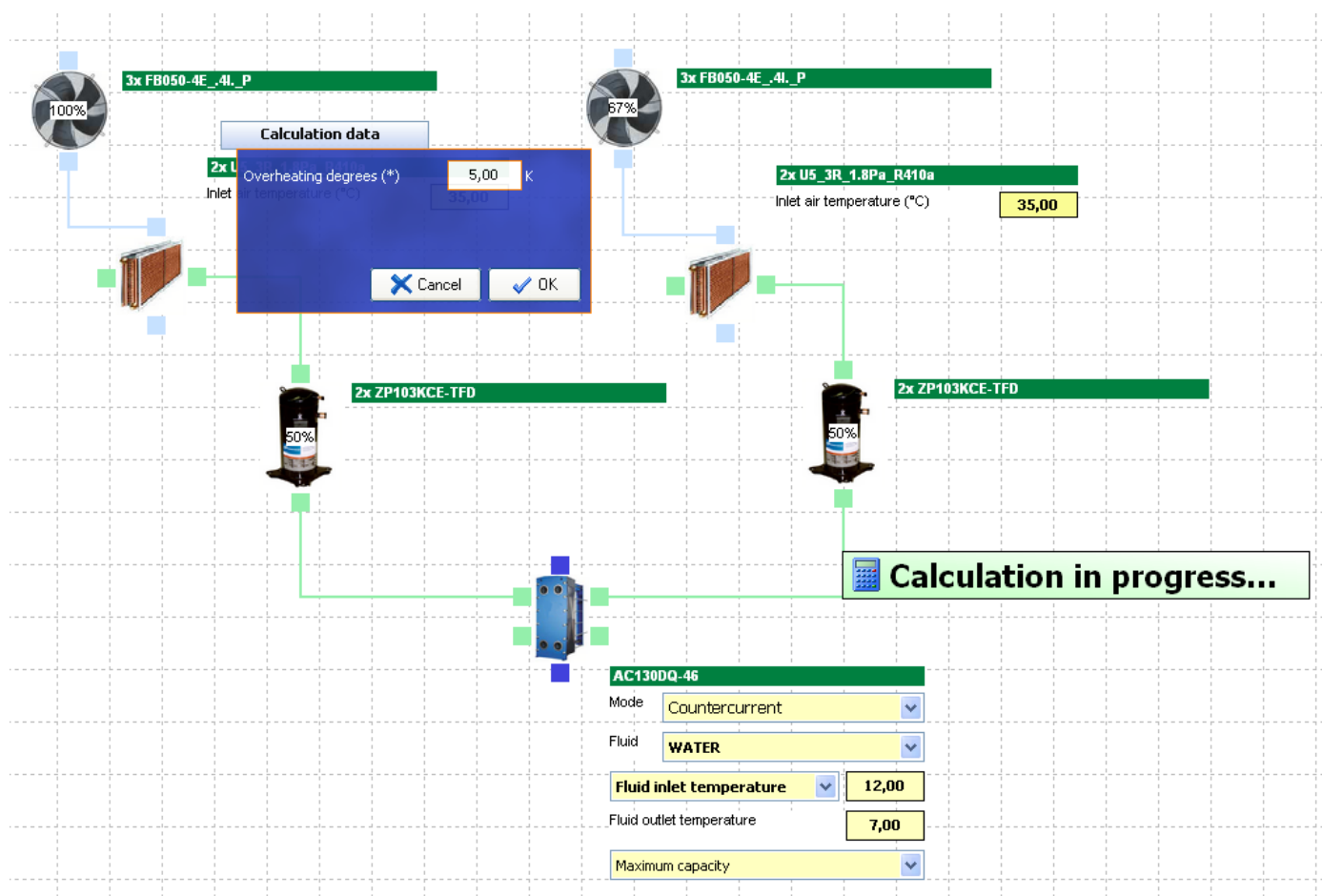
Then click on "Ok" button:



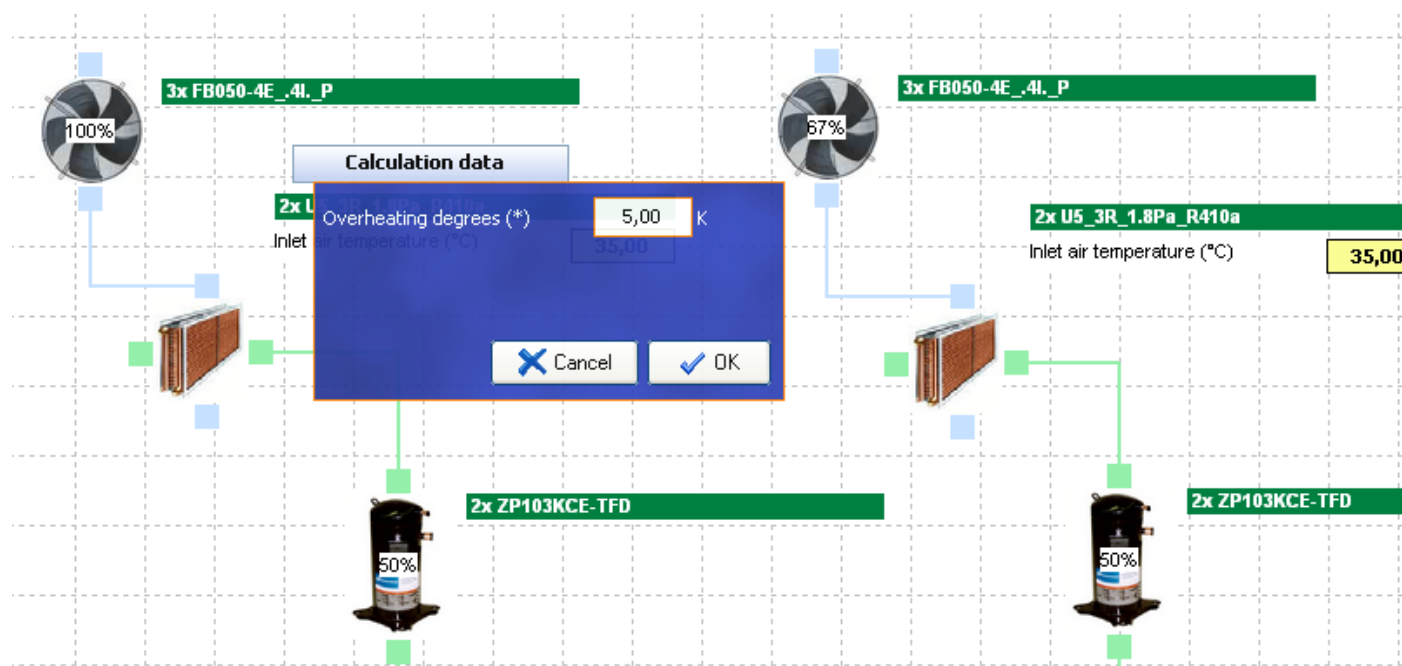
Let's now calculate:



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:

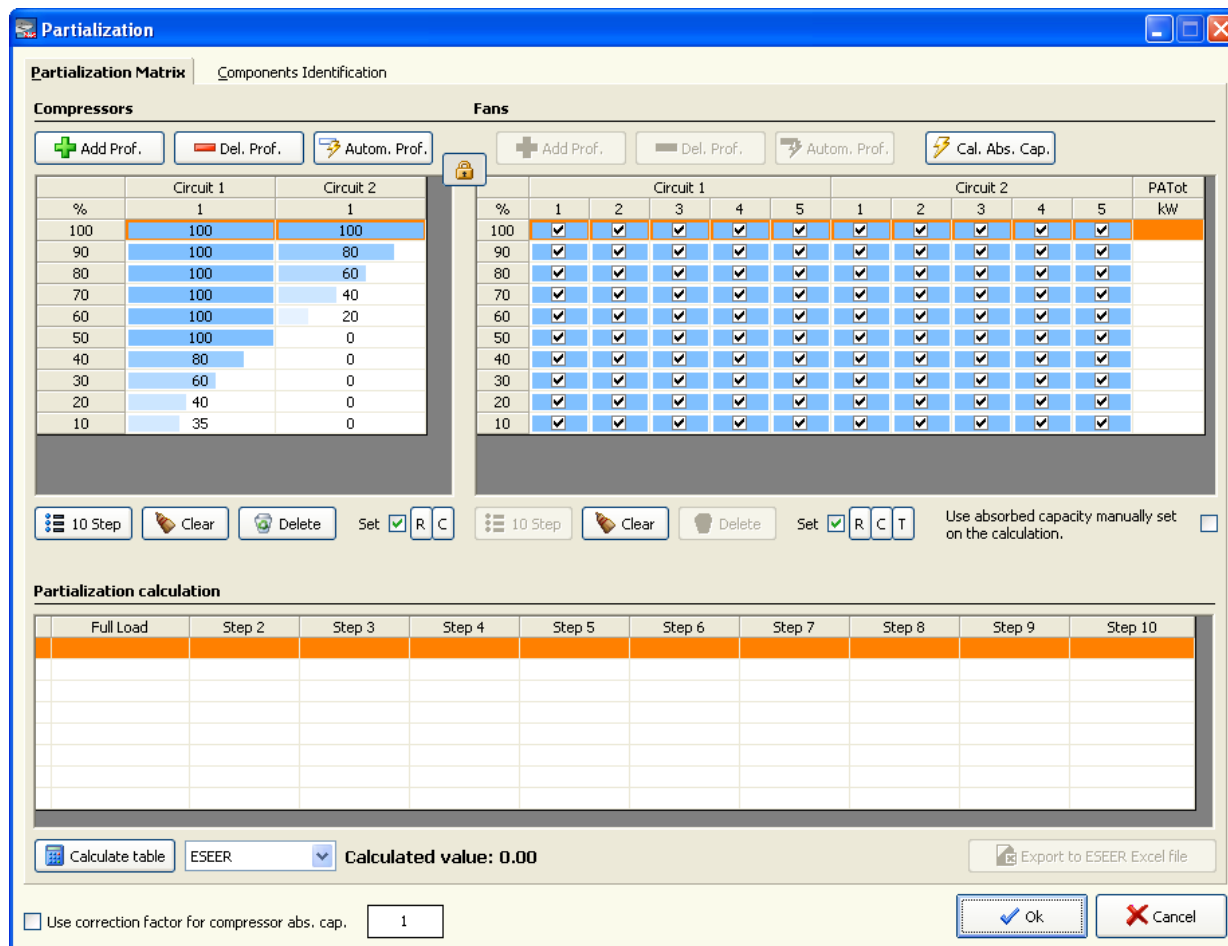
Calculation Data		
Refrigeration circuit global		
Cooling Capacity:	48,94	kW
Total Capacity:	61,09	kW
Abs. compressors capacity	12,15	kW
Abs. fans capacity	2,70	kW
Total absorbed capacity	14,85	kW
EER Compressors	4,03	
EER Fans	18,13	
EER Total	3,30	
Refrigeration circuit - side 1		
Evaporating Temperature:	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:



The screenshot shows the 'Partialization Matrix' window with two tabs: 'Partialization Matrix' and 'Components Identification'. The 'Partialization Matrix' tab is active, displaying two tables for 'Compressors' and 'Fans'.

Compressors Table:

%	Circuit 1	Circuit 2
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

Fans Table:

%	Circuit 1					Circuit 2					PATot kW
	1	2	3	4	5	1	2	3	4	5	
100	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
90	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
80	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
70	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
60	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
50	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
40	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
30	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Below the tables are buttons for '10 Step', 'Clear', 'Delete', and 'Set' with checkboxes for 'R', 'C', and 'T'. A checkbox 'Use absorbed capacity manually set on the calculation.' is also present.

Partialization calculation

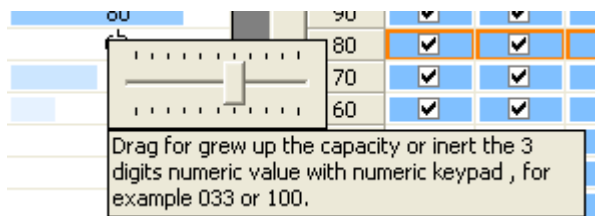
Full Load	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10

At the bottom, there is a 'Calculate table' button, a dropdown menu set to 'ESEER', a 'Calculated value: 0.00' field, an 'Export to ESEER Excel file' button, and a checkbox 'Use correction factor for compressor abs. cap.' with a value of '1'. 'Ok' and 'Cancel' buttons are at the bottom right.

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:

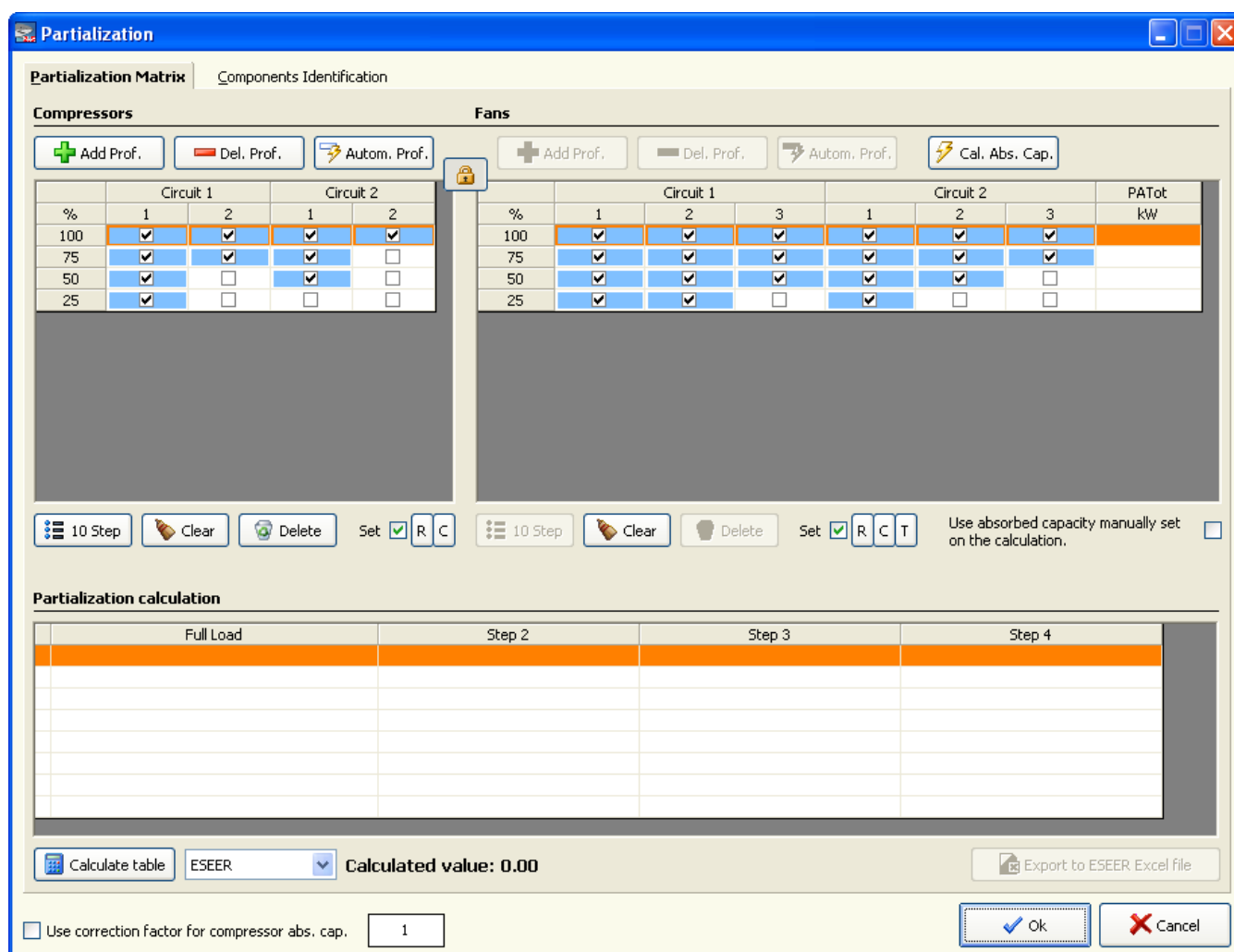


As you can see, you can drag the slider to set the value or enter the value with the keyboard.

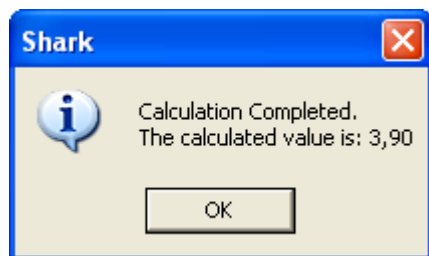
Please notice that 50% doesn't mean that the resulting capacity will be exactly 50% of the capacity at 100%. The program applies a correction factor to the calculation result of the compressors and performs the simulation of the whole unit, indicating the new condensing and evaporating temperatures.

ESEER and IPLV

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



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



And it will complete the performance table:

Partialization calculation

	Full Load	Step 2	Step 3	Step 4
Pf	83,78	65,97	48,46	20,87
Pe	30,86	23,09	14,80	7,03
Pf	88,44	69,69	50,94	21,88
Pe	28,06	21,11	13,61	6,43
Pf	93,02	73,10	53,18	22,77
Pe	25,64	19,37	12,56	5,90
Pf	97,10	76,15	55,21	23,57
Pe	23,51	17,83	11,61	5,44

Calculate table ESEER Calculated value: 3,90 Export to ESEER Excel file

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.

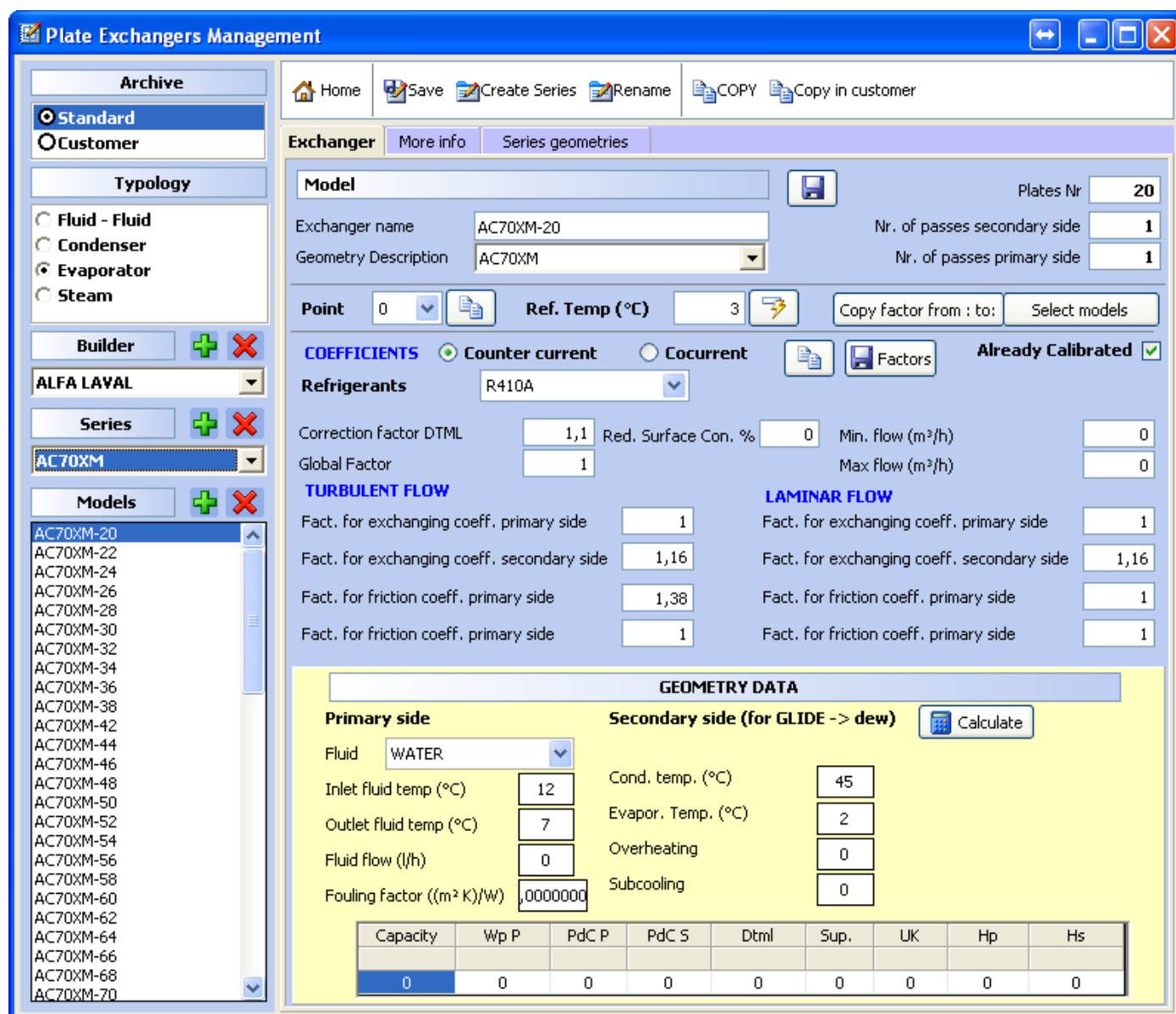
Factors usage in SHARK

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.



The screenshot shows the 'Plate Exchangers Management' window. On the left is a sidebar with 'Archive' (Standard, Customer), 'Typology' (Fluid-Fluid, Condenser, Evaporator, Steam), 'Builder', 'ALFA LAVAL', 'Series' (AC70XM), and 'Models' (a list of models including AC70XM-20). The main area has tabs for 'Exchanger', 'More info', and 'Series geometries'. The 'Exchanger' tab is active, showing fields for 'Model' (AC70XM-20), 'Plates Nr' (20), 'Exchanger name' (AC70XM-20), 'Geometry Description' (AC70XM), 'Nr. of passes secondary side' (1), and 'Nr. of passes primary side' (1). Below these are 'Point' (0) and 'Ref. Temp (°C)' (3). A 'COEFFICIENTS' section includes 'Counter current' (selected), 'Refrigerants' (R410A), and 'Already Calibrated' (checked). It lists factors for 'TURBULENT FLOW' and 'LAMINAR FLOW'. A 'GEOMETRY DATA' section at the bottom has 'Primary side' (Fluid: WATER, Inlet temp: 12, Outlet temp: 7, Flow: 0, Fouling factor: 0.000000) and 'Secondary side (for GLIDE -> dew)' (Cond. temp: 45, Evapor. Temp: 2, Overheating: 0, Subcooling: 0). A 'Calculate' button is present. At the bottom is a table with columns: Capacity, Wp P, PdC P, PdC S, Dtml, Sup., UK, Hp, Hs, with values: 0, 0, 0, 0, 0, 0, 0, 0, 0.

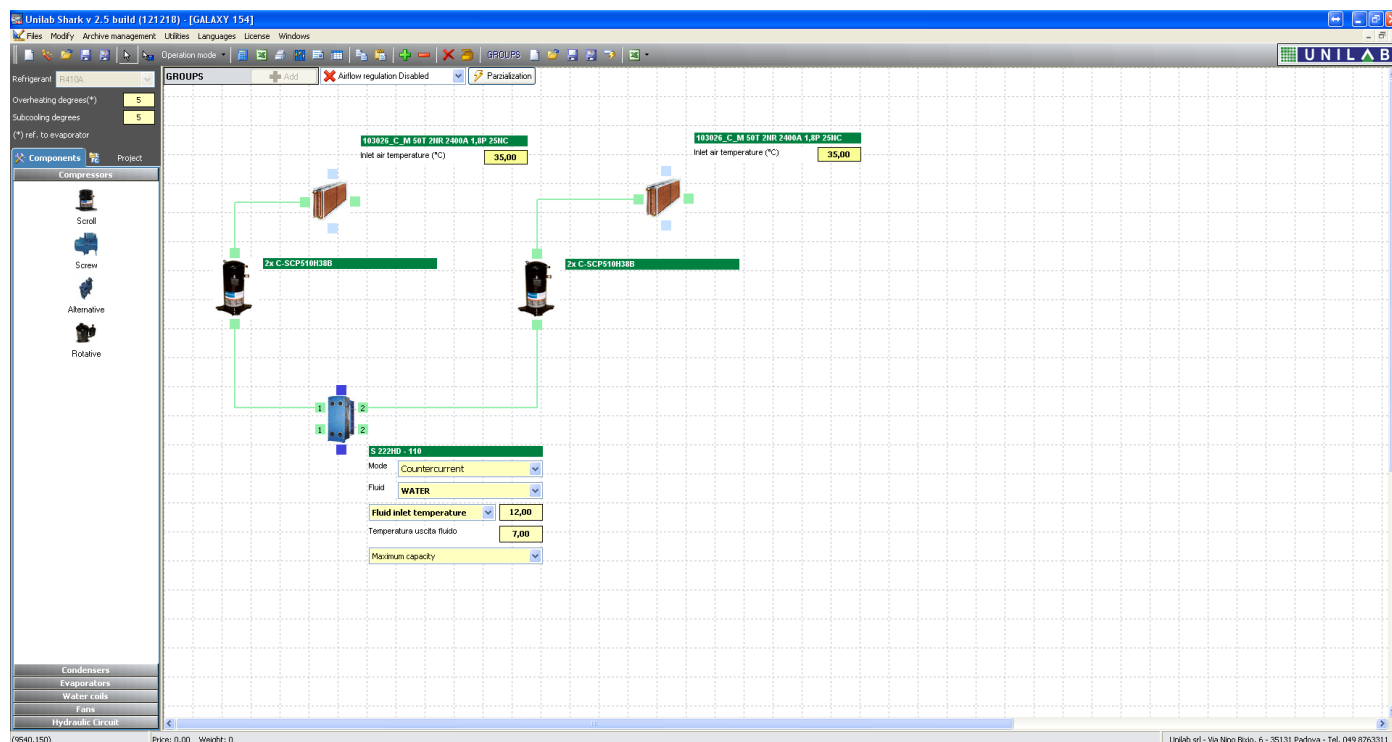
As we can see in the central part of the window contains a series of factors relative to the chosen exchanger

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

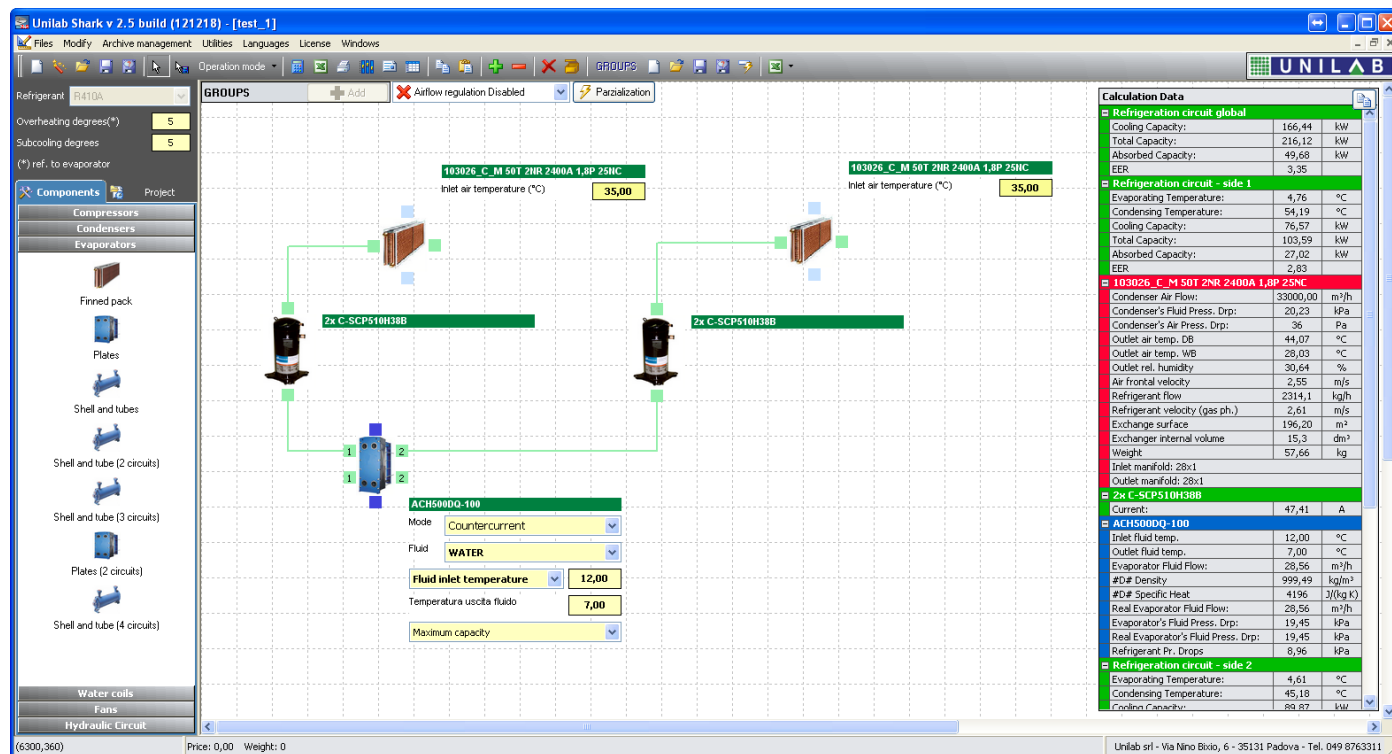
Fouling Factor recuperator

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:

Evaporator FD Factor	1,000000
Condenser Factor	1,150000
Compressor Factor	1,000000

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:

Evaporator FD Factor	1,000000
Condenser Factor	1,250000
	1,000000

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
Cooling Capacity:	168,97	kW

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:

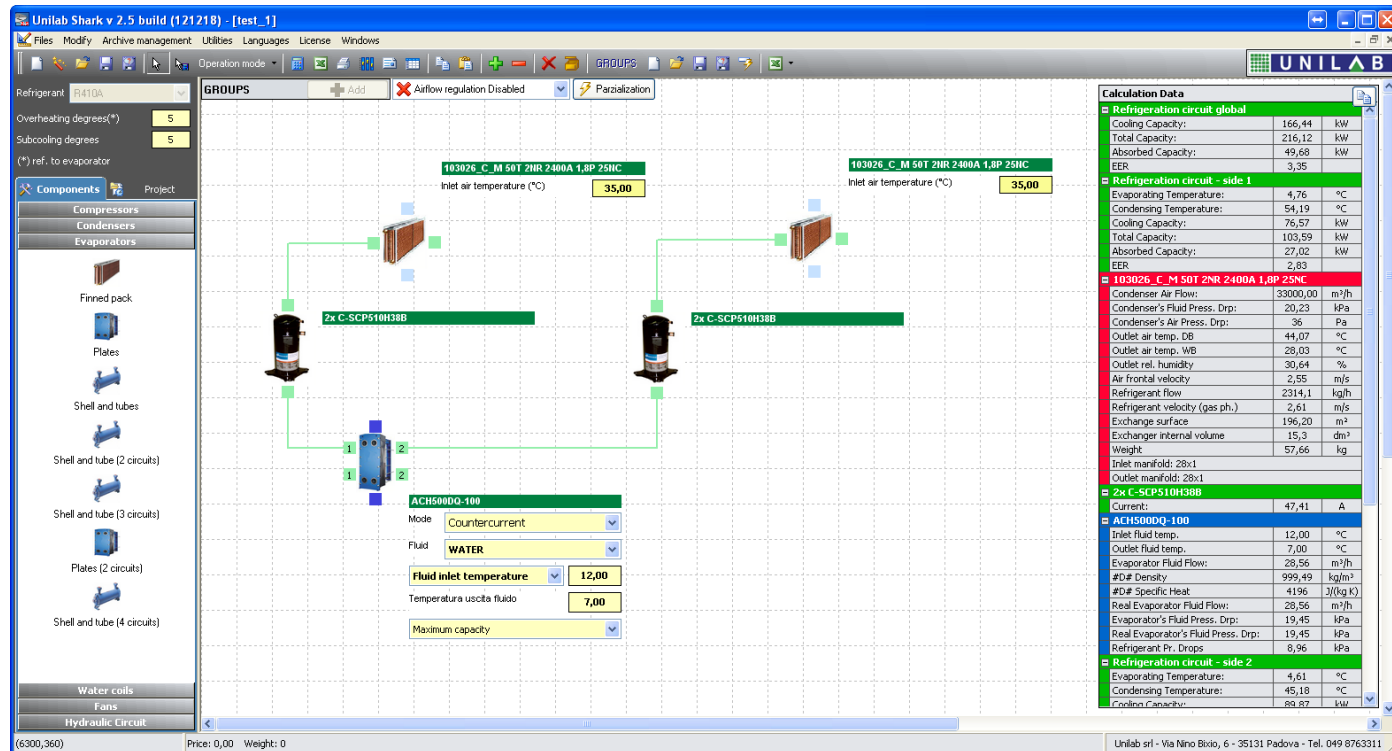


The factors table will appear. At the center of each factors group, we find:

Global power Factor	1,000000	Global power Factor
Absorbed power Factor	1,000000	Absorbed power Factor
Abs. current factor	1,000000	Absorbed current factor
Hydraulic K _g	0,000000	

Rating Example

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



The results of the calculation:

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

We open again the table of the factors:

CHILLER	
Evaporator Factor	1,000000
Sensible capacity factor	1,000000
Evaporator PD Factor	1,000000
Condenser Factor	1,250000
Condenser PD Factor	1,000000
Global power Factor	1,000000
Absorbed power Factor	1,000000
Abs. current factor	1,000000

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:

Condenser PD Factor	1,000000
Global power Factor	1,006100
...	1,000000

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:

Global power Factor	1,006100
Absorbed power Factor	0,985000

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

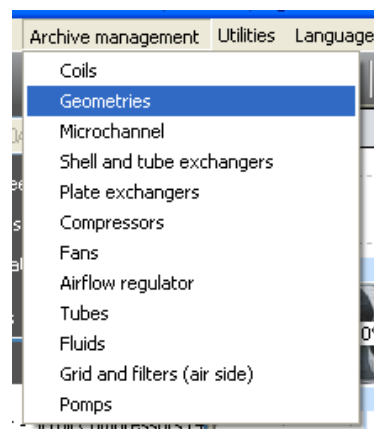
The two database archive of SHARK

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:

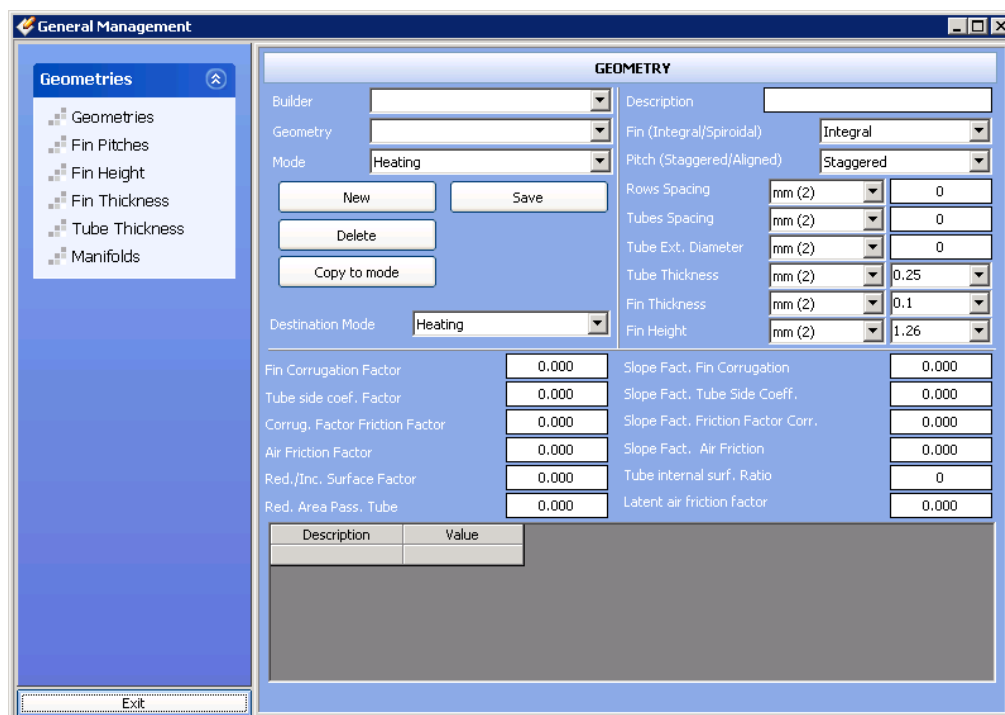
- Standard: are standard archives given by Unilab and are periodically updated. No components should be inserted in this archive because it could be removed by one of our updates.
- Customer: is the archive where to insert new components, which can be shared with the users of the Shark in the technical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

How to insert a geometry

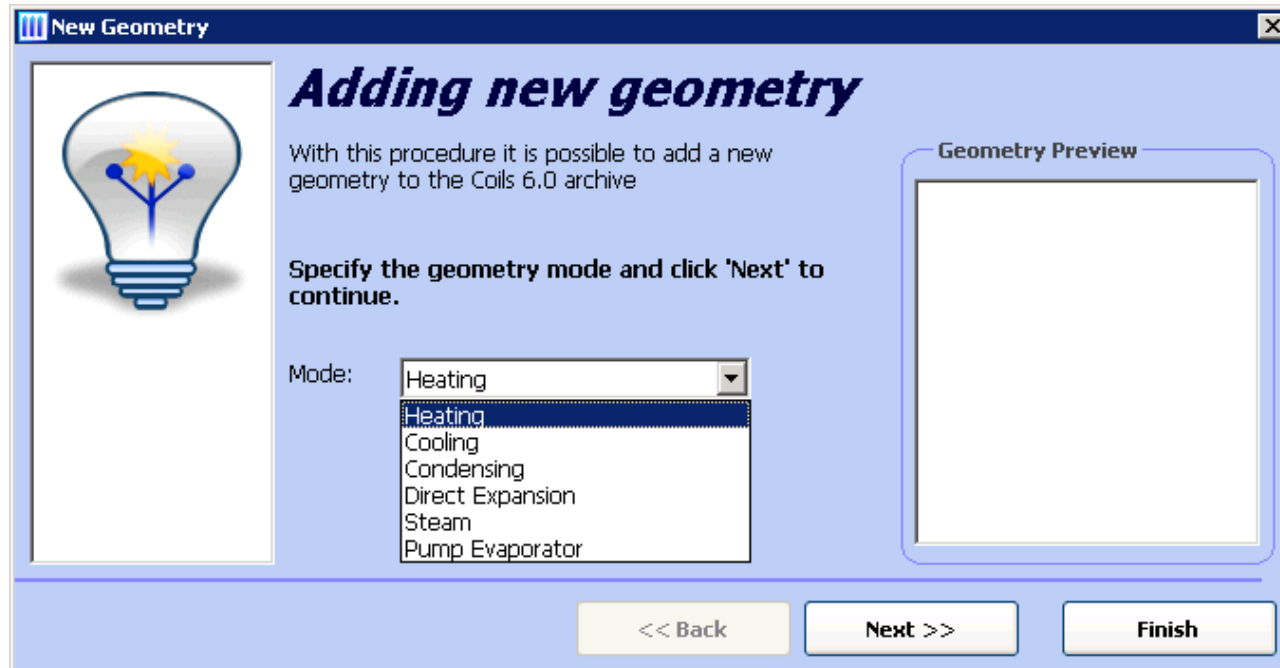
To insert geometry in Shark, we click on "Archive Management", then "Geometries":



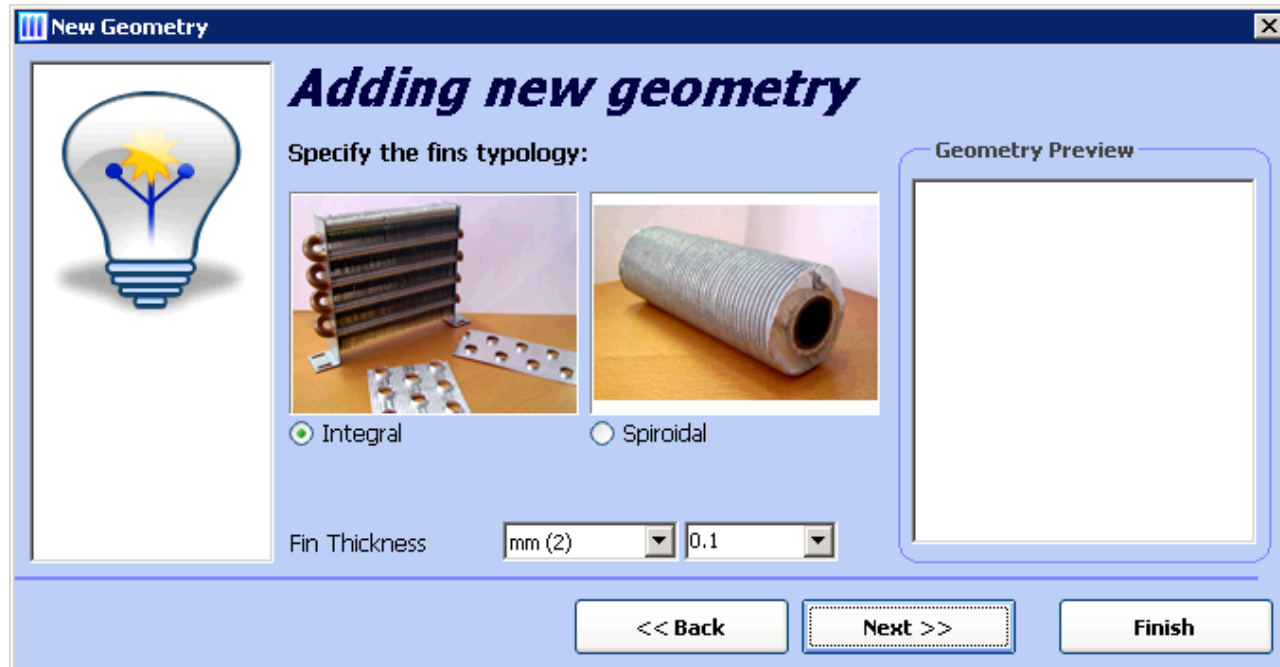
We click on "New" to start the insertion:



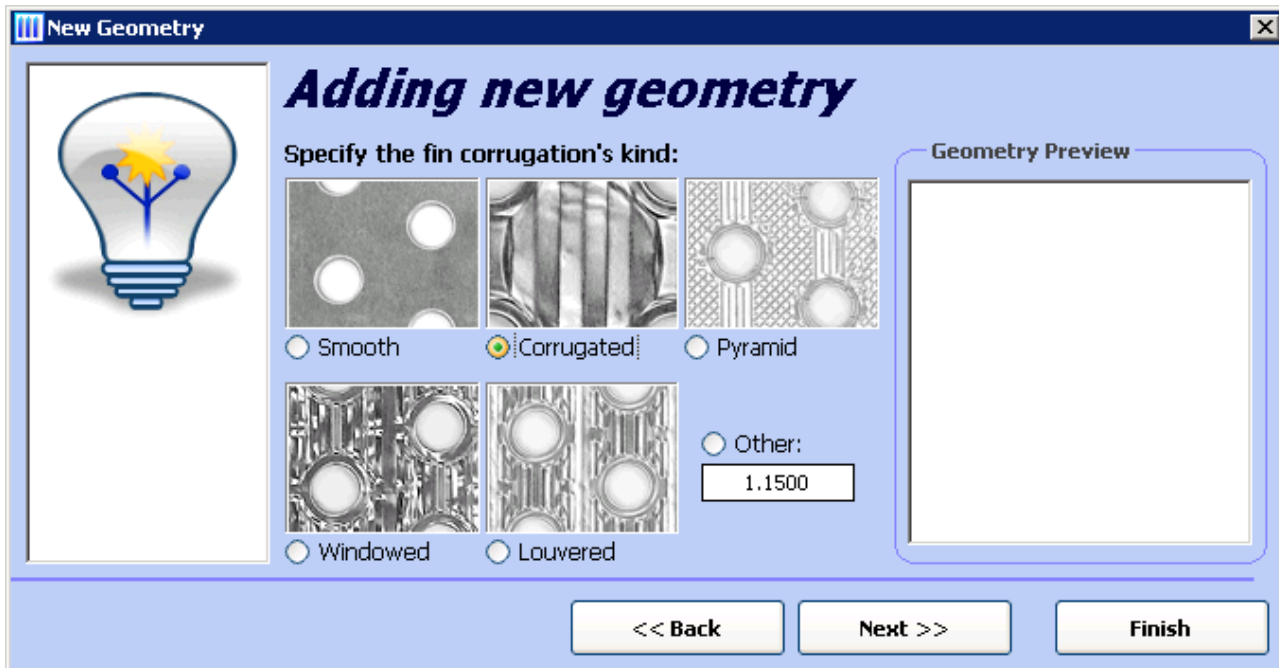
We can choose the modality of the geometry:



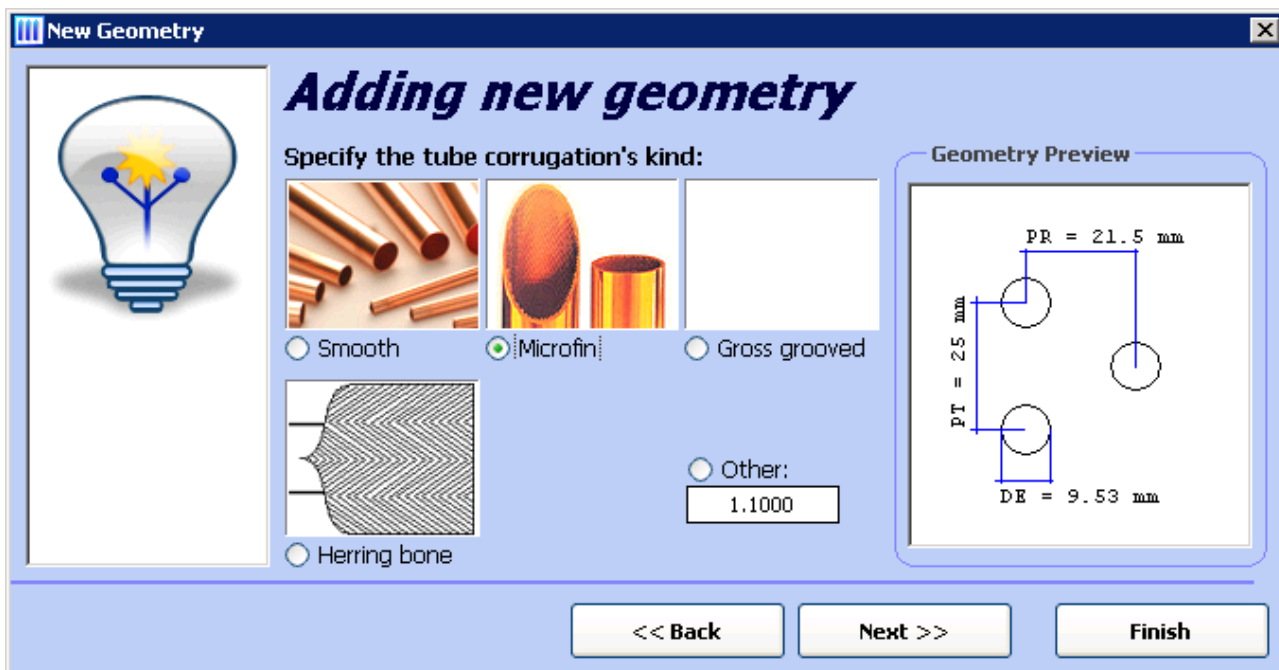
Then we click on "Next" and insert the builder, then we click on Next again and we can now choose the type of fin, either integral or spiroidal and choose the fin thickness and click on Next:



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

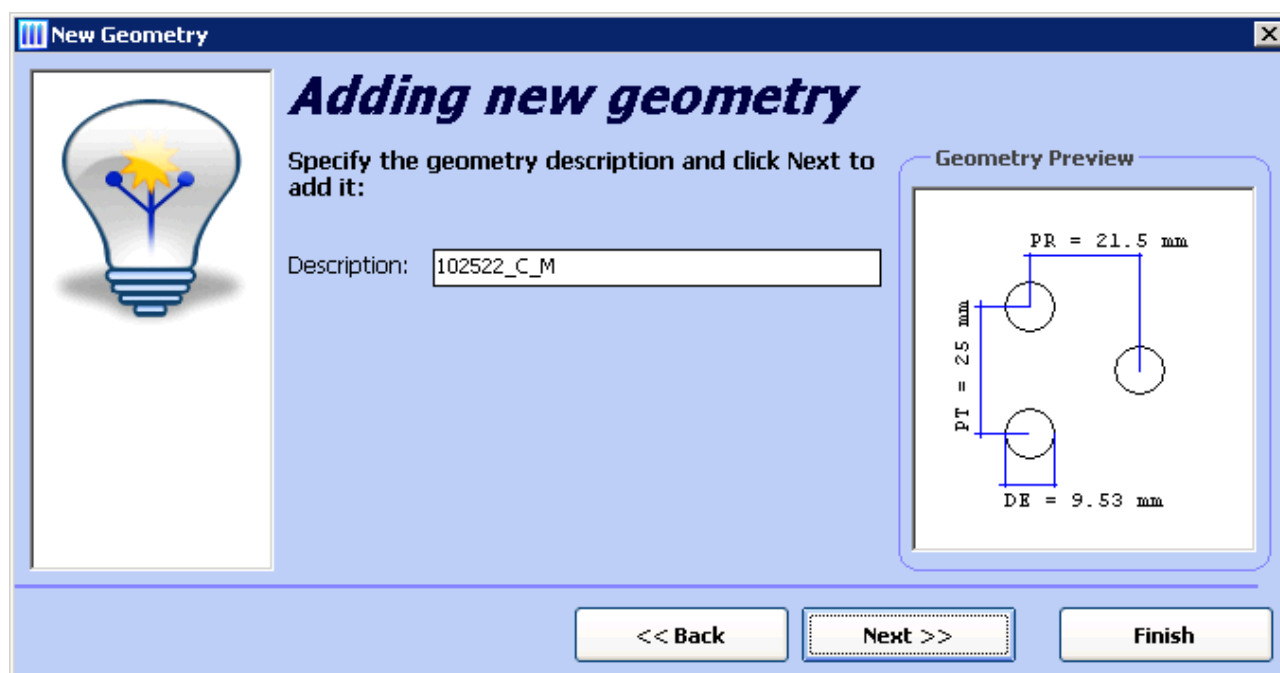


We can then specify the tube alignment -> Staggered or Aligned, and insert the tube external diameter, tube thickness, rows spacing, and tubes spacing, then we click on Next:

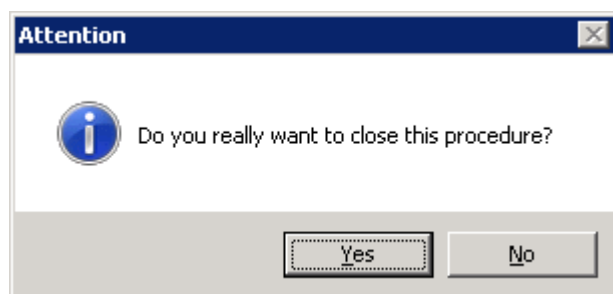


And then we specify the tube corrugation and check the relative factor on the field "Other"

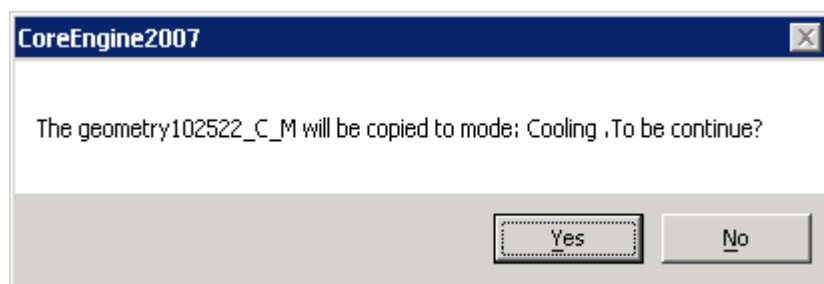
Then we can see the description of the same and click on Next.



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:

General Management

Geometries

- Geometries
- Fin Pitches
- Fin Height
- Fin Thickness
- Tube Thickness
- Manifolds

GEOMETRY

Builder: Description:

Geometry: Fin (Integral/Spiroidal):

Mode: Pitch (Staggered/Aligned):

Destination Mode:

Fin Corrugation Factor: Slope Fact. Fin Corrugation:

Tube side coef. Factor: Slope Fact. Tube Side Coeff.:

Corrug. Factor Friction Factor: Slope Fact. Friction Factor Corr.:

Air Friction Factor: Slope Fact. Air Friction:

Red./Inc. Surface Factor: Tube internal surf. Ratio:

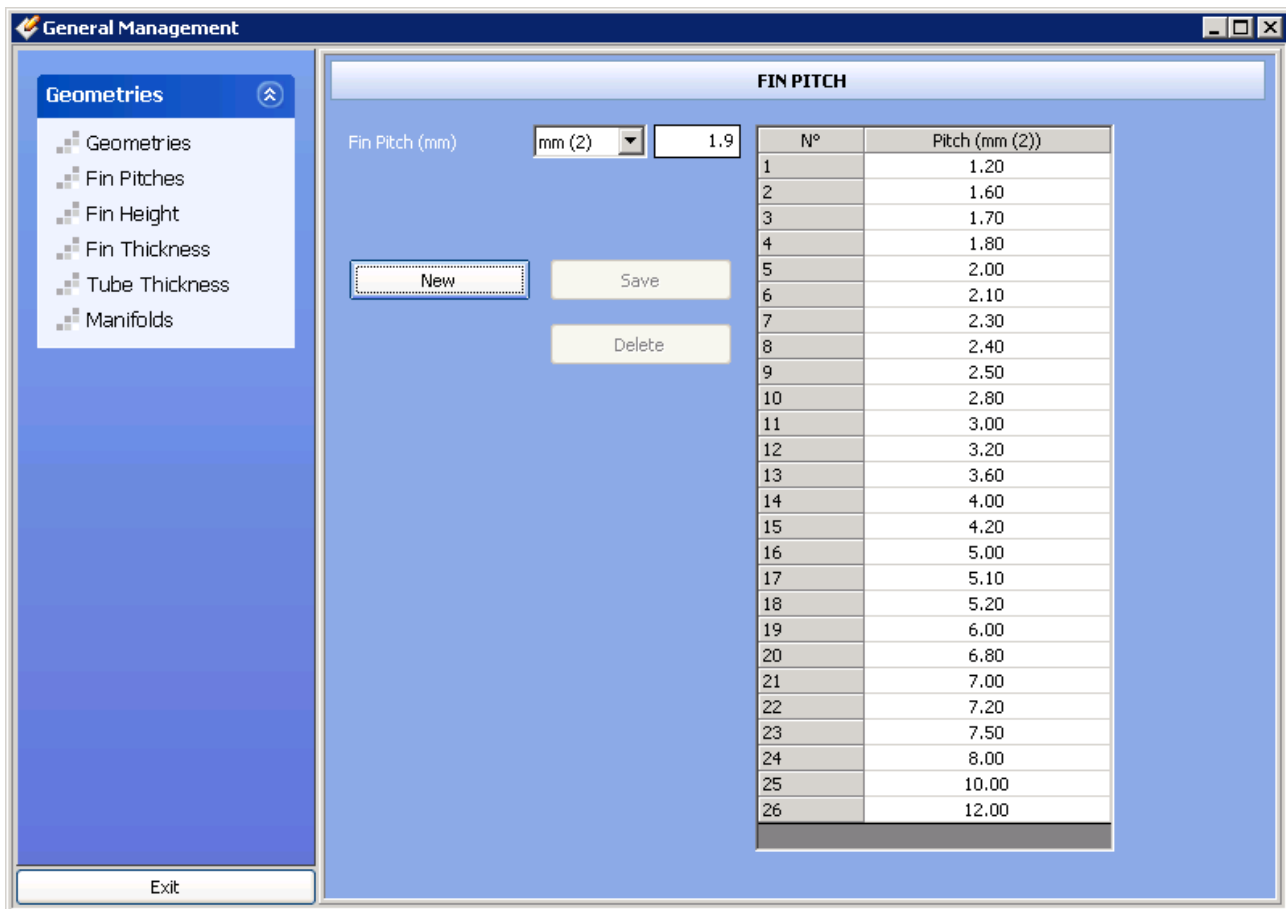
Red. Area Pass. Tube: Latent air friction factor:

Geometry	Rows Spacing	Tubes Spacing	Tube Ext. Diameter	Tube Thickness	Fin Thickness
Geometry	(mm)	(mm)	(mm)	(mm)	(mm)
102522_C_M	21.50	25.00	9.53	0.25	0.10

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 window, we can manage the fin pitches, height thickness, tube thickness and manifolds.

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



General Management

Geometries

- Geometries
- Fin Pitches
- Fin Height
- Fin Thickness
- Tube Thickness
- Manifolds

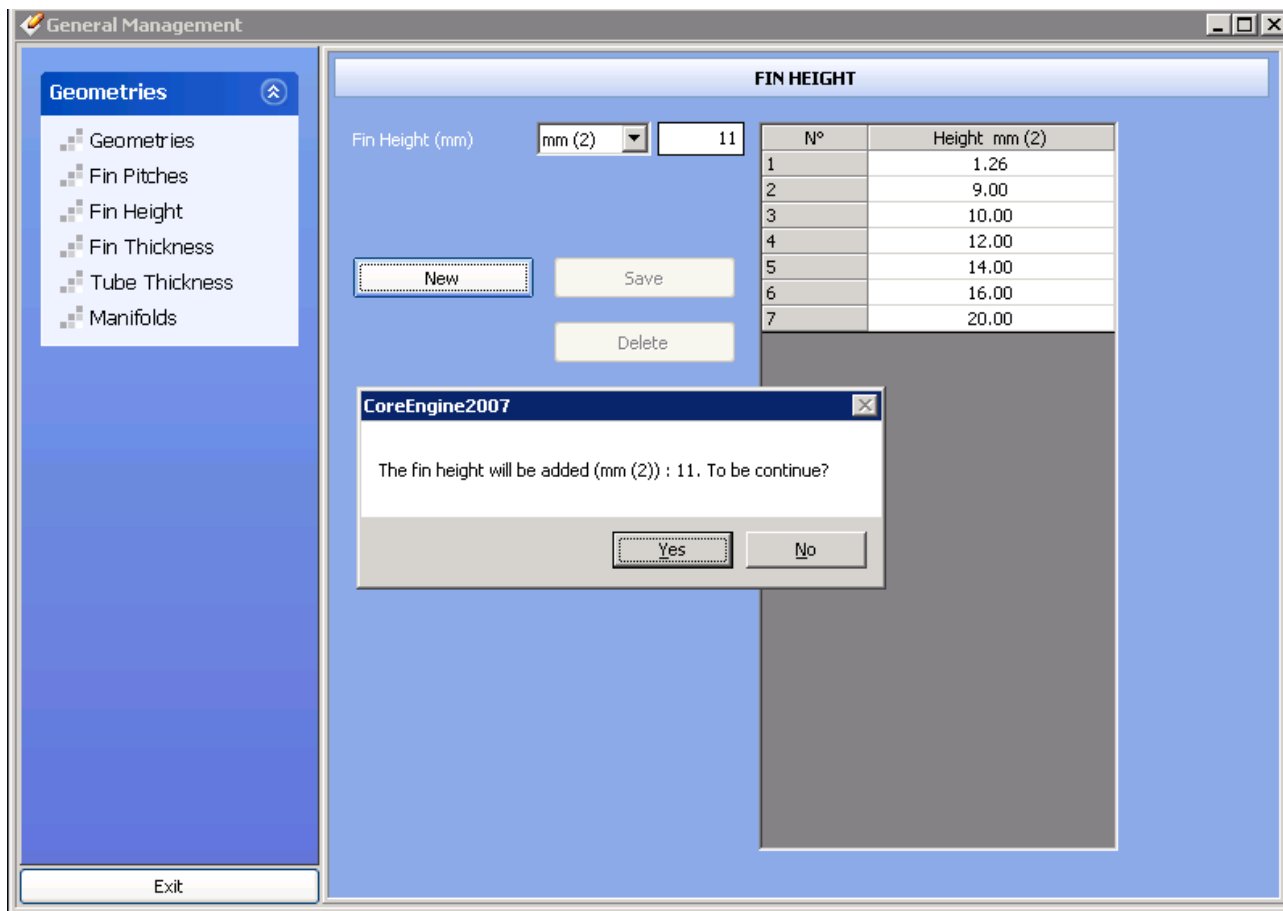
FIN PITCH

Fin Pitch (mm) mm (2)

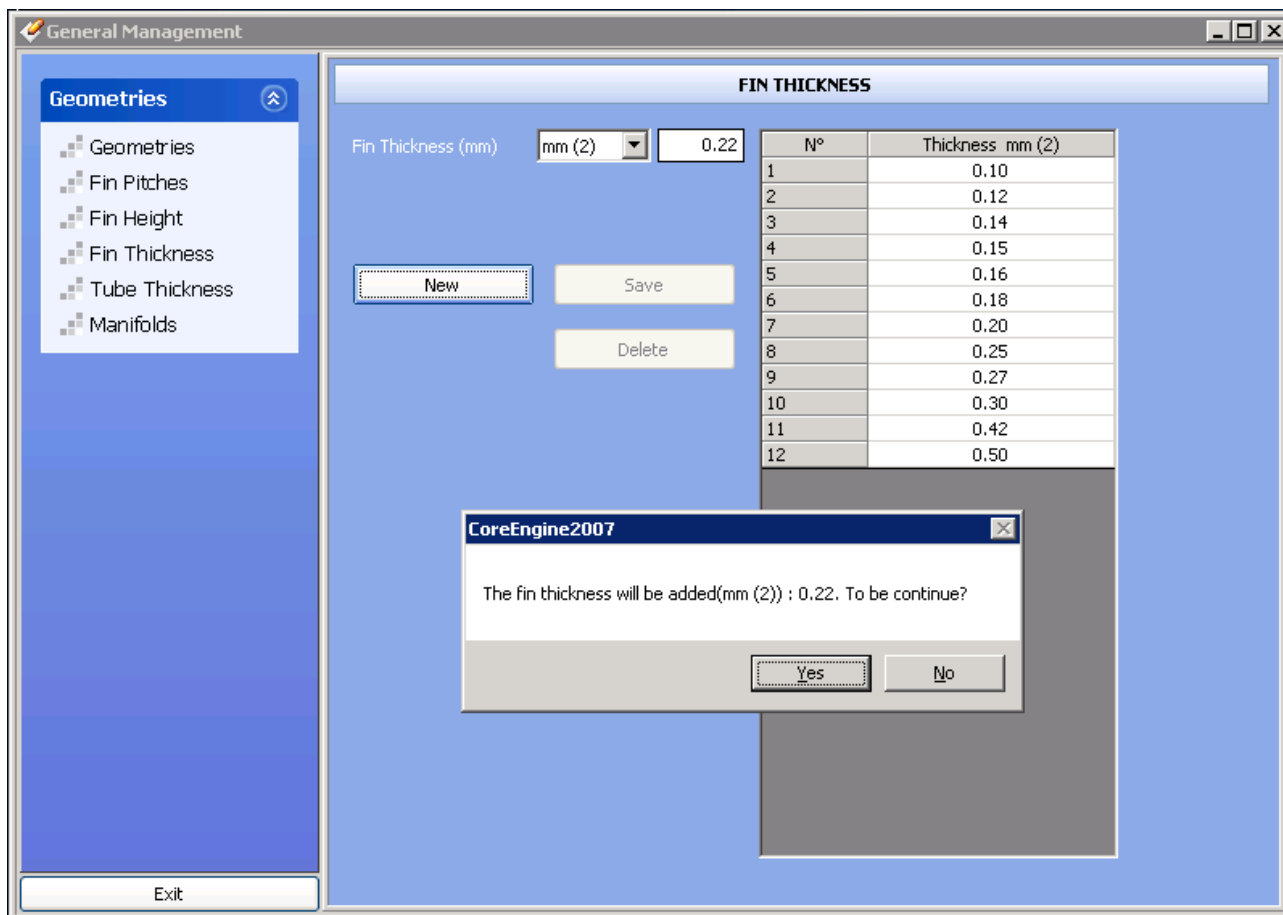
N°	Pitch (mm (2))
1	1.20
2	1.60
3	1.70
4	1.80
5	2.00
6	2.10
7	2.30
8	2.40
9	2.50
10	2.80
11	3.00
12	3.20
13	3.60
14	4.00
15	4.20
16	5.00
17	5.10
18	5.20
19	6.00
20	6.80
21	7.00
22	7.20
23	7.50
24	8.00
25	10.00
26	12.00

Suppose we want to 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.

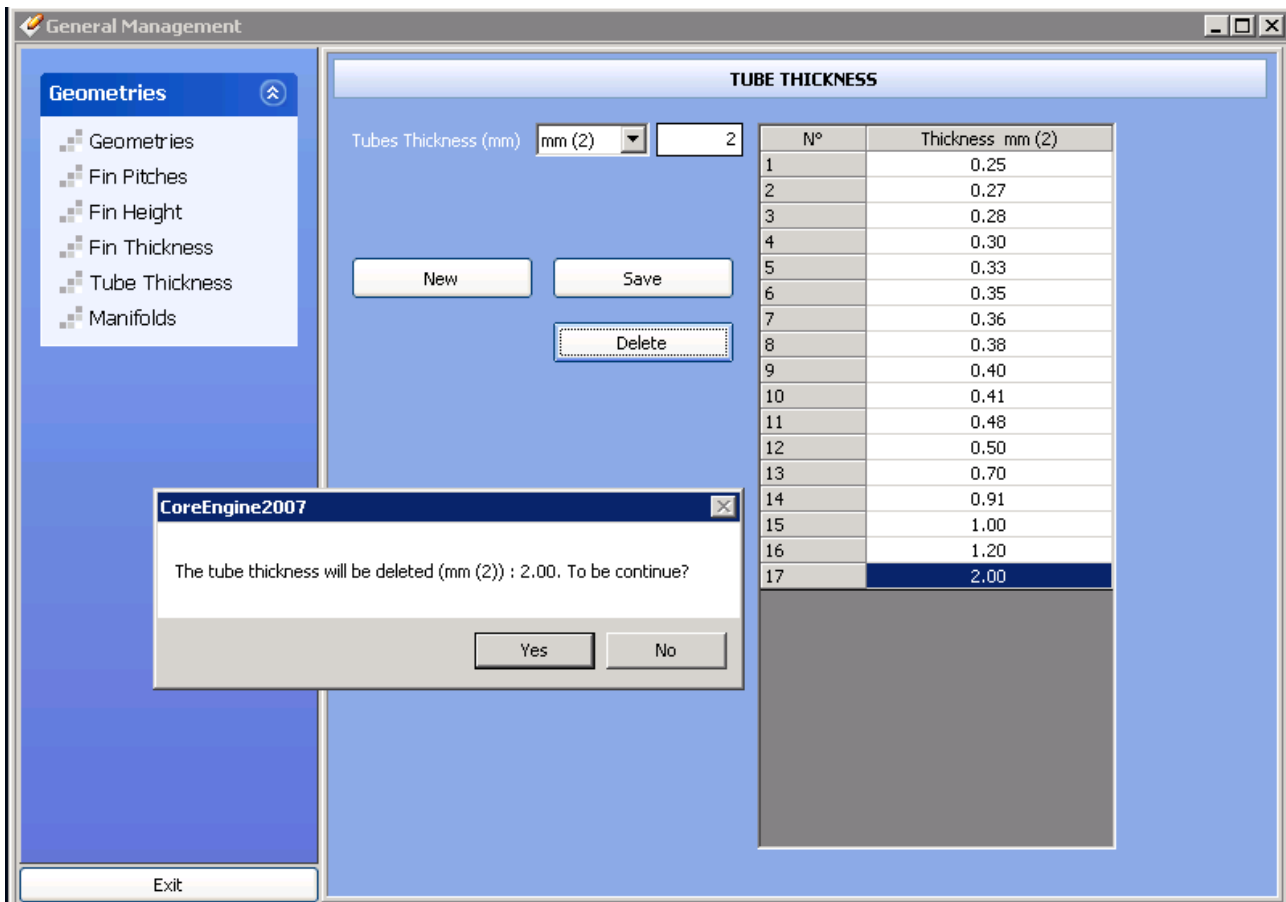
Similarly we can add a new fin height value (for example 11.00 mm)



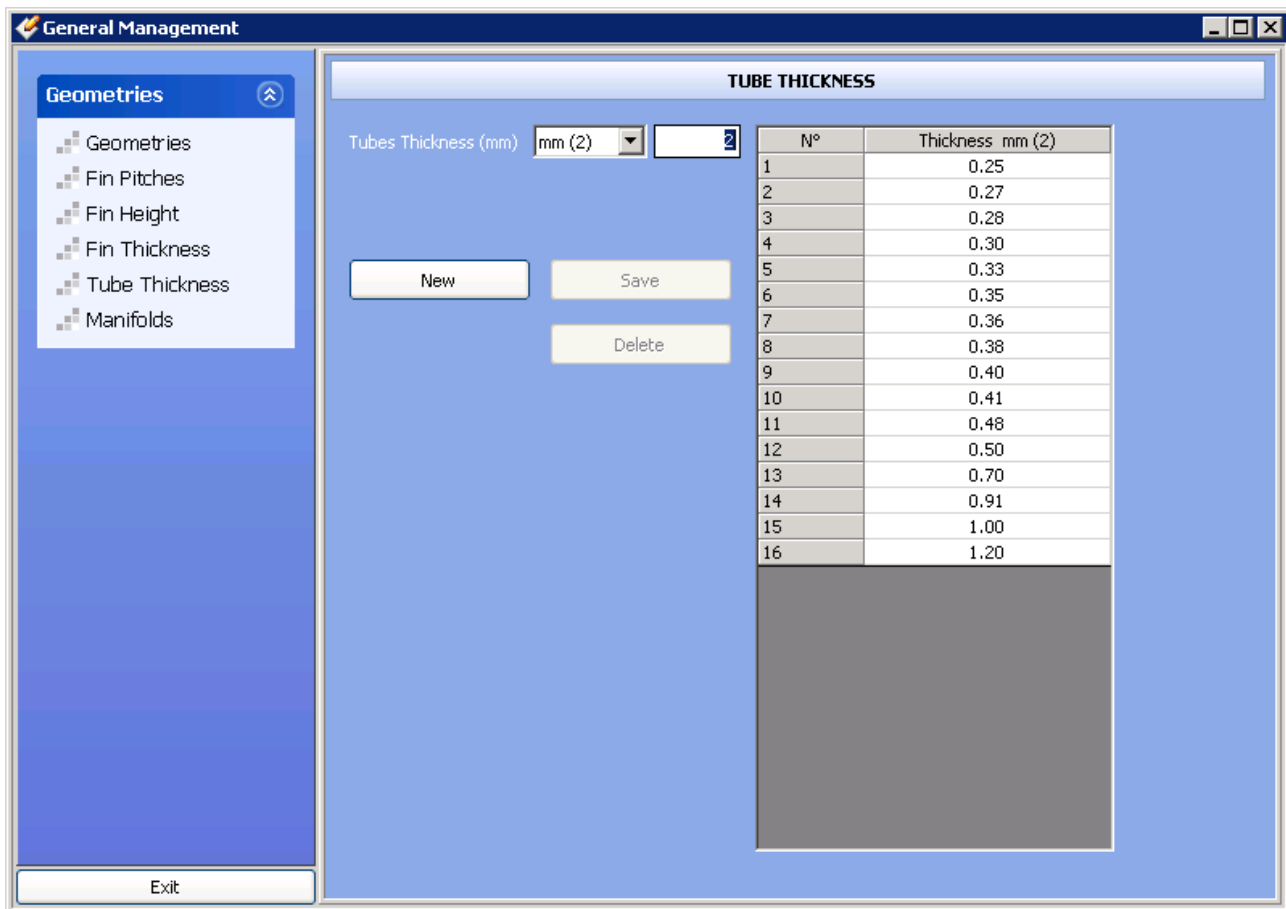
Similarly we can add a fin thickness value (example 0.22 mm)



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.



General Management

Geometries

- Geometries
- Fin Pitches
- Fin Height
- Fin Thickness
- Tube Thickness
- Manifolds

TUBE THICKNESS

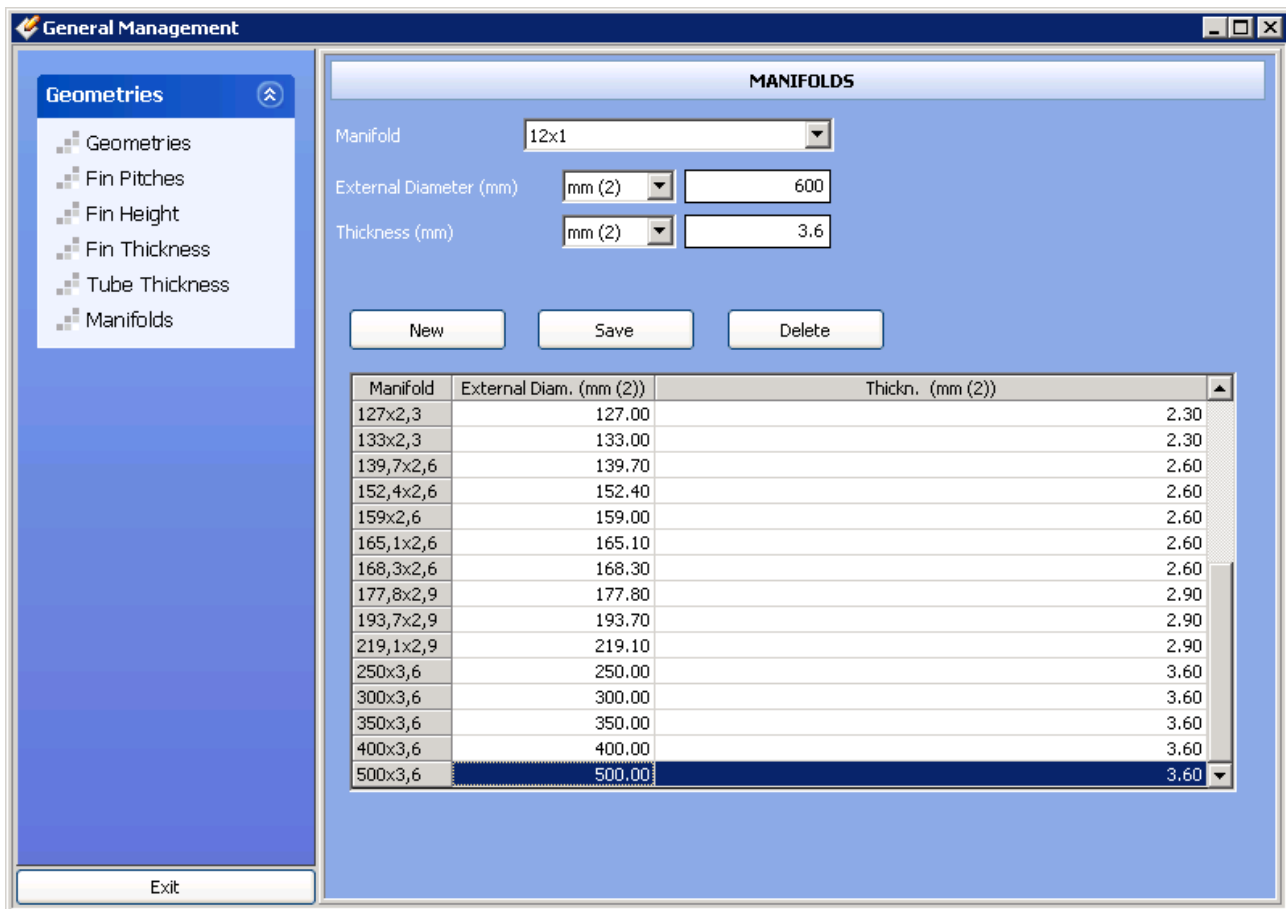
Tubes Thickness (mm) **mm (2)**

New **Save** **Delete**

N°	Thickness mm (2)
1	0.25
2	0.27
3	0.28
4	0.30
5	0.33
6	0.35
7	0.36
8	0.38
9	0.40
10	0.41
11	0.48
12	0.50
13	0.70
14	0.91
15	1.00
16	1.20

Exit

As last point let us insert a new manifold

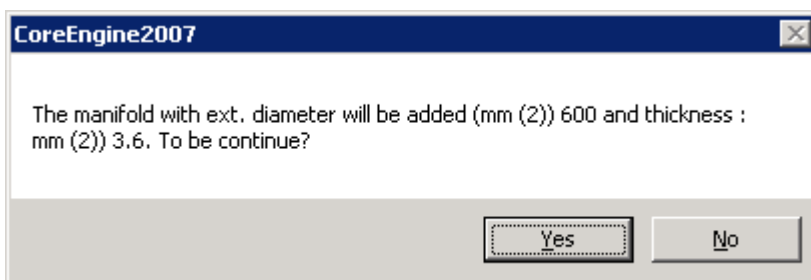


The screenshot shows the 'General Management' window with the 'MANIFOLDS' tab selected. On the left, a 'Geometries' sidebar lists options: Geometries, Fin Pitches, Fin Height, Fin Thickness, Tube Thickness, and Manifolds. The main area contains a 'Manifold' dropdown set to '12x1', 'External Diameter (mm)' set to '600', and 'Thickness (mm)' set to '3.6'. Below these are 'New', 'Save', and 'Delete' buttons. A table lists various manifold specifications.

Manifold	External Diam. (mm (2))	Thickn. (mm (2))
127x2,3	127.00	2.30
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

An 'Exit' button is located at the bottom left of the window.

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



The screenshot shows a dialog box titled 'CoreEngine2007'. The text inside reads: 'The manifold with ext. diameter will be added (mm (2)) 600 and thickness : mm (2)) 3.6. To be continue?'. At the bottom, there are 'Yes' and 'No' buttons.

As we can see from the figure in the bottom

General Management

Geometries

- Geometries
- Fin Pitches
- Fin Height
- Fin Thickness
- Tube Thickness
- Manifolds

MANIFOLDS

Manifold
12x1

External Diameter (mm)
mm (2)
12

Thickness (mm)
mm (2)
1

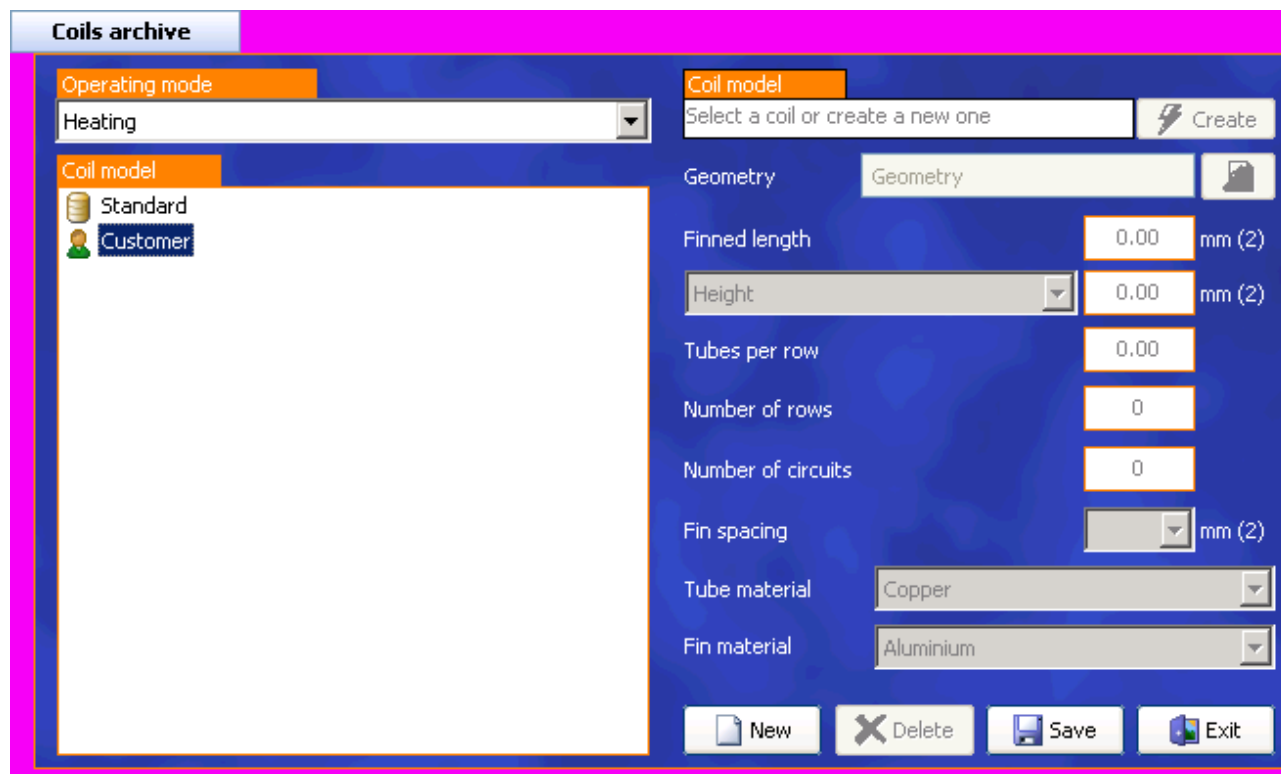
New Save Delete

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

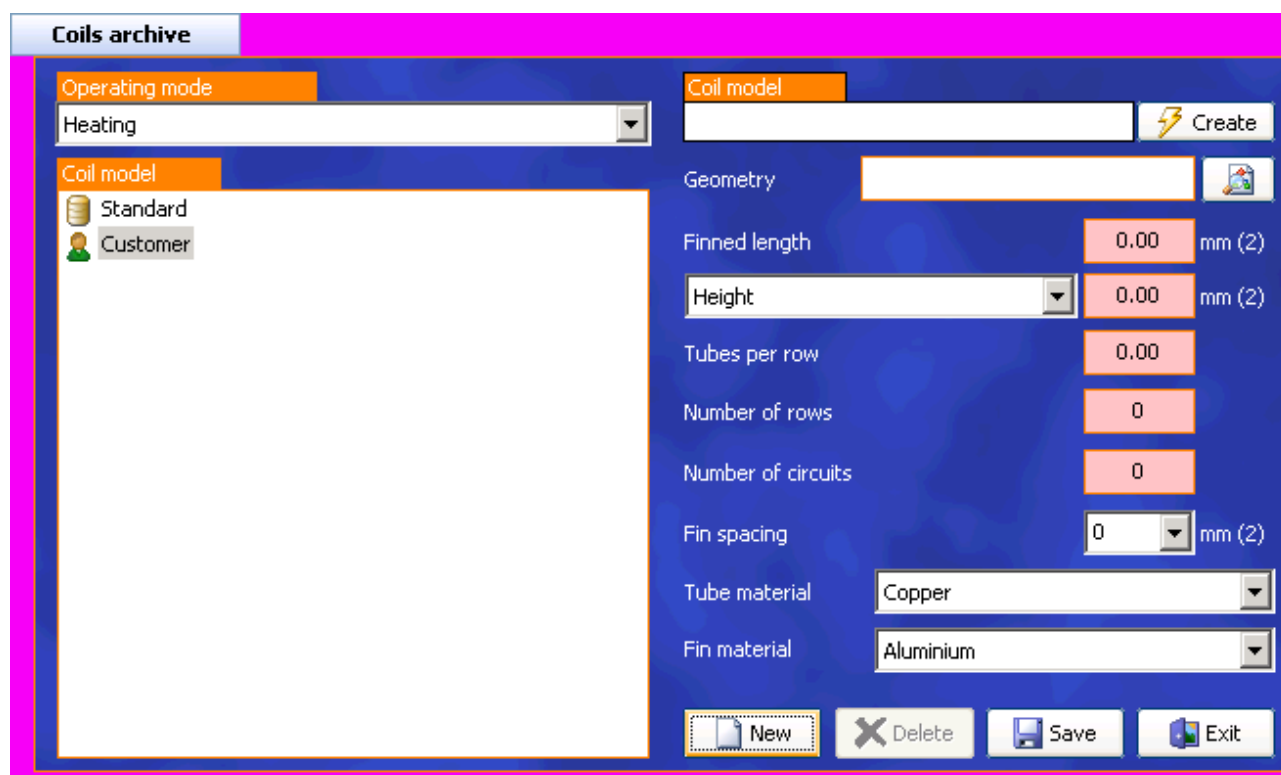
Exit

How to insert a coil

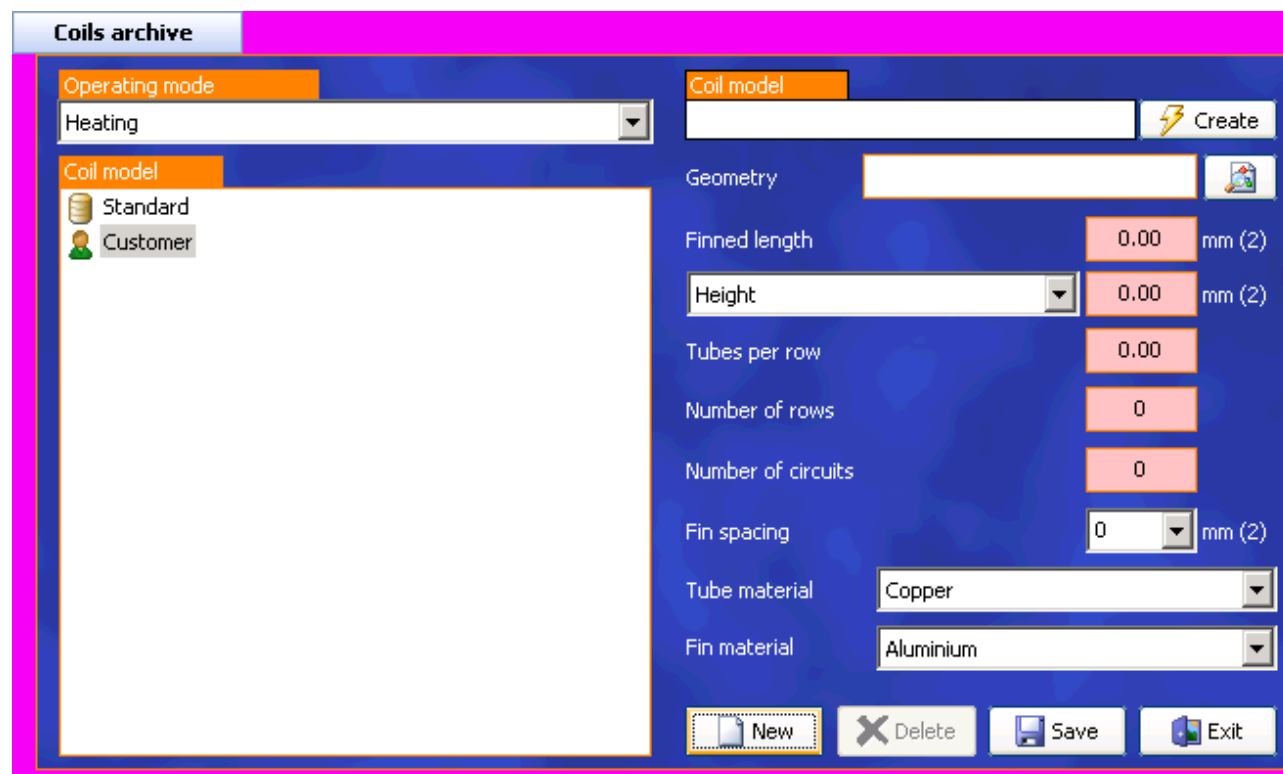
We click on Archive Management, and then on Coils, we will see:



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



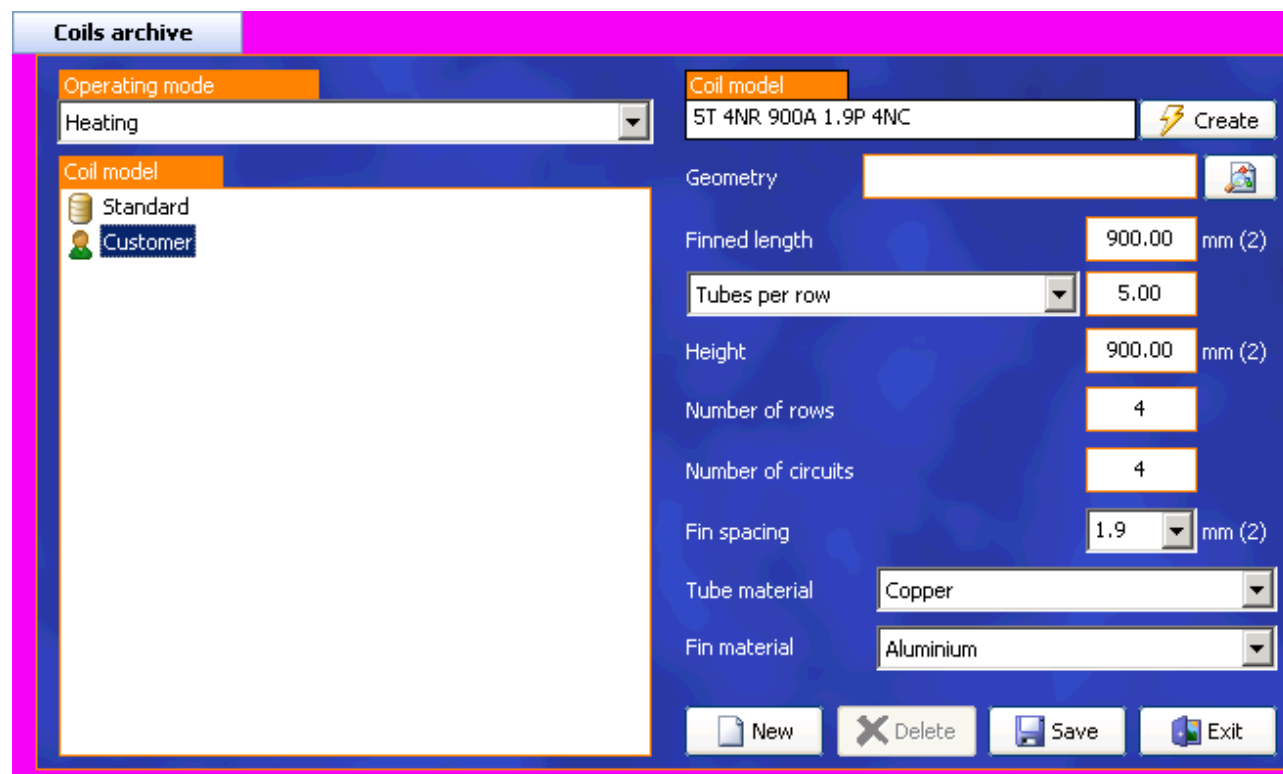
Then we click on New and get:



The screenshot shows the 'Coils archive' window with the following fields and controls:

- Operating mode:** Heating (dropdown menu)
- Coil model:**
 - Standard (icon)
 - Customer (icon)
- Coil model:** (empty text field)
- Create:** (lightning bolt icon)
- Geometry:** (empty text field)
- Finned length:** 0.00 mm (2)
- Height:** 0.00 mm (2)
- Tubes per row:** 0.00
- Number of rows:** 0
- Number of circuits:** 0
- Fin spacing:** 0 mm (2)
- Tube material:** Copper (dropdown menu)
- Fin material:** Aluminium (dropdown menu)
- Buttons:** New (highlighted), Delete, Save, Exit

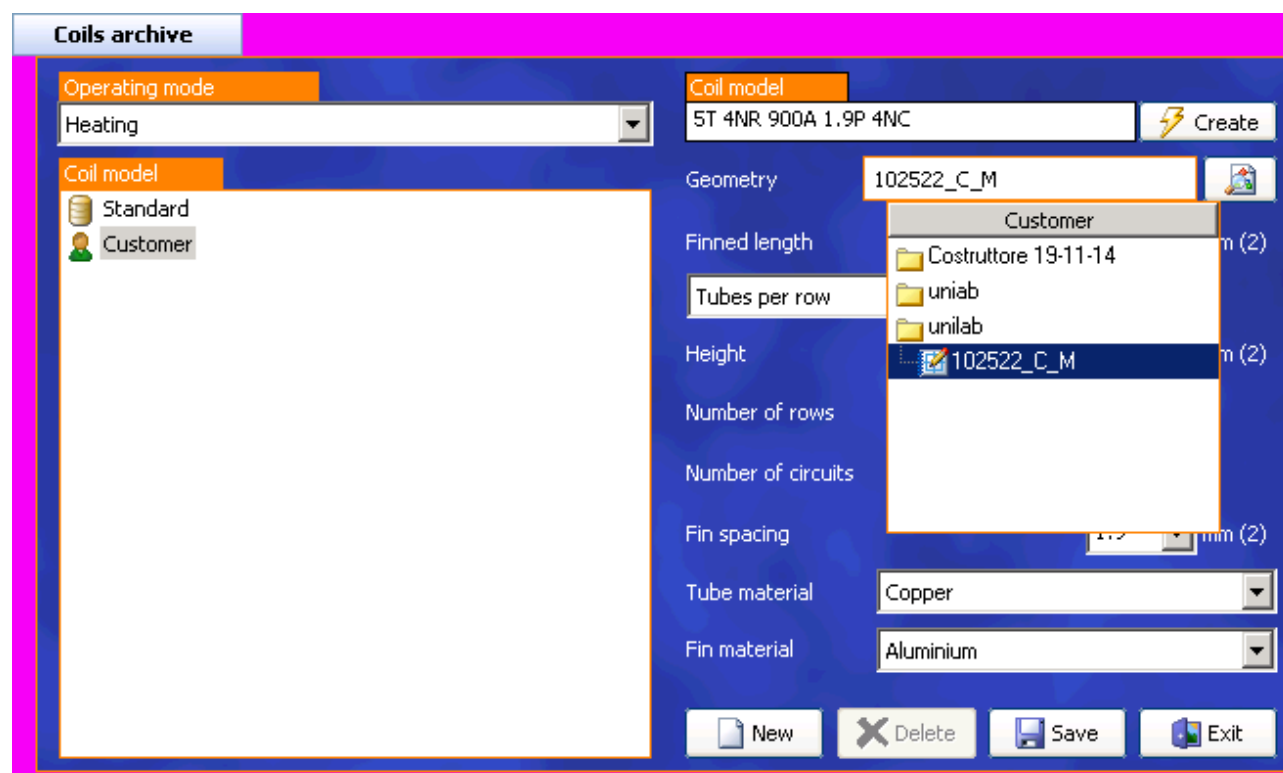
We insert the dimensions on the coils:



The screenshot shows the 'Coils archive' window with the following fields and controls:

- Operating mode:** Heating (dropdown menu)
- Coil model:**
 - Standard (icon)
 - Customer (icon)
- Coil model:** ST 4NR 900A 1.9P 4NC
- Create:** (lightning bolt icon)
- Geometry:** (empty text field)
- Finned length:** 900.00 mm (2)
- Tubes per row:** 5.00
- Height:** 900.00 mm (2)
- Number of rows:** 4
- Number of circuits:** 4
- Fin spacing:** 1.9 mm (2)
- Tube material:** Copper (dropdown menu)
- Fin material:** Aluminium (dropdown menu)
- Buttons:** New, Delete, Save, Exit

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:



Coils archive

Operating mode
Heating

Coil model
Standard
Customer

Coil model
ST 4NR 900A 1.9P 4NC ⚡ Create

Geometry
102522_C_M 📁

Finned length
mm (2)

Tubes per row
mm (2)

Height
mm (2)

Number of rows
mm (2)

Number of circuits
mm (2)

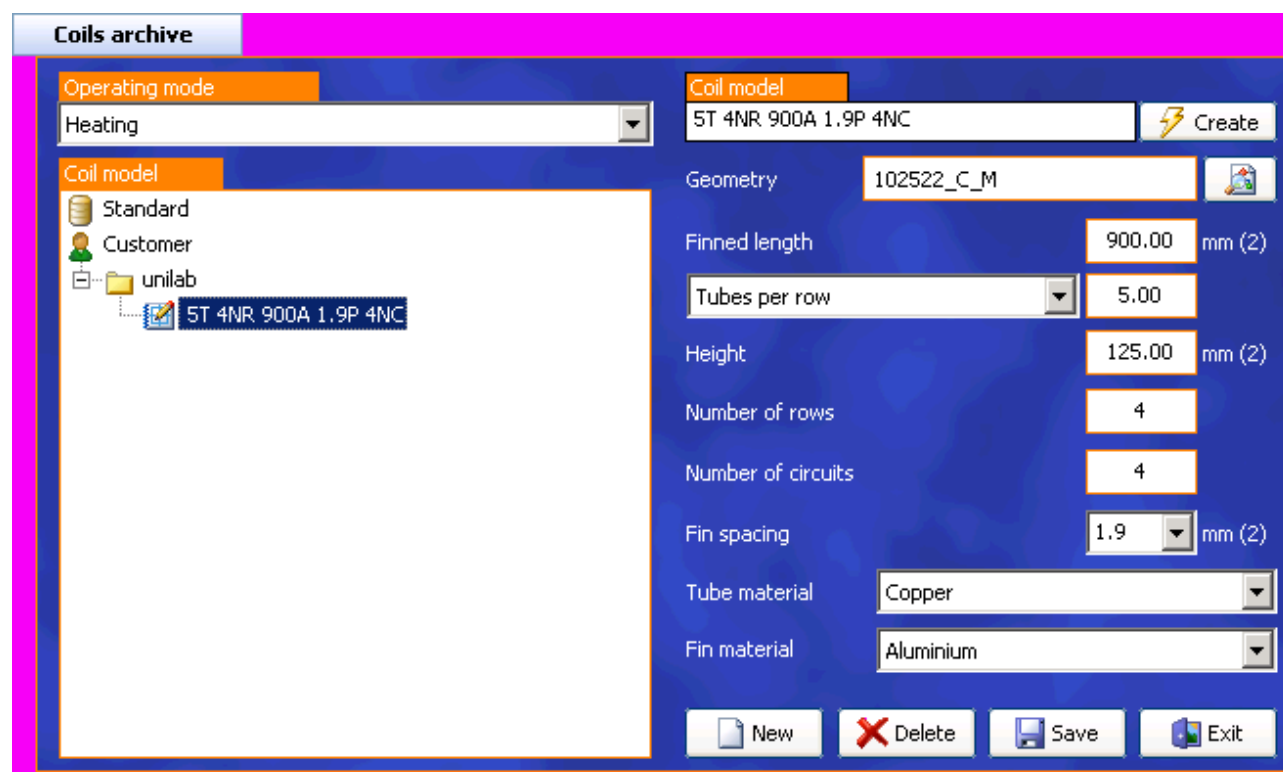
Fin spacing
mm (2)

Tube material
Copper

Fin material
Aluminium

New Delete Save Exit

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



Coils archive

Operating mode
Heating

Coil model
Standard
Customer
unilab
102522_C_M

Coil model
ST 4NR 900A 1.9P 4NC ⚡ Create

Geometry
102522_C_M 📁

Finned length
900.00 mm (2)

Tubes per row
5.00

Height
125.00 mm (2)

Number of rows
4

Number of circuits
4

Fin spacing
1.9 mm (2)

Tube material
Copper

Fin material
Aluminium

New Delete Save Exit

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.

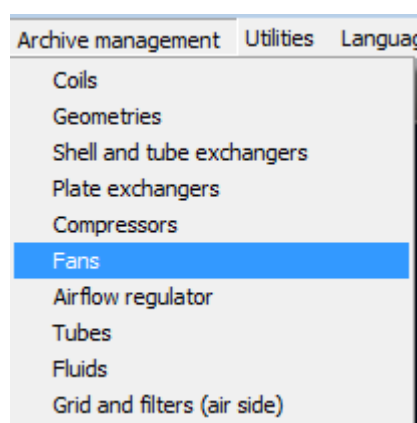
SHARK supports the following types of fans:

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

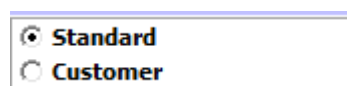
Given that what is important to SHARK is not the fan typology "from the manufacturer catalogue", but how it is used in the unit and driven from the controller.

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.



Builder

Ziehl-Abegg

Typology

Axials

Subtype

Monophase

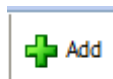
Series

Series FE

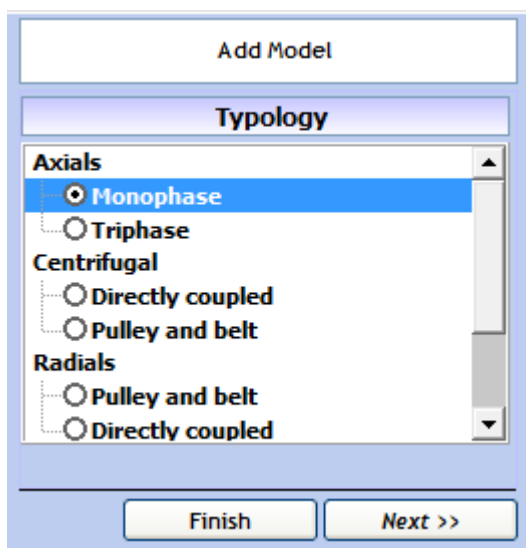
Models

FE031-4D _0C._

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:



Add Model

Typology

Axials

☒ Monophase

☐ Triphase

Centrifugal

☐ Directly coupled

☐ Pulley and belt

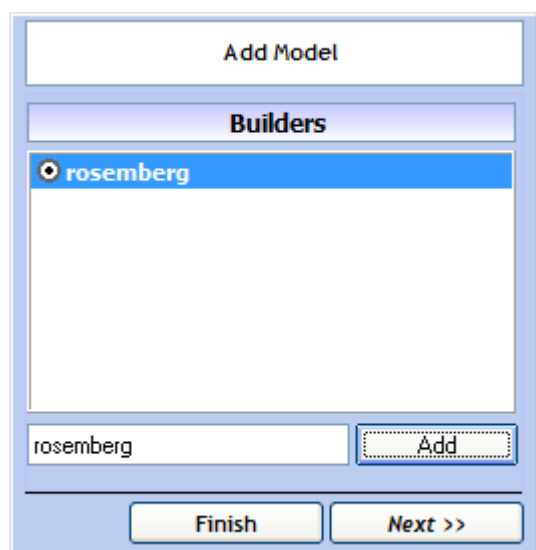
Radials

☐ Pulley and belt

☐ Directly coupled

Finish **Next >>**

We click on Next to specify the manufacturer:



Add Model

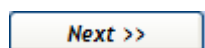
Builders

• roseberg

roseberg Add

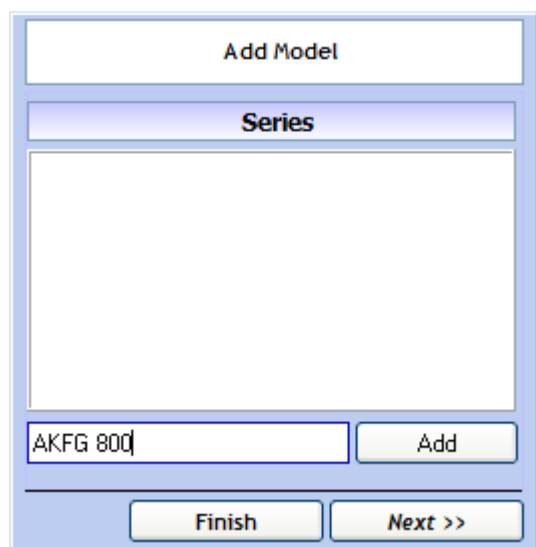
Finish Next >>

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



Next >>

Click on next and specify the fan series:



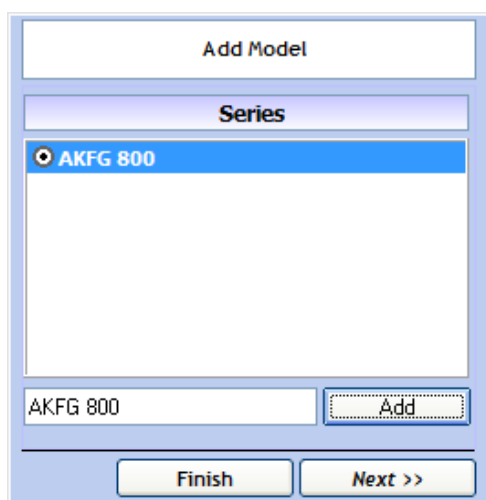
Add Model

Series

AKFG 800 Add

Finish Next >>

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":



Add Model

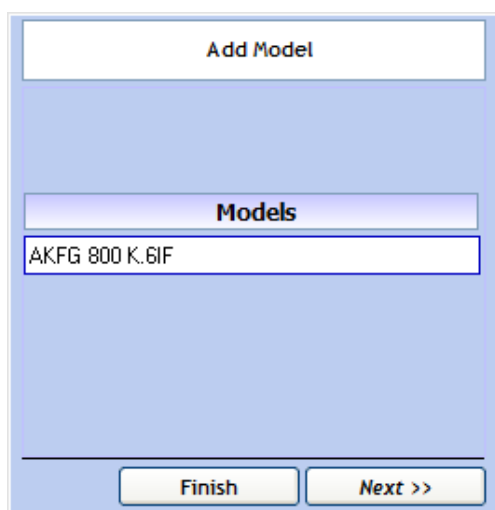
Series

☒ AKFG 800

AKFG 800 Add

Finish Next >>

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



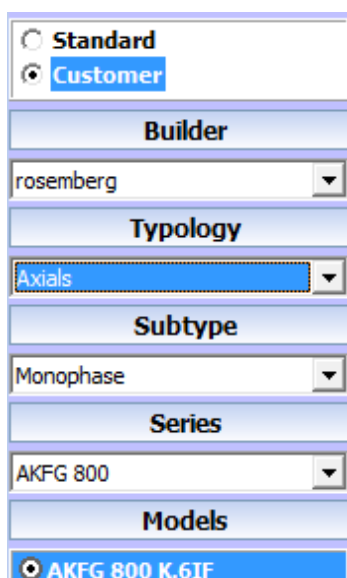
Add Model

Models

AKFG 800 K.6IF

Finish Next >>

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



☐ Standard
☒ Customer

Builder
roseberg

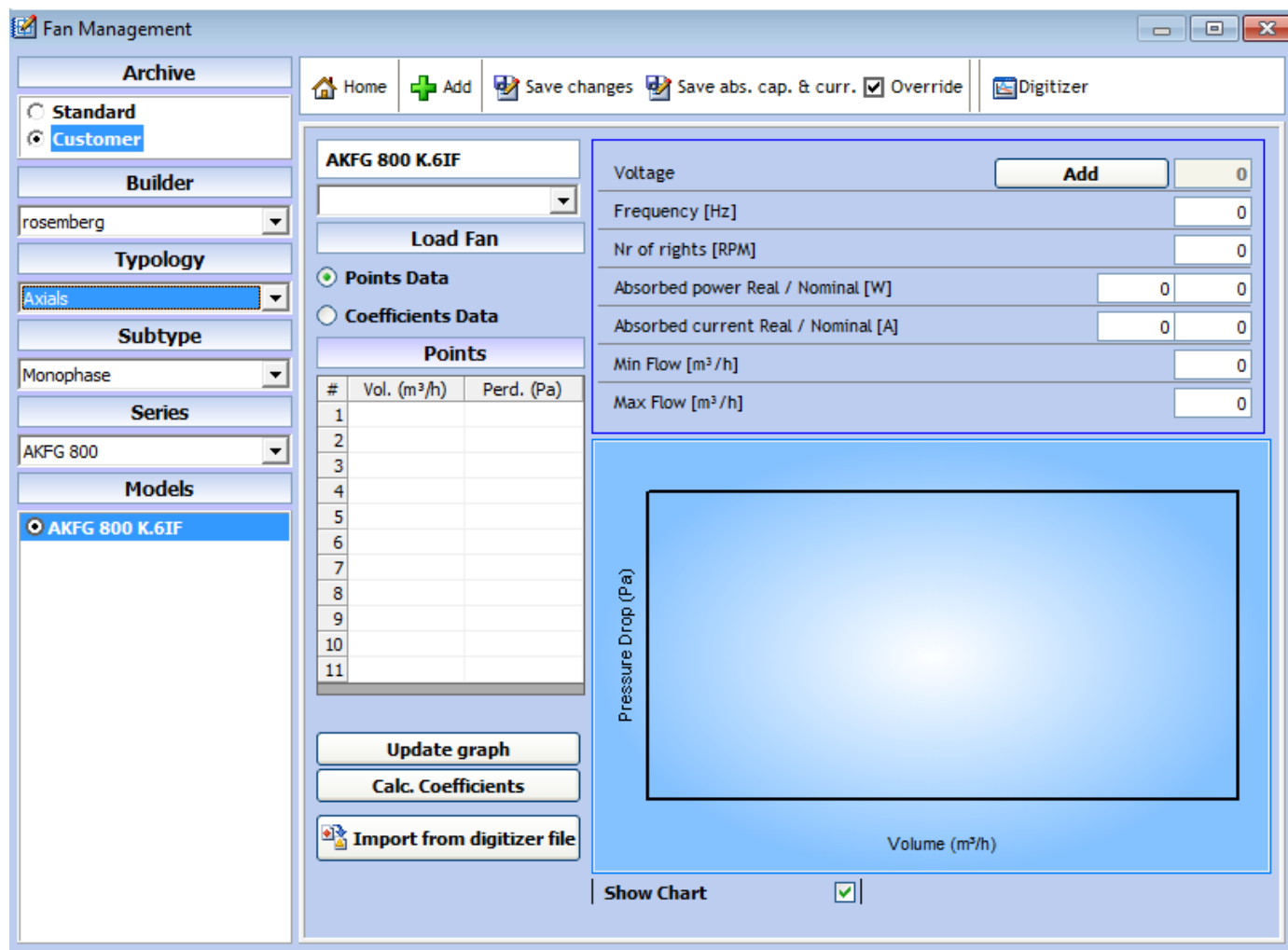
Typology
Axials

Subtype
Monophase

Series
AKFG 800

Models
☒ AKFG 800 K.6IF

We will see the following:



Archive

☐ Standard
☒ Customer

Builder

roseberg

Typology

Axials

Subtype

Monophase

Series

AKFG 800

Models

AKFG 800 K.6IF

Home Add Save changes Save abs. cap. & curr. ☒ Override Digitizer

AKFG 800 K.6IF

Load Fan

☒ Points Data
☐ Coefficients Data

Points

#	Vol. (m³/h)	Perd. (Pa)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

Update graph

Calc. Coefficients

Import from digitizer file

Parameters:

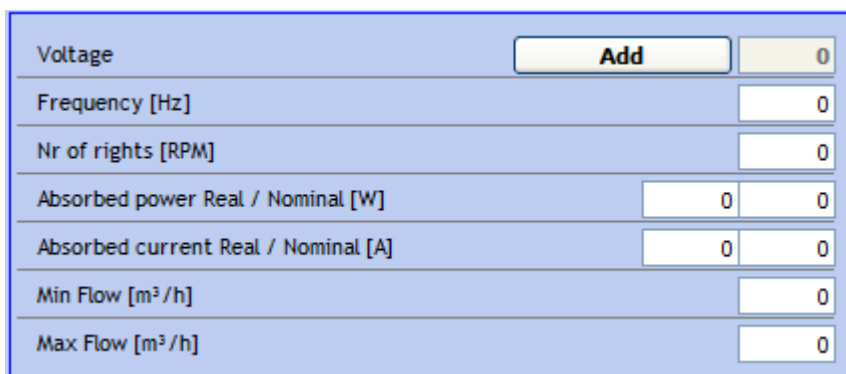
Voltage	Add	0
Frequency [Hz]		0
Nr of rights [RPM]		0
Absorbed power Real / Nominal [W]	0	0
Absorbed current Real / Nominal [A]	0	0
Min Flow [m³/h]		0
Max Flow [m³/h]		0

Pressure Drop (Pa)

Volume (m³/h)

Show Chart ☒

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



Voltage	Add	0
Frequency [Hz]		0
Nr of rights [RPM]		0
Absorbed power Real / Nominal [W]	0	0
Absorbed current Real / Nominal [A]	0	0
Min Flow [m³/h]		0
Max Flow [m³/h]		0

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

Add

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

New Voltage	400
Cancel	Add

Once it is specified we click on "Add"

Add

Now the voltage is shown:

Voltage	Add	400
Frequency [Hz]		0
Nr of rights [RPM]		0
Absorbed power Real / Nominal [W]	0	0
Absorbed current Real / Nominal [A]	0	0
Min Flow [m ³ /h]		0
Max Flow [m ³ /h]		0

Now we set the nominal data in the window:

Voltage	Add	400
Frequency [Hz]		50
Nr of rights [RPM]		1000
Absorbed power Real / Nominal [W]	0	1000
Absorbed current Real / Nominal [A]	0	2
Min Flow [m ³ /h]		0
Max Flow [m ³ /h]		0

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:

AKFG 800 K.6IF

400

Load Fan

☒ Points Data

☐ Coefficients Data

Points

#	Vol. (m³/h)	Perd. (Pa)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

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:

Min Flow [m³/h]	12500
Max Flow [m³/h]	25000

We click on "Update Chart":

Update graph

We obtain the following:

AKFG 800 K.6IF

400

Load Fan

☒ Points Data
☐ Coefficients Data

Points

#	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

Update graph

Calc. Coefficients

Import from digitizer file

Voltage

Add

400

Frequency [Hz]

50

Nr of rights [RPM]

1000

Absorbed power Real / Nominal [W]

0

1000

Absorbed current Real / Nominal [A]

0

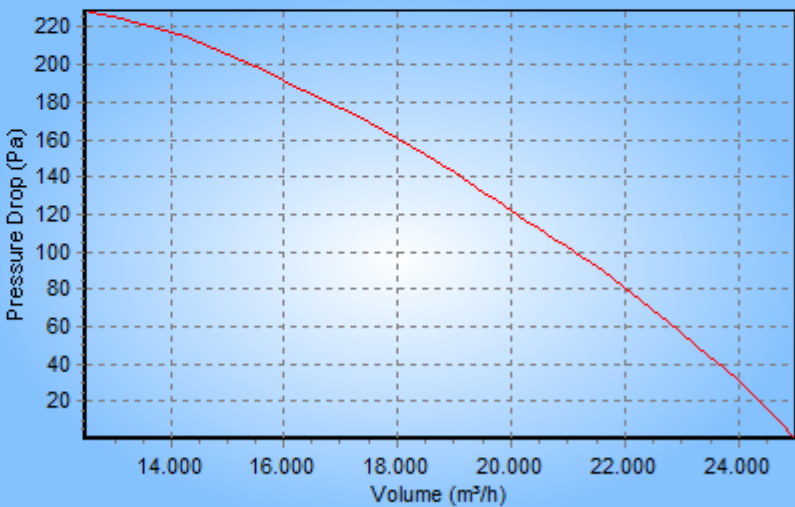
2

Min Flow [m³/h]

12500

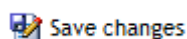
Max Flow [m³/h]

25000



Show Chart ☒

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



We will see the confirmation message:

CoreEngine2007

Save?

Si

No

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:

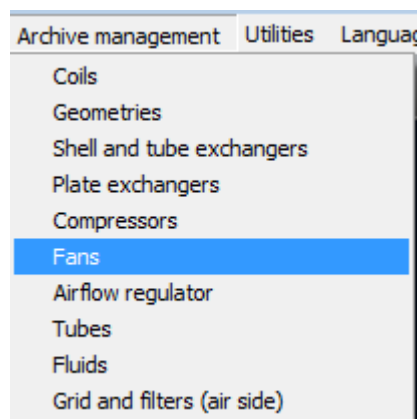
T uC	10 V		9 V		8 V		7 V		6 V		5 V	
	400 V		360 V		320 V		280 V		240 V		200 V	
	1000 min ⁻¹		900 min ⁻¹		800 min ⁻¹		706 min ⁻¹		604 min ⁻¹		504 min ⁻¹	
	m ³ /h	Pa	m ³ /h	Pa	m ³ /h	Pa	m ³ /h	Pa	m ³ /h	Pa	m ³ /h	Pa
1	12500	229	11200	183	10000	142	8700	110	7500	81,5	6300	56,7
2	13500	223	12200	177	11000	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 be organized in a precise way that will be explained later on.

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

T uC	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":



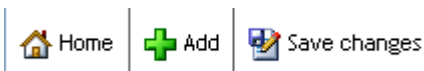
Choose the "Customer" archive:

- ☒ **Standard**
☐ **Customer**

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

Builder
rosemborg
Typology
Axials
Subtype
Monophase
Series
AKFG 800
Models
<input checked="" type="radio"/> AKFG 800 K.6IF

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:

Add Model
Typology
<input type="radio"/> Pulley and belt Radials <input type="radio"/> Pulley and belt <input type="radio"/> Directly coupled Multicurve AC/EC <input type="radio"/> AC with voltage selector <input type="radio"/> EC with RPM regulation <input checked="" type="radio"/> EC with 0-10V regulation
<input type="button" value="Finish"/> <input type="button" value="Next >>"/>

We click on "Next" to specify the manufacturer:



Add Model

Builders

- ☒ Ziehl-Abegg
- ☐ Ebm
- ☐ Nicotra
- ☐ Comefri
- ☐ CBI
- ☐ Nicotra_1

Rosemberg

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:



Add Model

Series

- ☒ AKFG 800

AKFG 800

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:

Add Model

Models

AKFC 800 K.6IF - EC

Finish

Next >>

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:

Fan Management
Home Add Save changes Digitizer

Archive

☐ Standard
 ☒ Customer

Builder

Rosenberg

Typology

Multicurve AC/EC

Subtype

EC with 0-10V regulation

Series

AKFG 800

Models

AKFC 800 K.6IF - EC

Curves Coefficients =>

Impeller Diameter [mm]

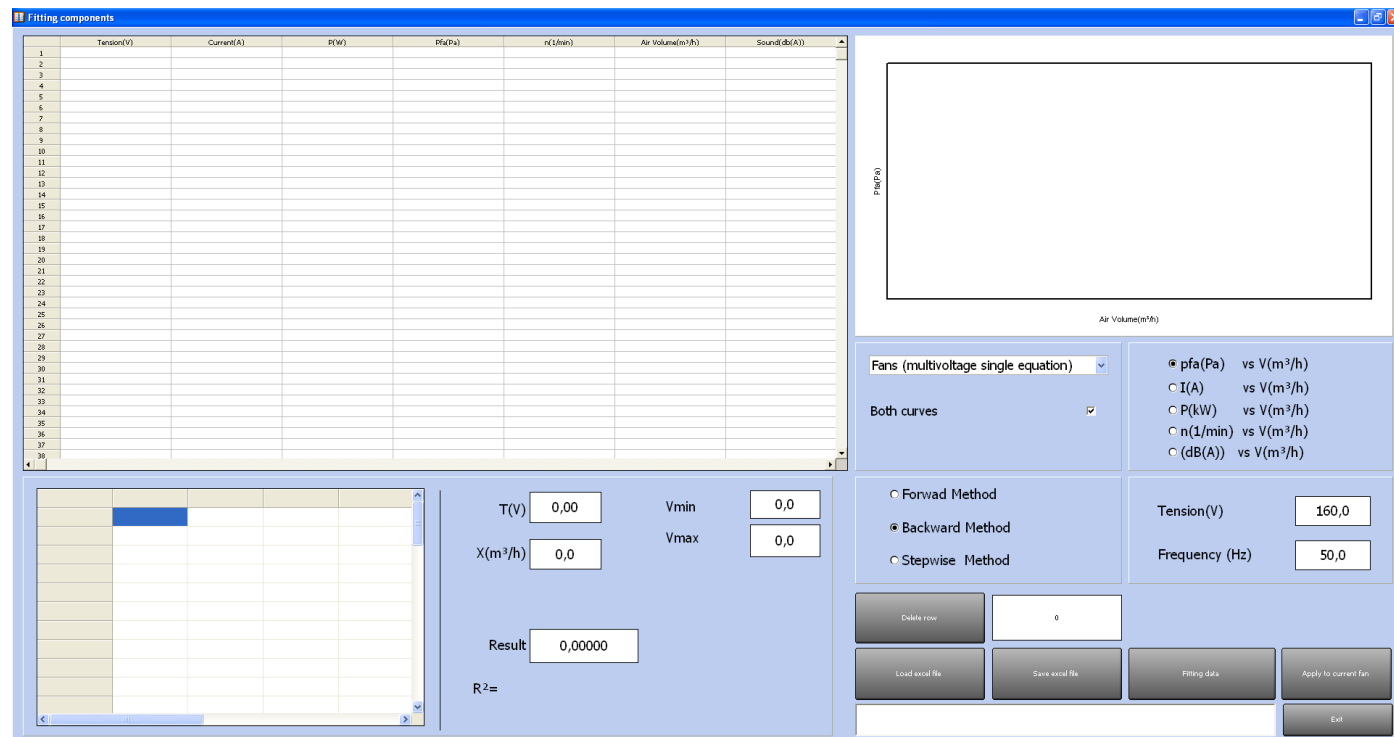
Fitting

#	PD (Pa)	Curr (A)	P Abs (W)	RPM
1	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
2	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
3	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
4	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
5	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
6	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
7	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
8	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
9	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
10	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
11	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
12	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
13	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
14	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
15	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
16	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
17	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
18	00.000000E+00	00.000000E+00	00.000000E+00	00.000000E+00
Vmin	0	0	0	0
Vmax	0	0	0	0
Factor	0	0	0	0
deltaSD	0	0	0	0
B0Vmin	0	0	0	0
B1Vmin	0	0	0	0
B0Vmax	0	0	0	0
B1Vmax	0	0	0	0
B0Int	0	0	0	0
B1Int	0	0	0	0
B2Int	0	0	0	0

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

Fitting

The following window will come up:



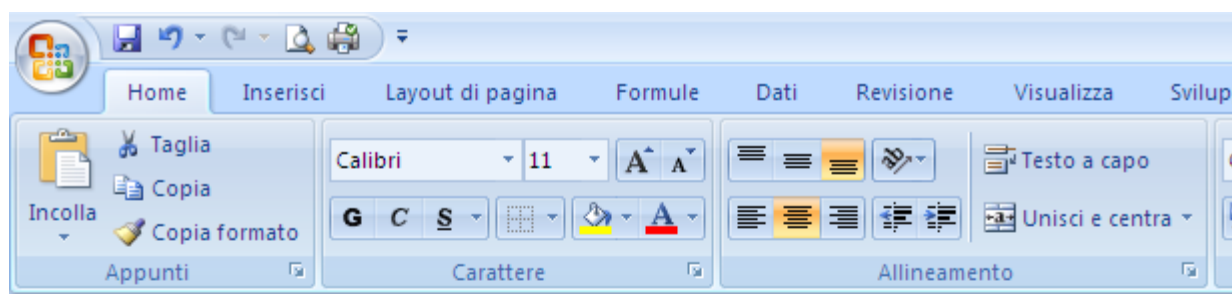
In the center, we see the format of the excel file we need to import:

	Tension(V)	Current(A)	P(W)	Pfa(Pa)	n(1/min)	Air Volume(m³/h)	Sound(db(A))
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							

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		
26	9	0	0	0	1000	22200	0		

Etc.

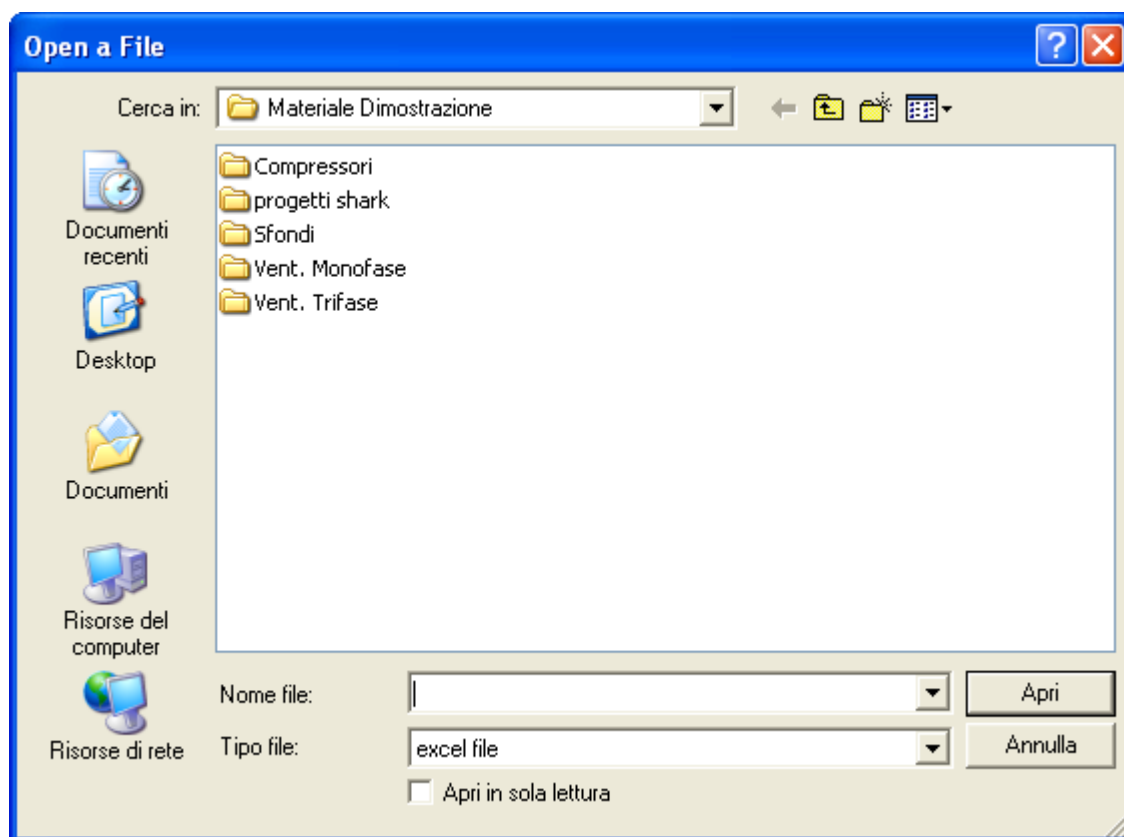
At this point, we click on "Load Excel File" to open the excel file just generated.



Choose the file:

UNILAB S.r.l. – Via N. Bixio 6 – 35131 – Padova (PD) – Italy – Tel.: 049 8763311 – Fax: 049 8750196

www.unilab.eu – info@unilab.eu



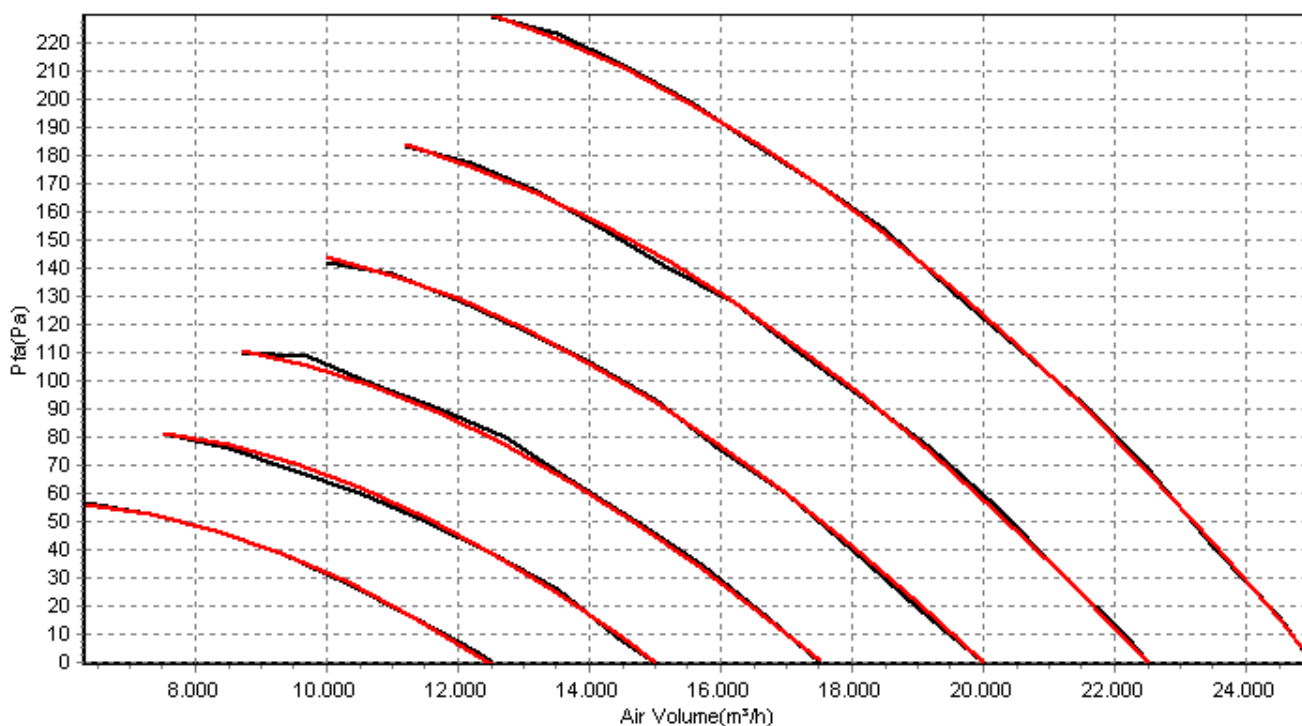
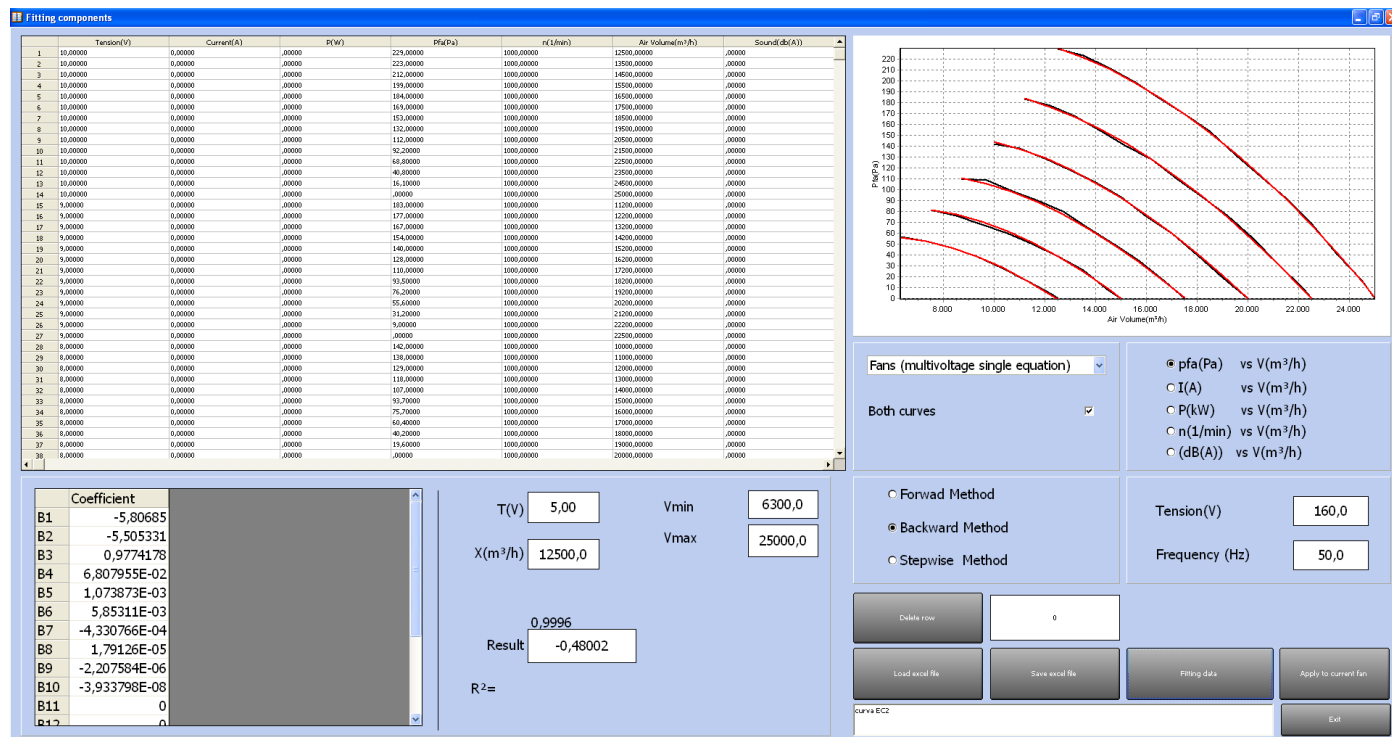
The content of the file is shown in the table:

	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

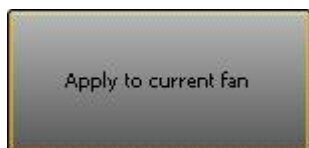
Click on "Fitting Data:"

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:

- ☒ pfa(Pa) vs V(m³/h)
- ☐ I(A) vs V(m³/h)
- ☐ P(kW) vs V(m³/h)
- ☐ n(1/min) vs V(m³/h)
- ☐ (dB(A)) vs V(m³/h)

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



The following window will appear:

Fan Management

Archive

☐ Standard
☒ Customer

Builder

Rosenberg

Typology

Multicurve AC/EC

Subtype

EC with 0-10V regulation

Series

AKFG 800

Models

☒ AKFC 800 K.6IF - EC

Home

Add

Save changes

Digitizer

Curves Coefficients =>

Impeller Diameter [mm]

800

Fitting

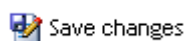
#	PD (Pa)	Curr (A)	P Abs (W)	RPM	
1	-58,068500E-01	00,000000E+00	00,000000E+00	00,000000E+00	00,0
2	-55,053310E-01	00,000000E+00	00,000000E+00	00,000000E+00	00,0
3	97,741780E-02	00,000000E+00	00,000000E+00	00,000000E+00	00,0
4	68,079550E-03	00,000000E+00	00,000000E+00	00,000000E+00	00,0
5	10,738730E-04	00,000000E+00	00,000000E+00	00,000000E+00	00,0
6	58,531100E-04	00,000000E+00	00,000000E+00	00,000000E+00	00,0
7	-43,307660E-05	00,000000E+00	00,000000E+00	00,000000E+00	00,0
8	17,912600E-06	00,000000E+00	00,000000E+00	00,000000E+00	00,0
9	-22,075840E-07	00,000000E+00	00,000000E+00	00,000000E+00	00,0
10	-39,337980E-09	00,000000E+00	00,000000E+00	00,000000E+00	00,0
11	00,000000E+00	00,000000E+00	00,000000E+00	00,000000E+00	00,0
12	00,000000E+00	00,000000E+00	00,000000E+00	00,000000E+00	00,0
13	63,520270E-12	00,000000E+00	00,000000E+00	00,000000E+00	00,0
14	00,000000E+00	00,000000E+00	00,000000E+00	00,000000E+00	00,0
15	00,000000E+00	00,000000E+00	00,000000E+00	00,000000E+00	00,0
16	-83,484370E-17	00,000000E+00	00,000000E+00	00,000000E+00	00,0
17	00,000000E+00	00,000000E+00	00,000000E+00	00,000000E+00	00,0
18	00,000000E+00	00,000000E+00	00,000000E+00	00,000000E+00	00,0
Vmin	6300	0	0	0	
Vmax	25000	0	0	0	
Factor	0	0	0	0	
deltaSD	0	0	0	0	
B0Vmin	0	0	0	0	
B1Vmin	0	0	0	0	
B0Vmax	0	0	0	0	
B1Vmax	0	0	0	0	
B0Int	0	0	0	0	
B1Int	0	0	0	0	
B2Int	0	0	0	0	

Let us set the Impeller Diameter:

Impeller Diameter [mm]

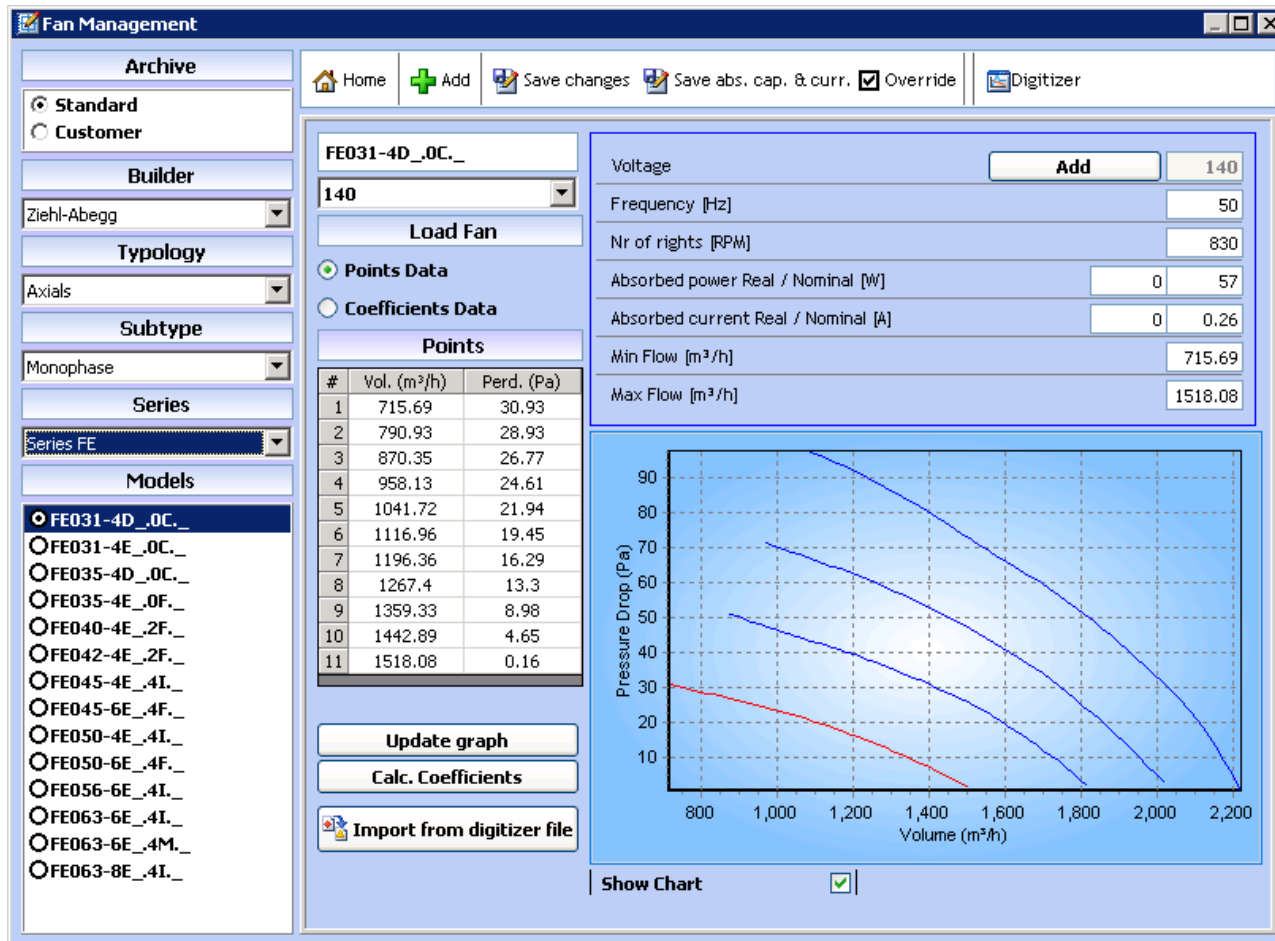
800

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:

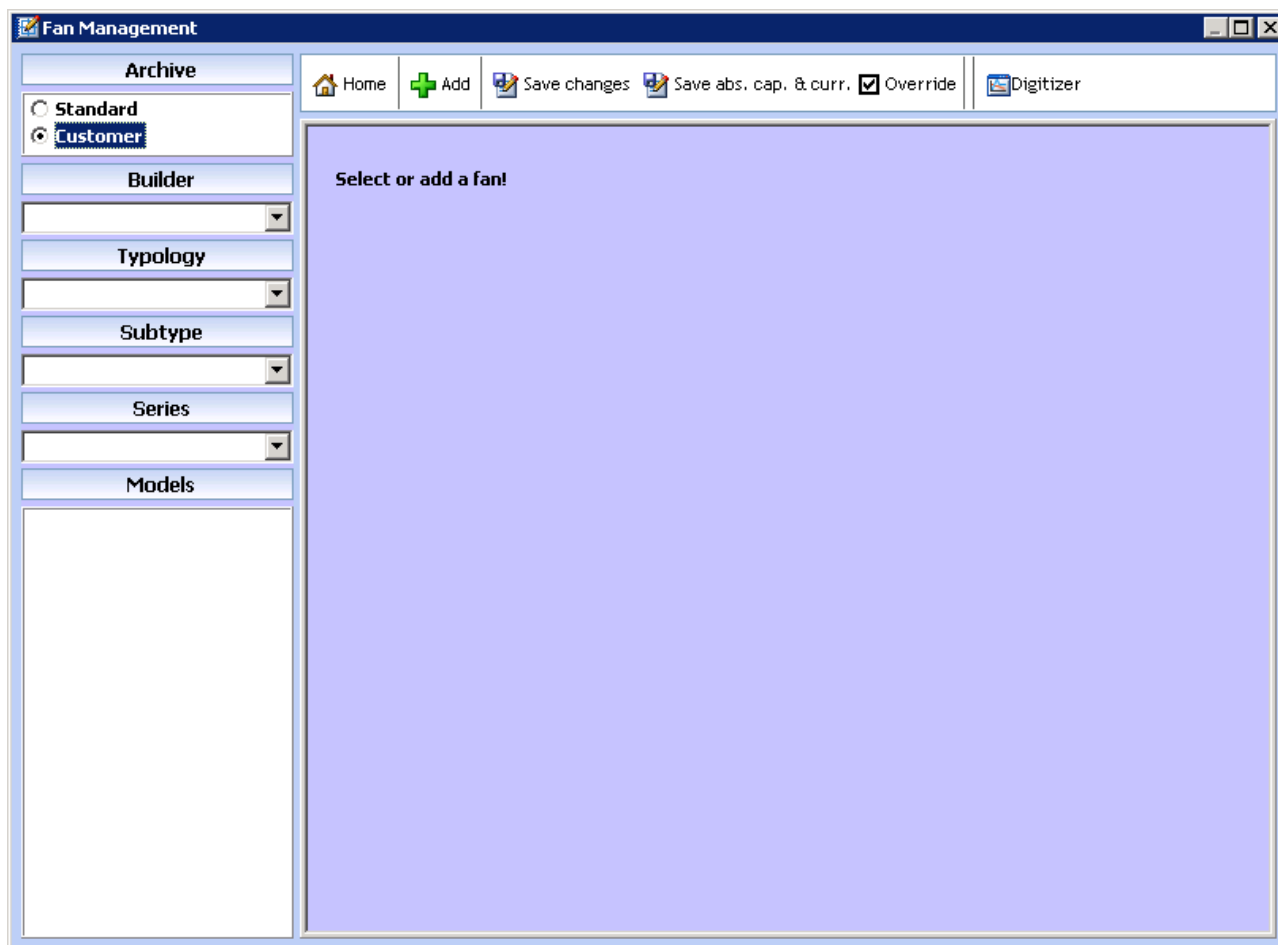


The screenshot shows the 'Fan Management' window with the 'Archive' tab selected. The 'Standard' radio button is chosen under 'Archive'. The 'Builder' is set to 'Ziehl-Abegg', 'Typology' to 'Axials', 'Subtype' to 'Monophase', and 'Series' to 'Series FE'. The 'Models' list on the left includes 'FE031-4D_0C_140' which is selected. The main area shows the configuration for 'FE031-4D_0C_140' with a 'Load Fan' button. The 'Points Data' radio button is selected, and a table of 11 points is displayed. The 'Coefficients Data' radio button is unselected. The 'Update graph' and 'Calc. Coefficients' buttons are visible. The 'Import from digitizer file' button is also present. The 'Voltage' field is set to 140, and the 'Add' button is highlighted. The 'Frequency [Hz]' is 50, 'Nr of rights [RPM]' is 830, 'Absorbed power Real / Nominal [W]' is 0 / 57, 'Absorbed current Real / Nominal [A]' is 0 / 0.26, 'Min Flow [m³/h]' is 715.69, and 'Max Flow [m³/h]' is 1518.08. A graph of 'Pressure Drop (Pa)' vs 'Volume (m³/h)' is shown with a red curve and a blue curve. The 'Show Chart' checkbox is checked.

#	Vol. (m³/h)	Perd. (Pa)
1	715.69	30.93
2	790.93	28.93
3	870.35	26.77
4	958.13	24.61
5	1041.72	21.94
6	1116.96	19.45
7	1196.36	16.29
8	1267.4	13.3
9	1359.33	8.98
10	1442.89	4.65
11	1518.08	0.16

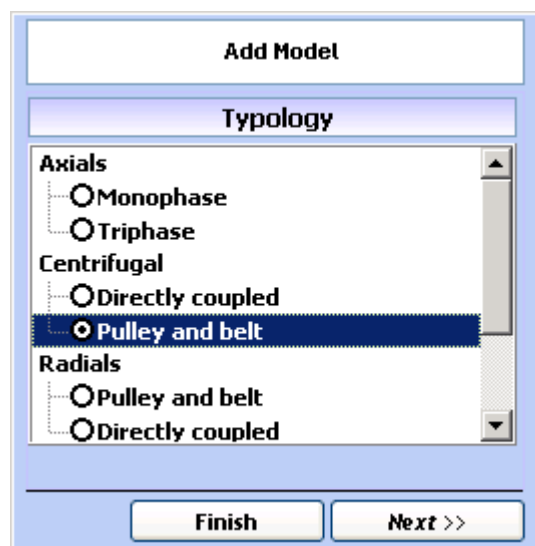
We then click on Customer, Add button, we can add the builder, the typology, the subtype, the series and the model.

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



The screenshot shows the 'Fan Management' window. On the left is a sidebar with sections: 'Archive' (containing 'Standard' and 'Customer' radio buttons, with 'Customer' selected), 'Builder' (a dropdown menu), 'Typology' (a dropdown menu), 'Subtype' (a dropdown menu), 'Series' (a dropdown menu), and 'Models' (a list box). The main area on the right has a toolbar with icons for 'Home', 'Add', 'Save changes', 'Save abs. cap. & curr.', 'Override' (checked), and 'Digitizer'. Below the toolbar, the text 'Select or add a fan!' is displayed above a large, empty light blue area.

Then we can insert the typology:



The 'Add Model' dialog box is shown. It has a 'Typology' section with a list box containing the following options: 'Axials' (with sub-options 'Monophase' and 'Triphase'), 'Centrifugal' (with sub-options 'Directly coupled' and 'Pulley and belt'), and 'Radials' (with sub-options 'Pulley and belt' and 'Directly coupled'). The 'Pulley and belt' option under 'Centrifugal' is currently selected. At the bottom of the dialog are two buttons: 'Finish' and 'Next >>'.

Then the model:

Add Model

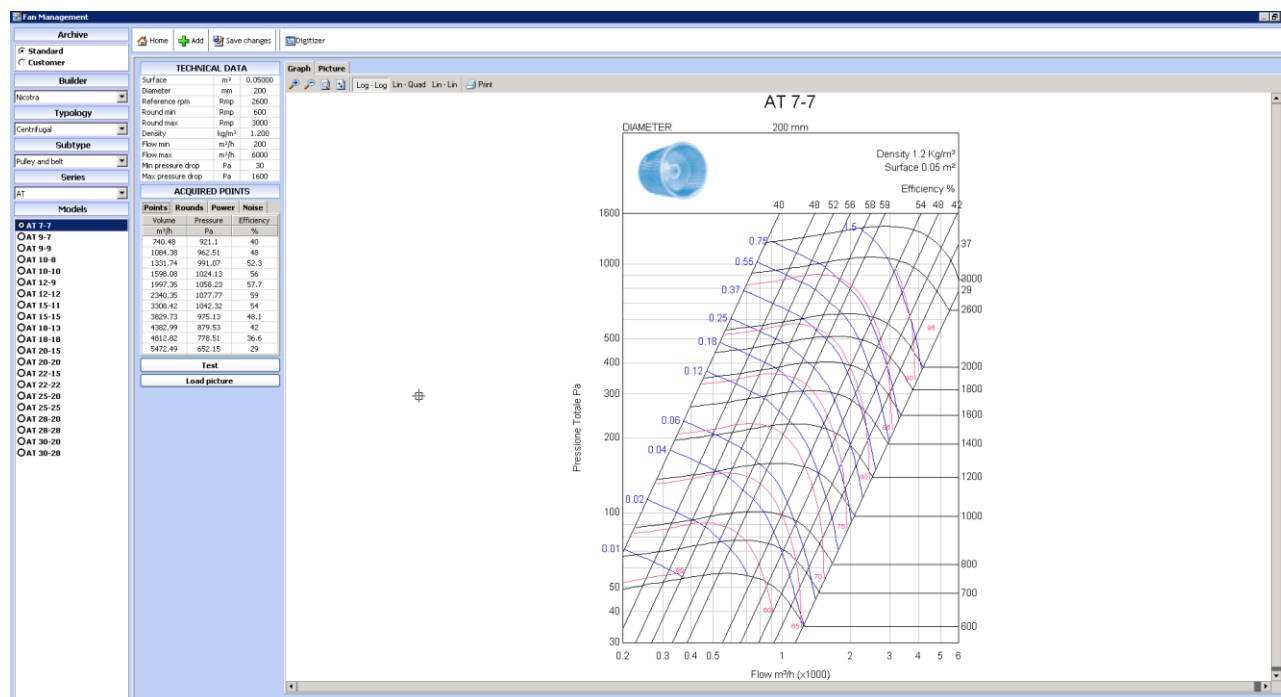
Models

NewModels

Finish

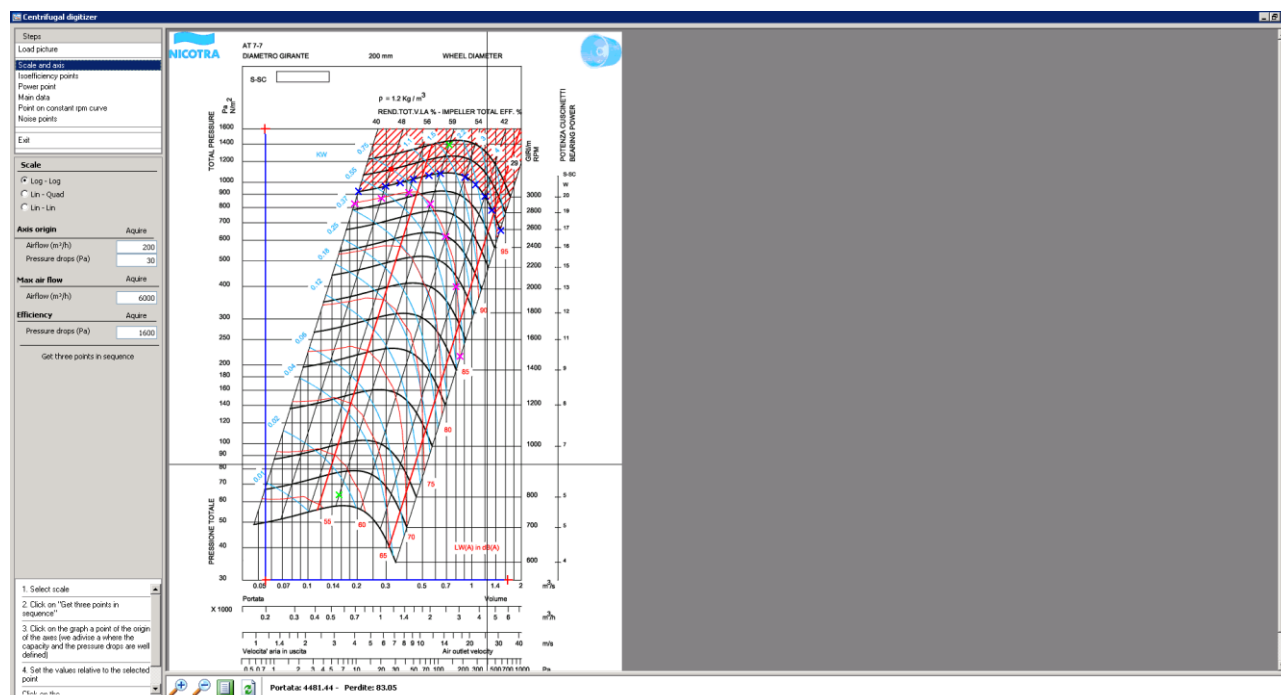
Next >>

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



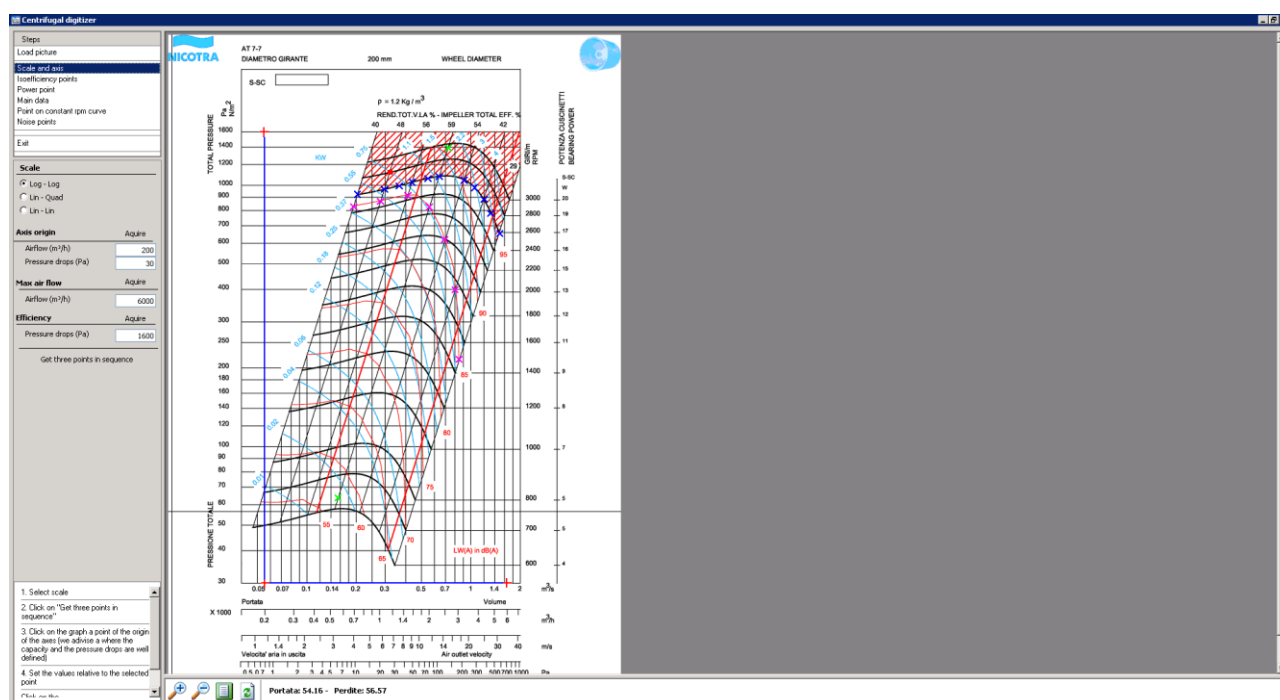
We click on "Scale and Axes". The types of scales are Logarithm-logarithm, Linear- quadratic and linear / linear.

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"

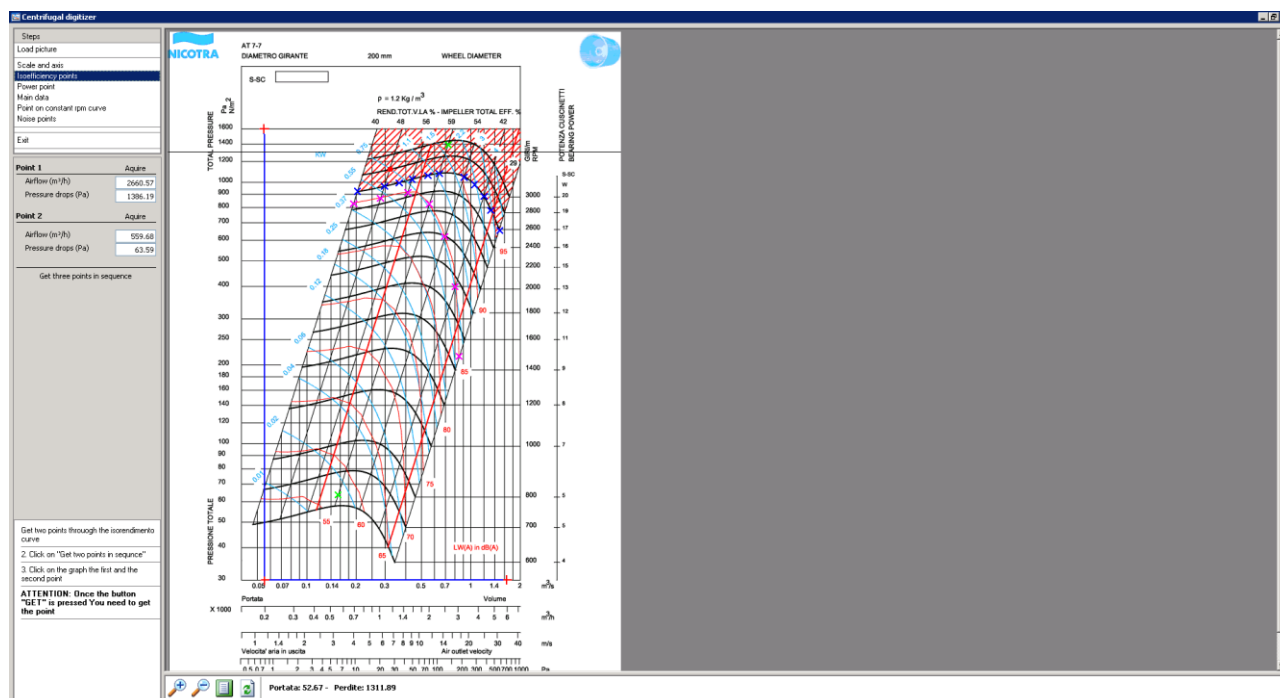
Scale	
<input checked="" type="radio"/> Log - Log	
<input type="radio"/> Lin - Quad	
<input type="radio"/> Lin - Lin	
Axis origin	
Airflow (m³/h)	200
Pressure drops (Pa)	30
Max air flow	
Airflow (m³/h)	6000
Efficiency	
Pressure drops (Pa)	1600
Get three points in sequence	



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.

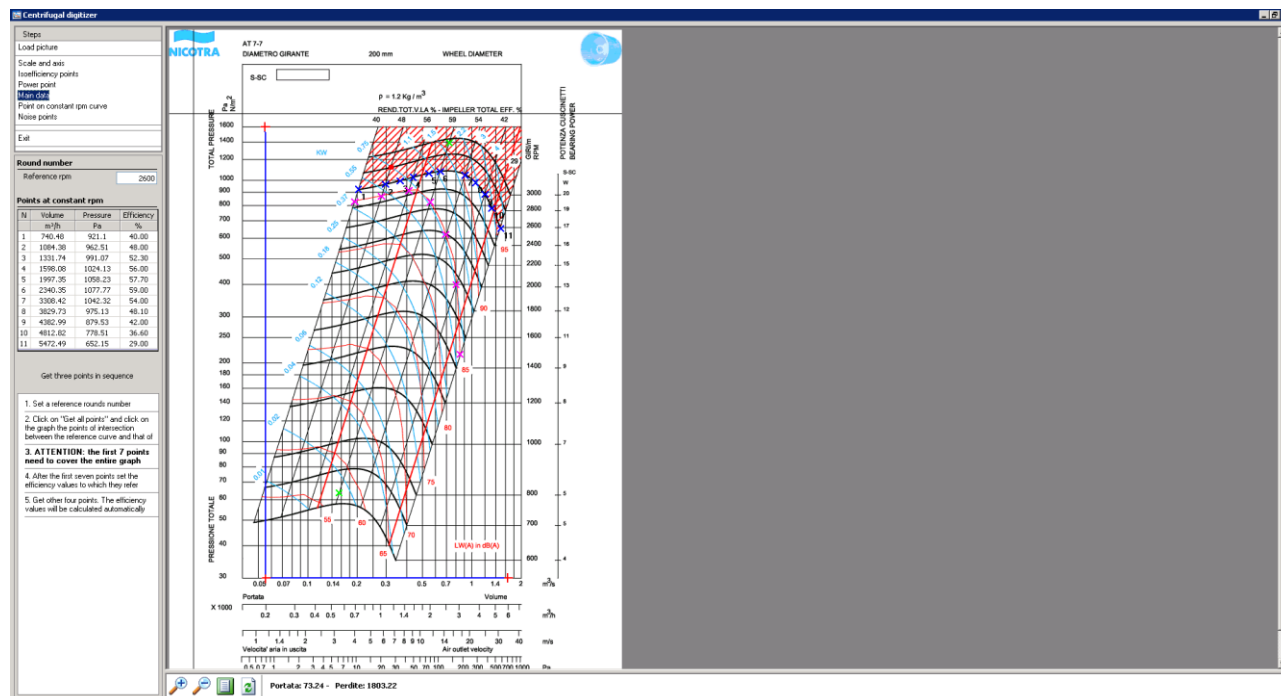
We click on "Power Point"



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.

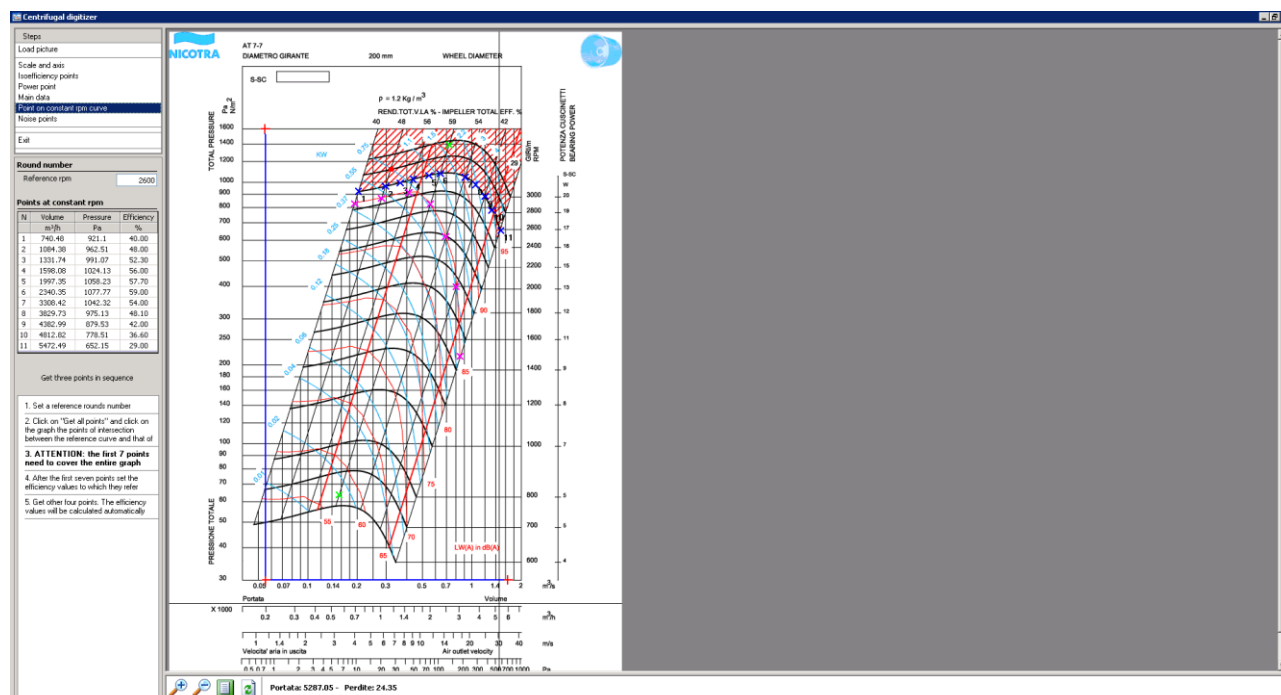
In case the air to the fan outlet is known we just insert the value , otherwise we click on "Get"(Fan Outlet) and we click on the on a point of the graph at a certain speed ; we have a field where we can enter the chosen air velocity and automatically the fan outlet will be calculated.

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"

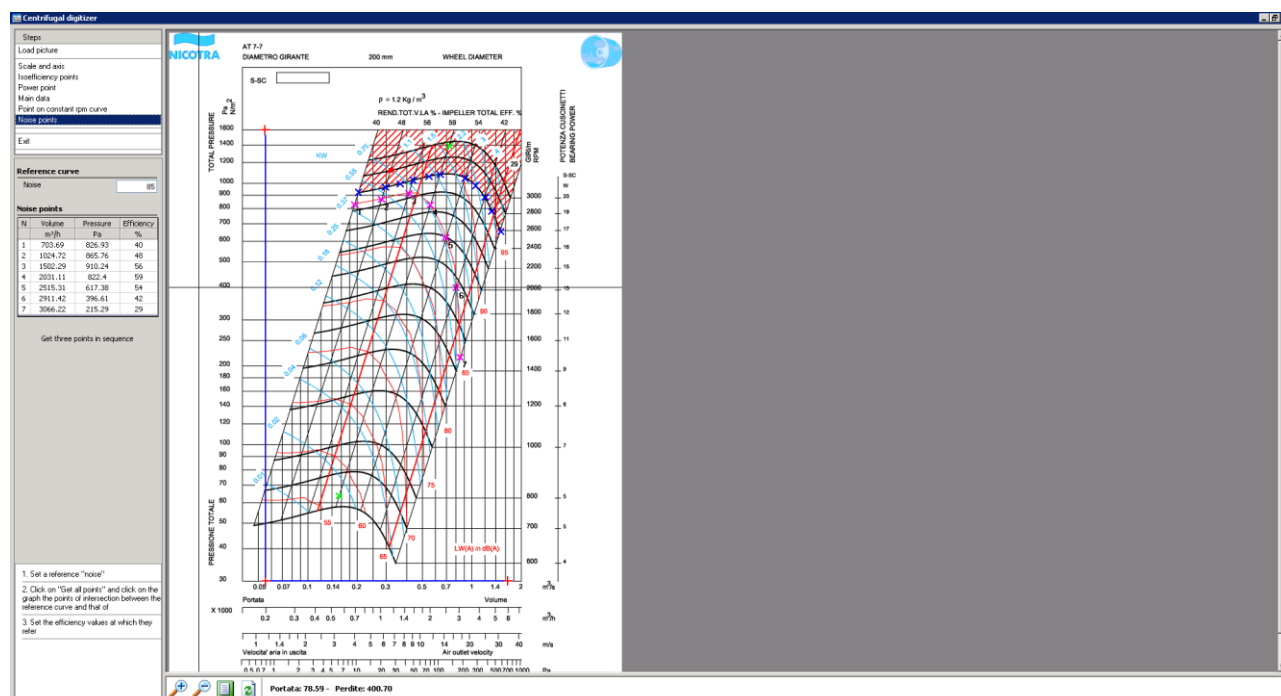
We click on "Point on constant rpm curve" and get:



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

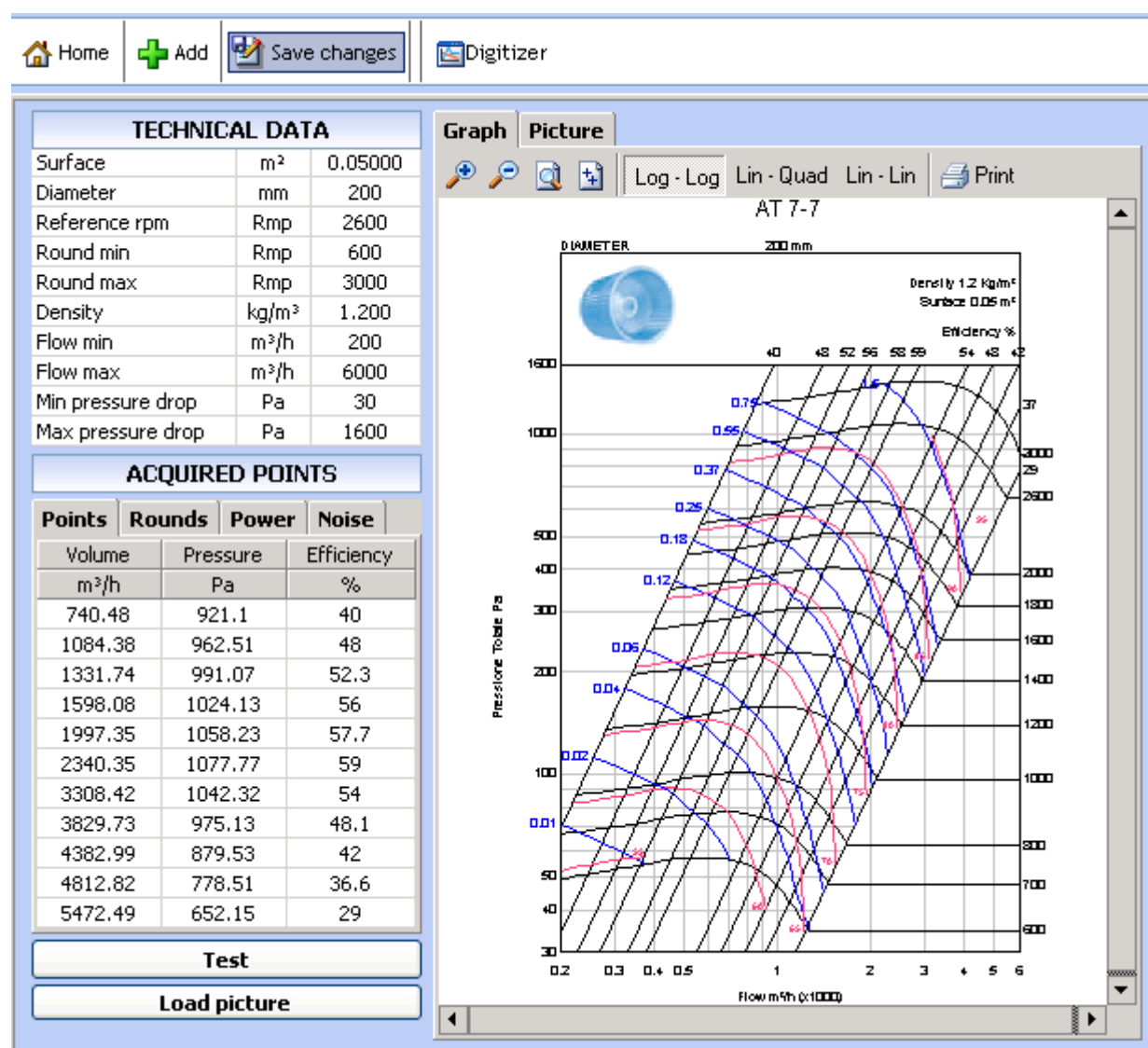


We follow the same procedure as for "Point on constant rpm curve"

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

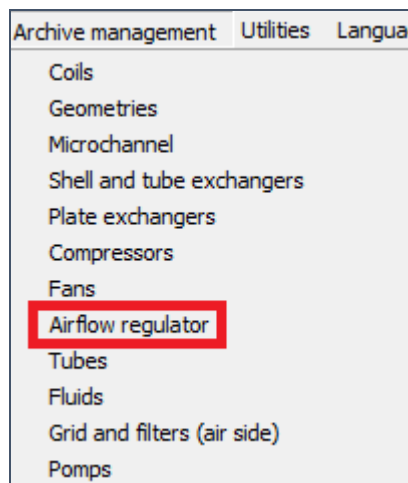
We click on "Exit" and on save changes



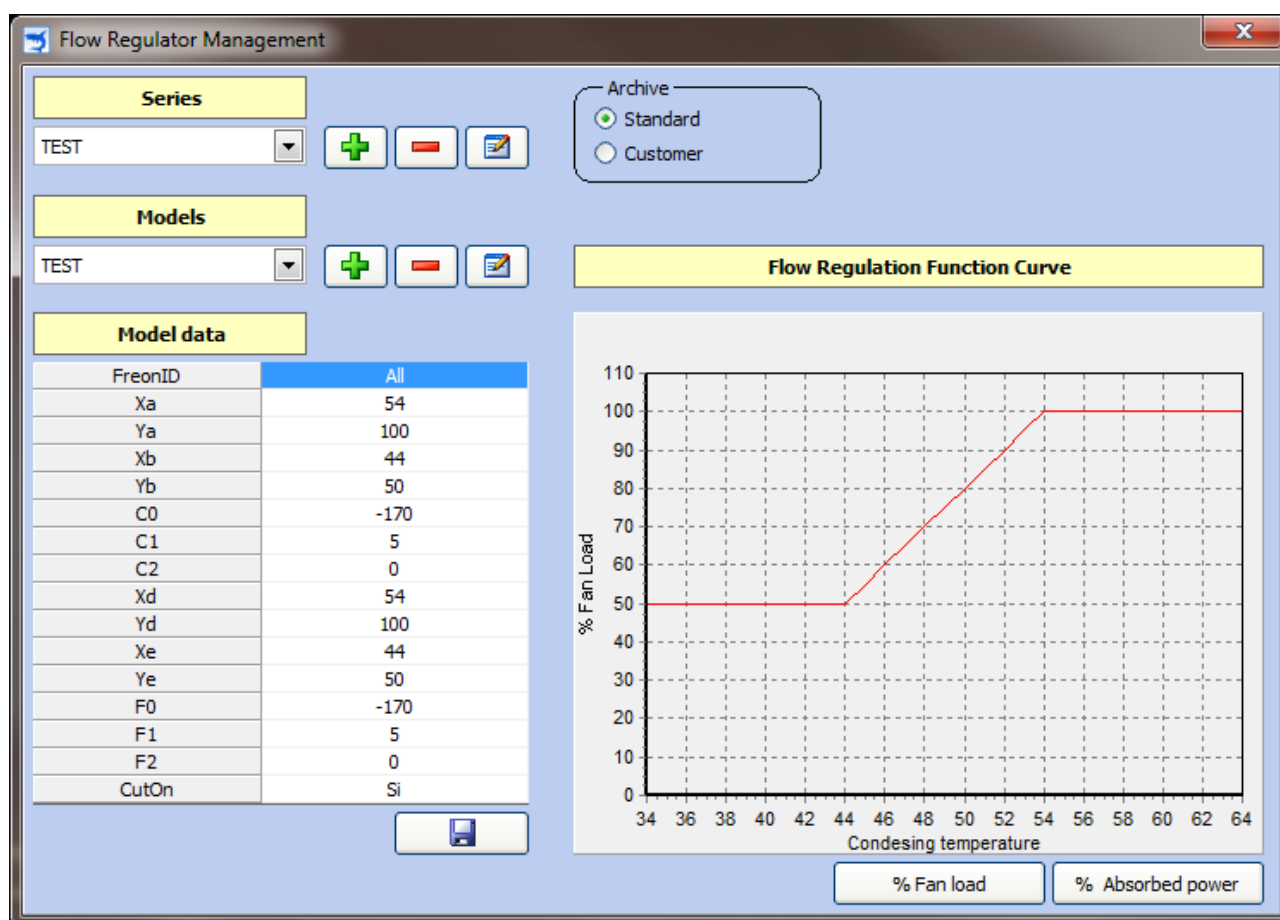
How to insert an Airflow regulator

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:



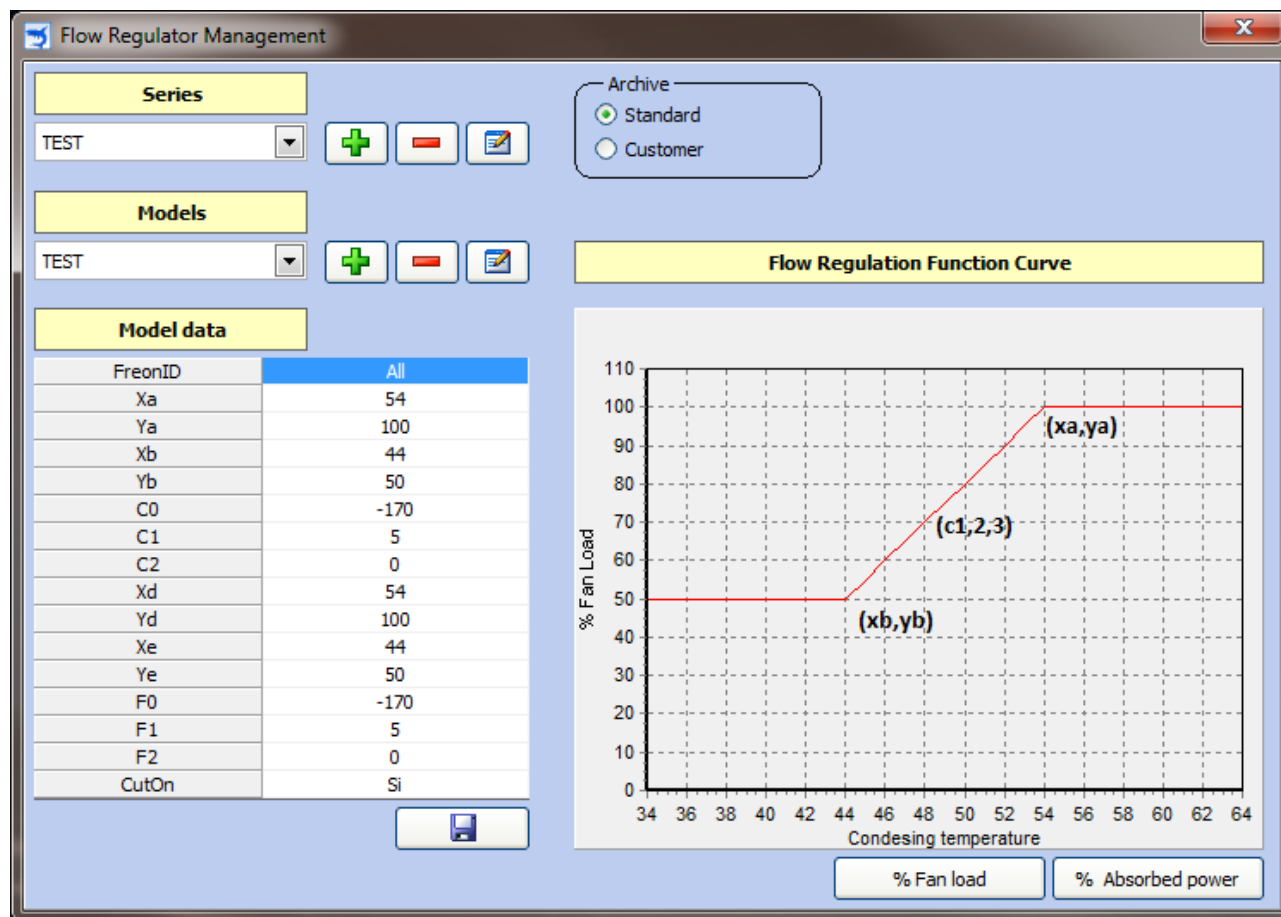
You will see the mask below with an example:



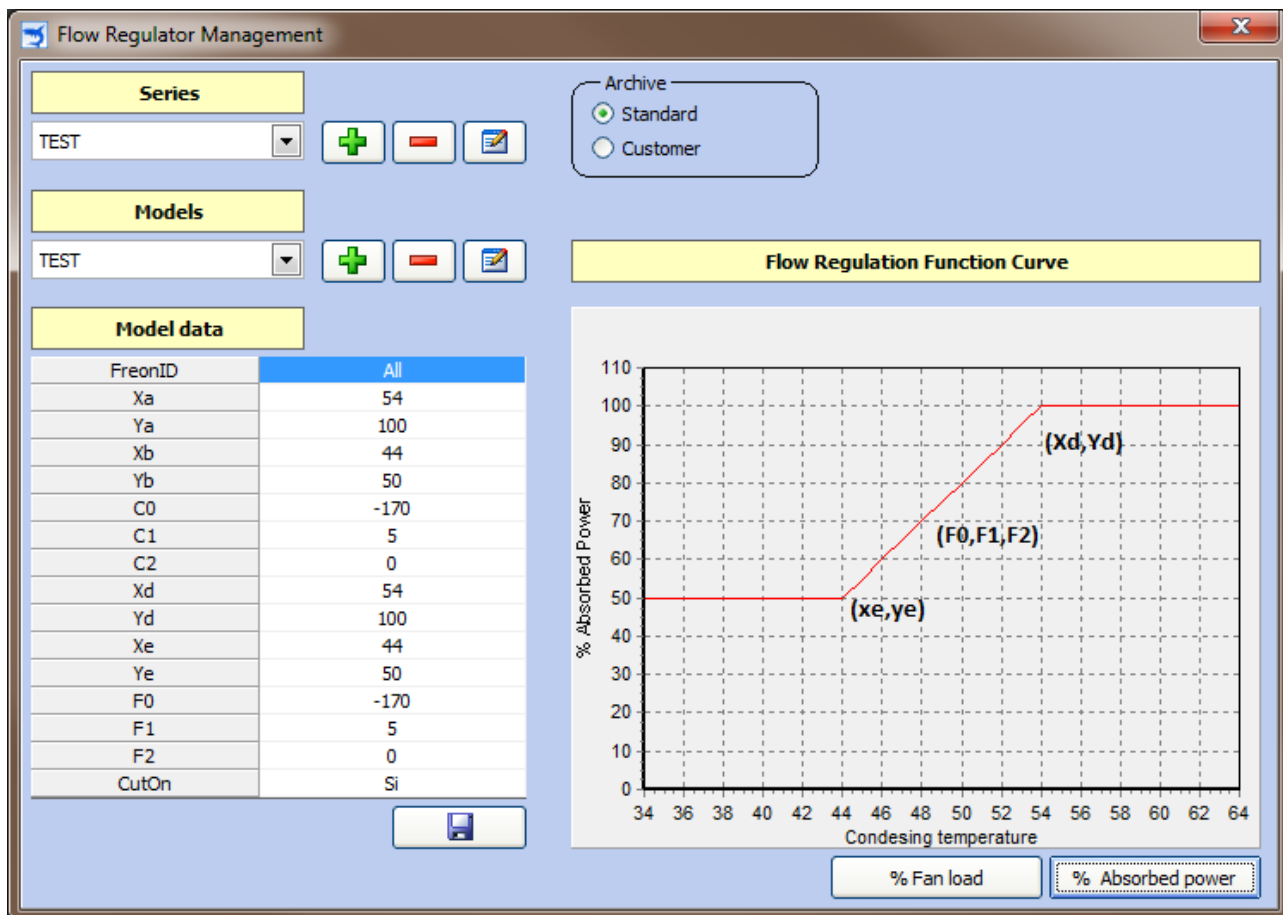
On the chart, you can see on the axis "y", %Fan or % absorbed power clicking on the buttons

Or

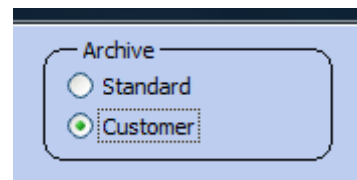
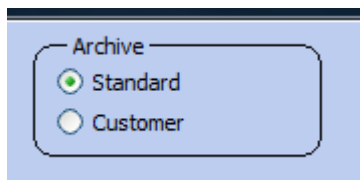
The coordinates (x_a, y_a) , (x_b, y_b) , and the known terms (c_0, c_1, c_2) refers to chart Condensing Temperature/% Fan Load.



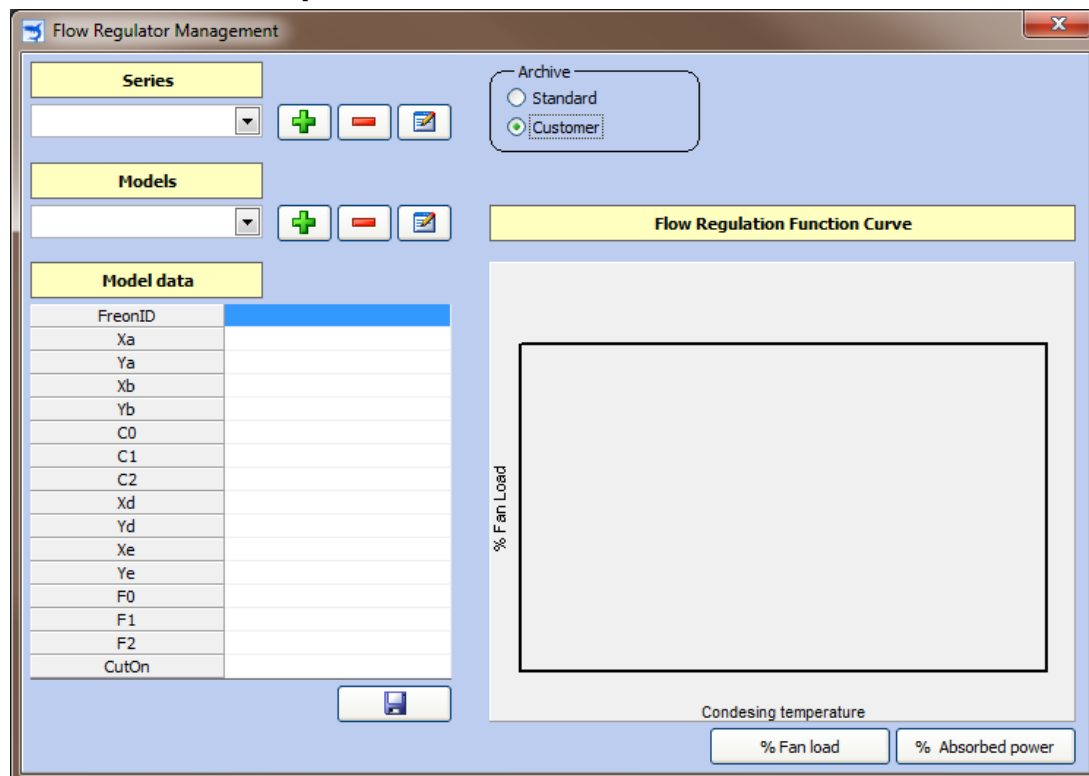
The coordinates (x_d, y_d) , (x_e, y_e) and the known terms (F_0, F_1, F_2) refers to chart Condensing Temperature/% Absorbed Power.



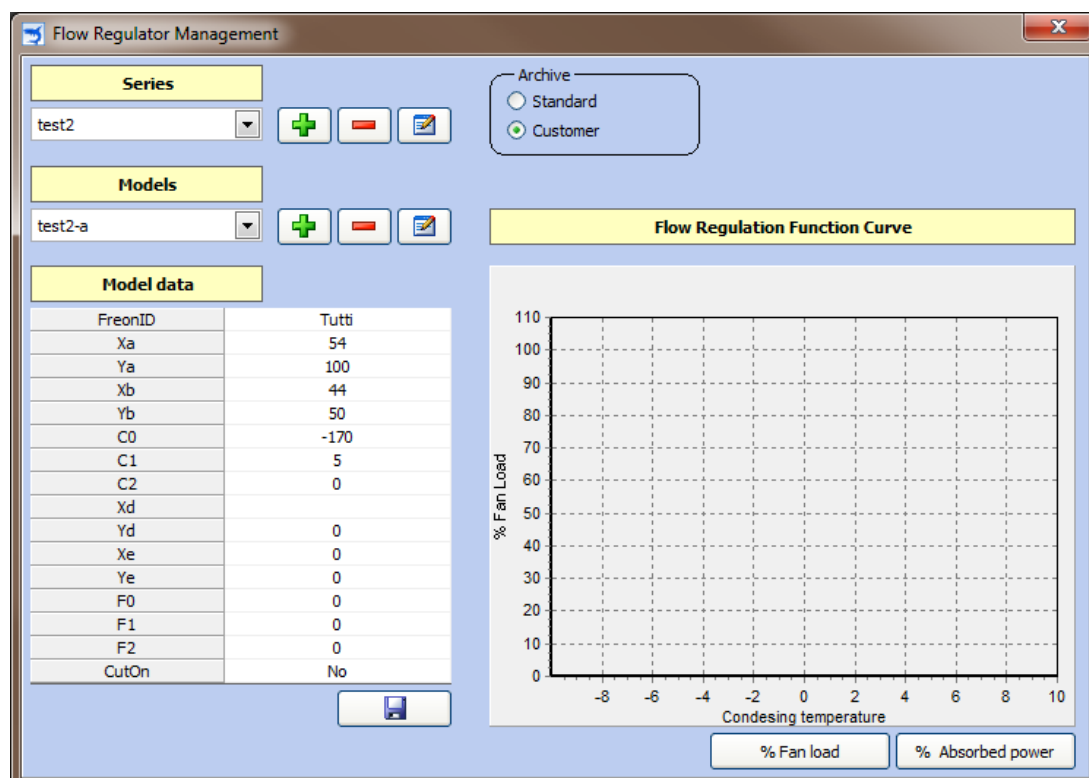
To insert a new series and a new regulator, it is possible to insert the data in the Customer Archive.



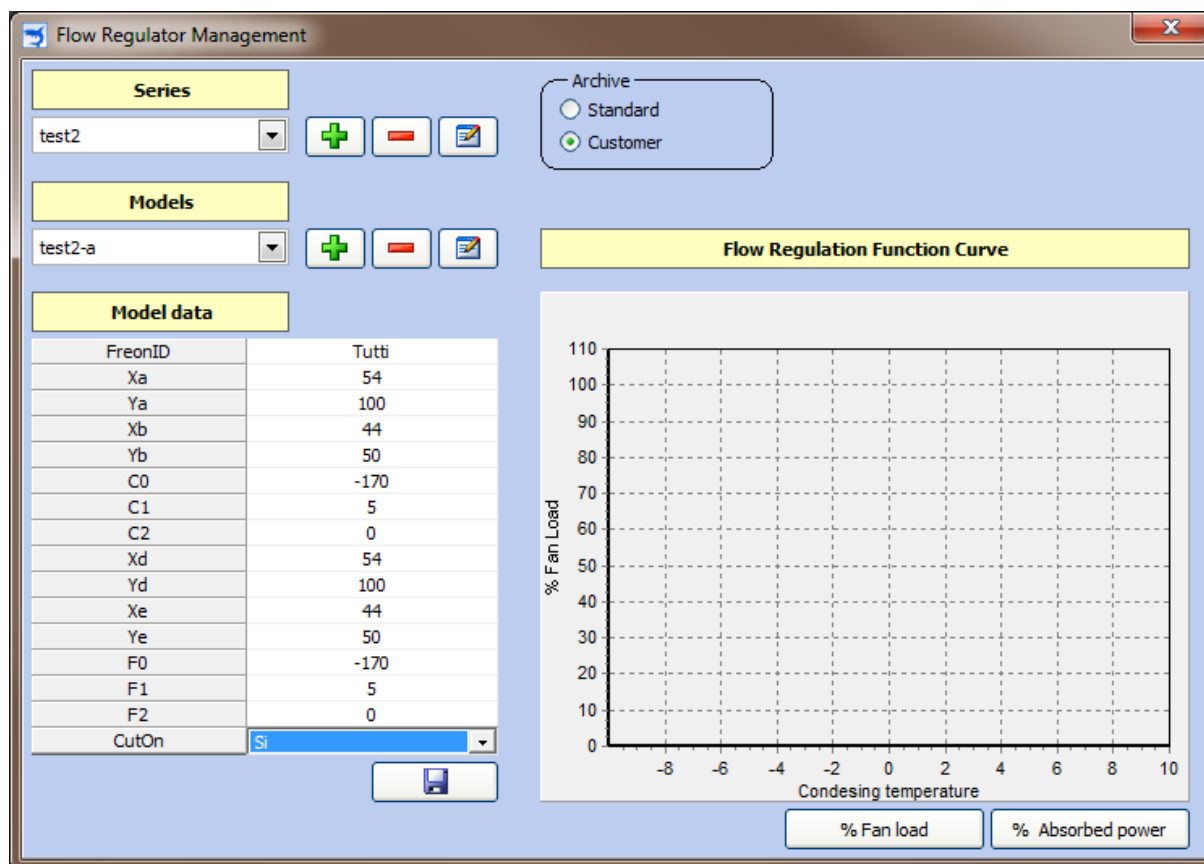
How to insert the points in the chart


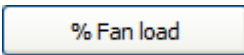


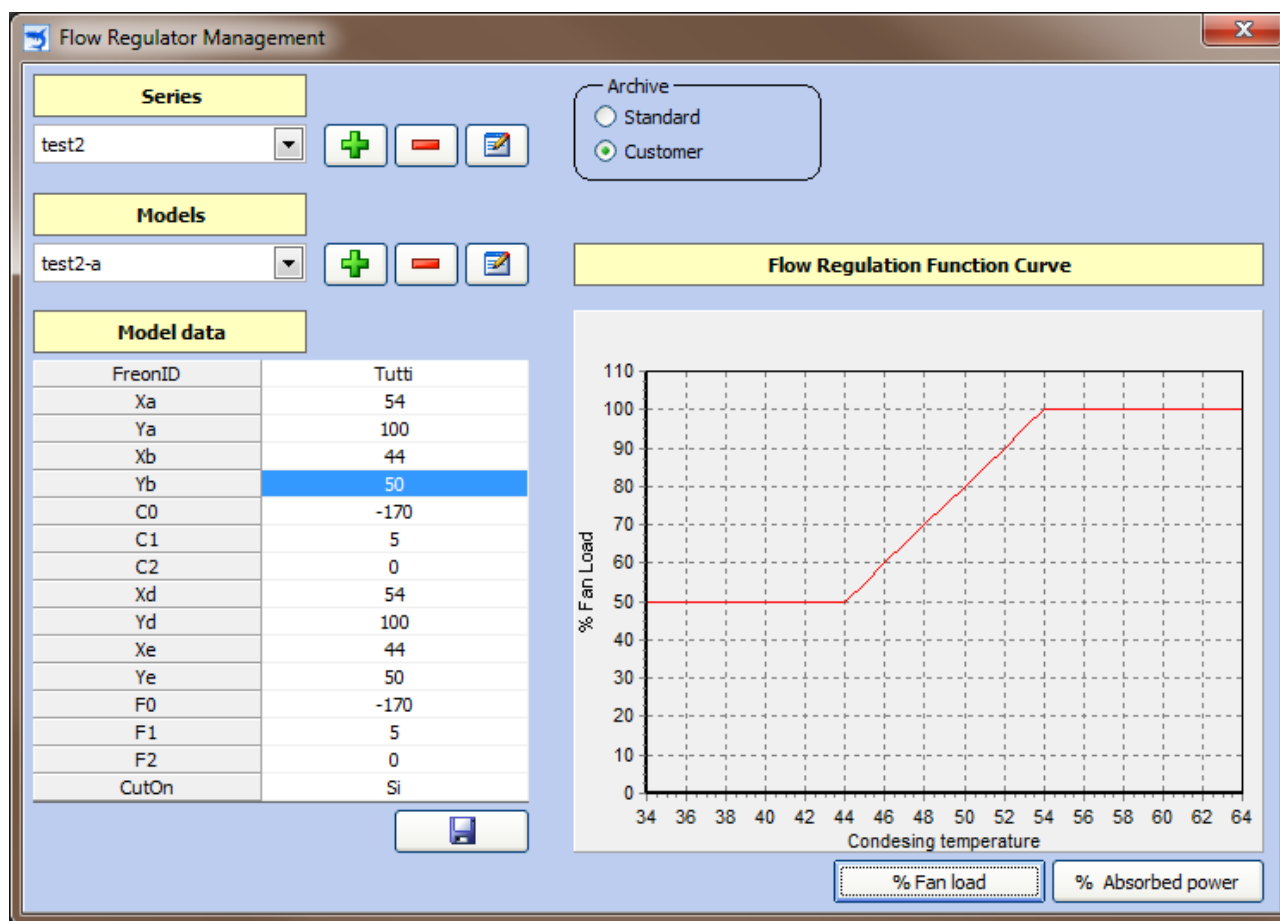
Click on the buttons  to insert SERIES and MODELS. Besides, to insert the variables "a, b, C", like the example below.



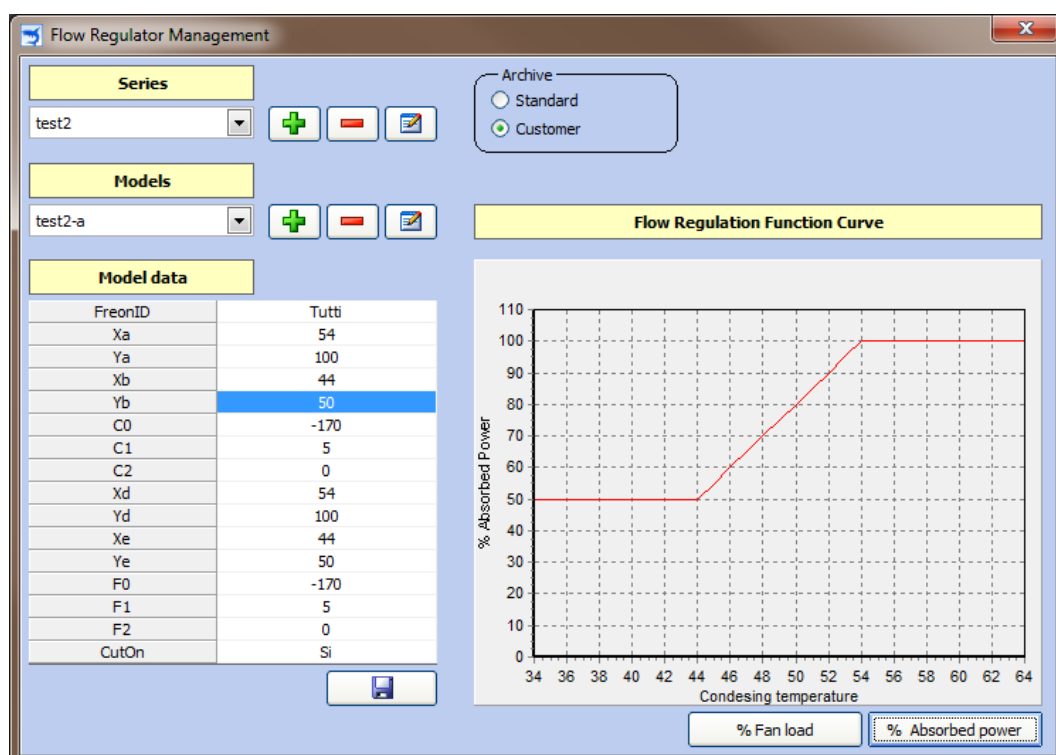
To insert also the variables "d,e,F".



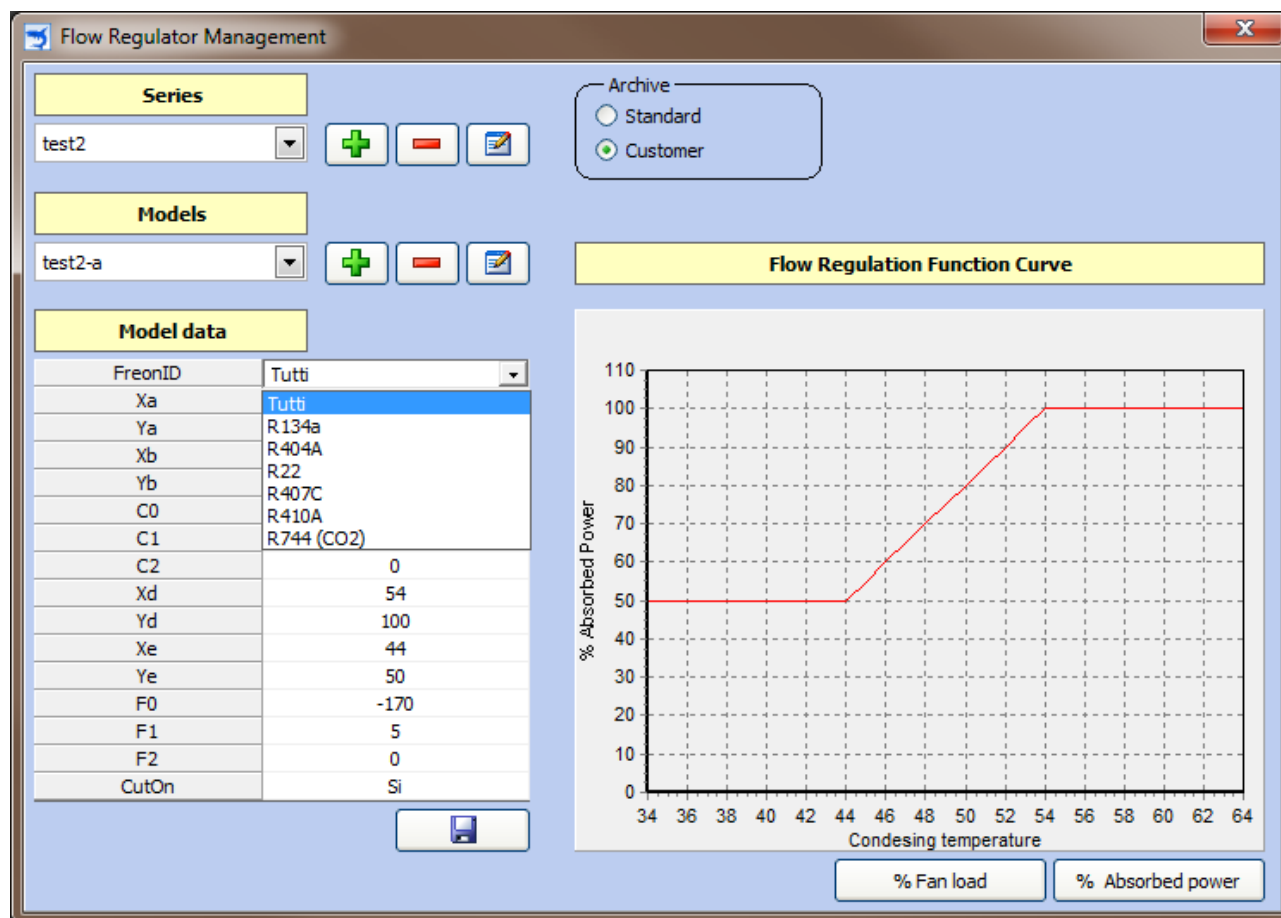
Click on  and on  so you can obtain:



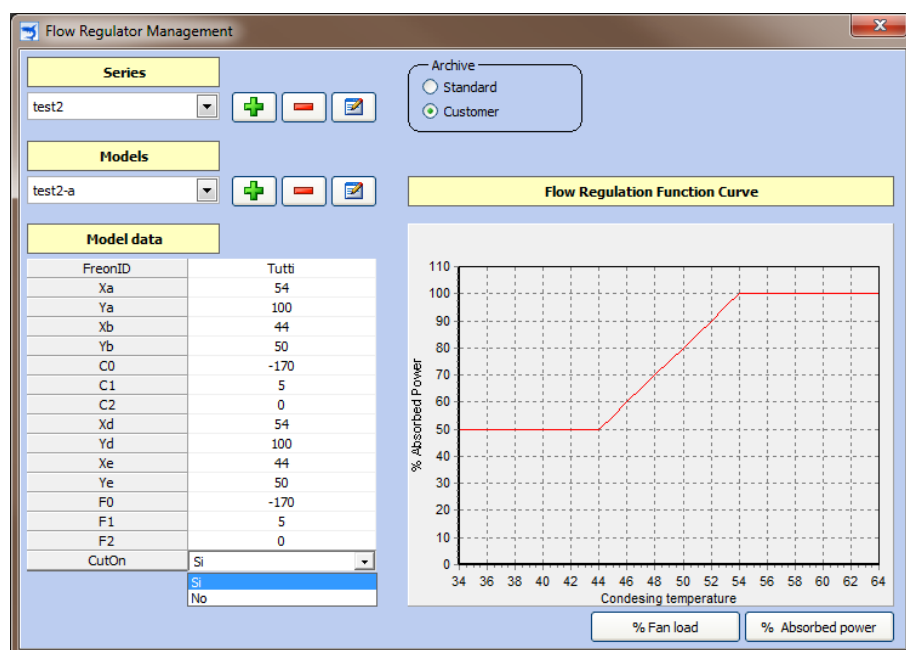
Click on **% Absorbed power** so you can see:



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

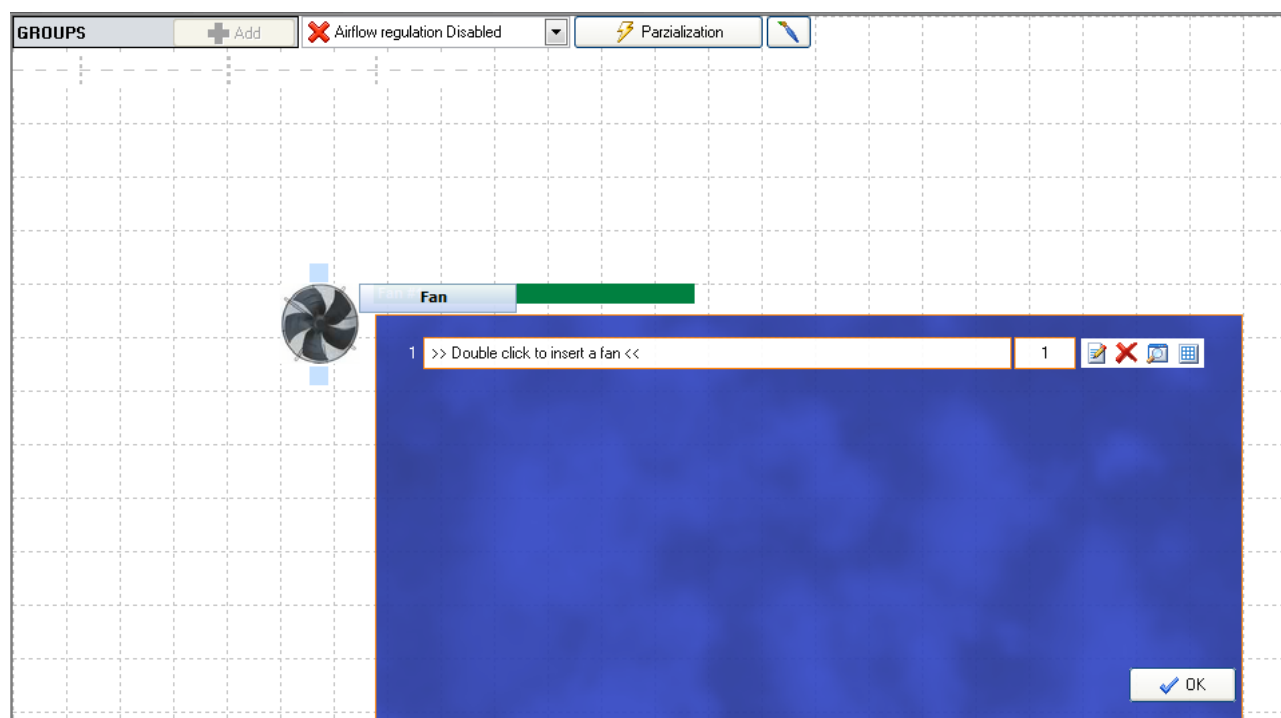


It is possible to simulate the fan shut down, choosing in the field "CutOn", YES or NO.

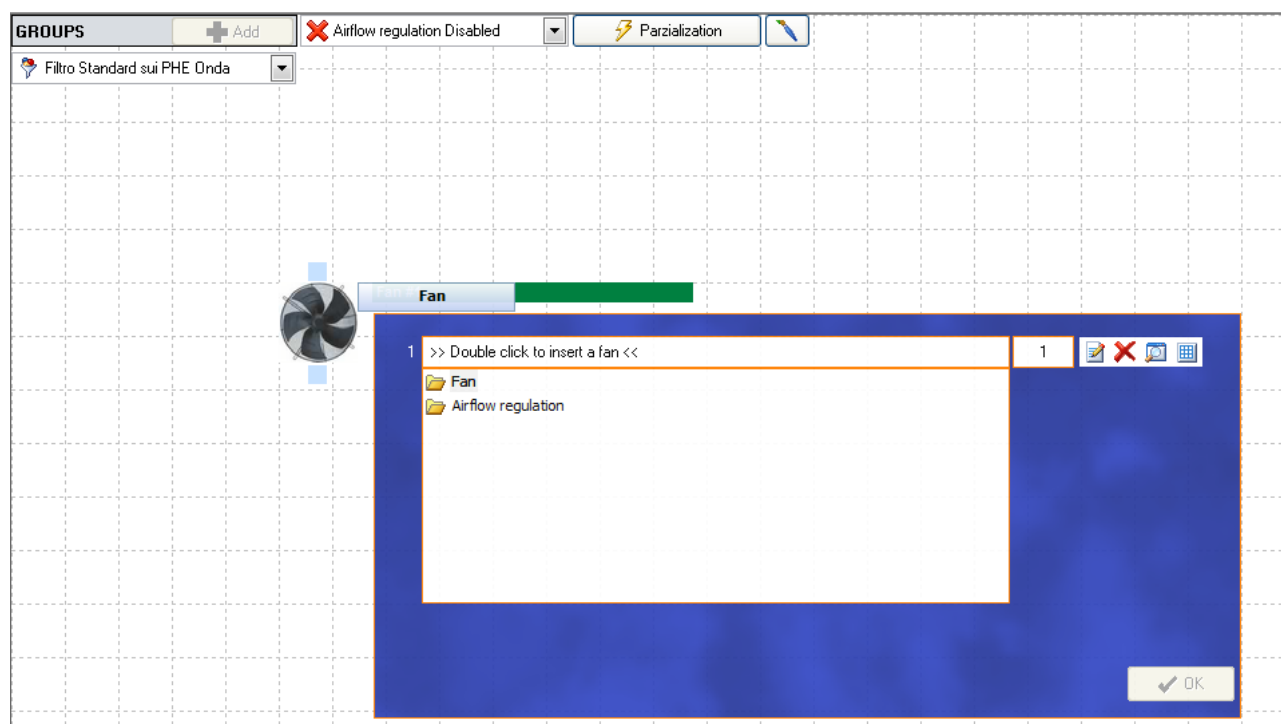


Example of application

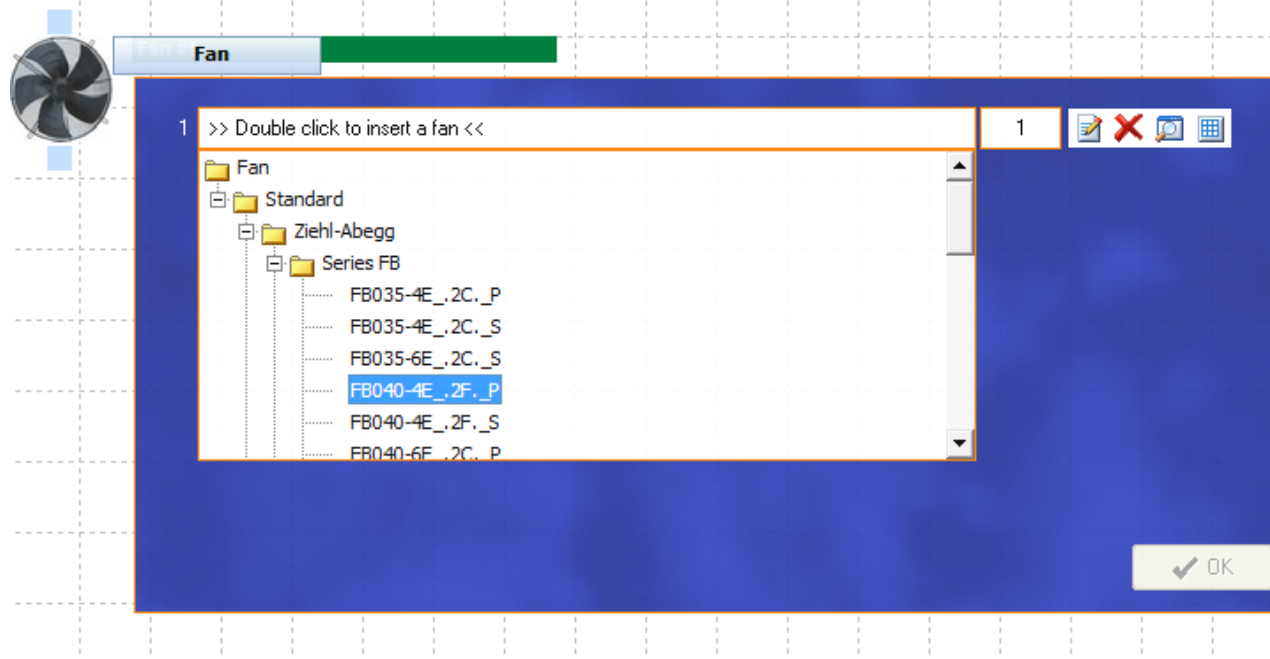
To test the new airflow regulator, it is possible to insert a fan in Shark software:



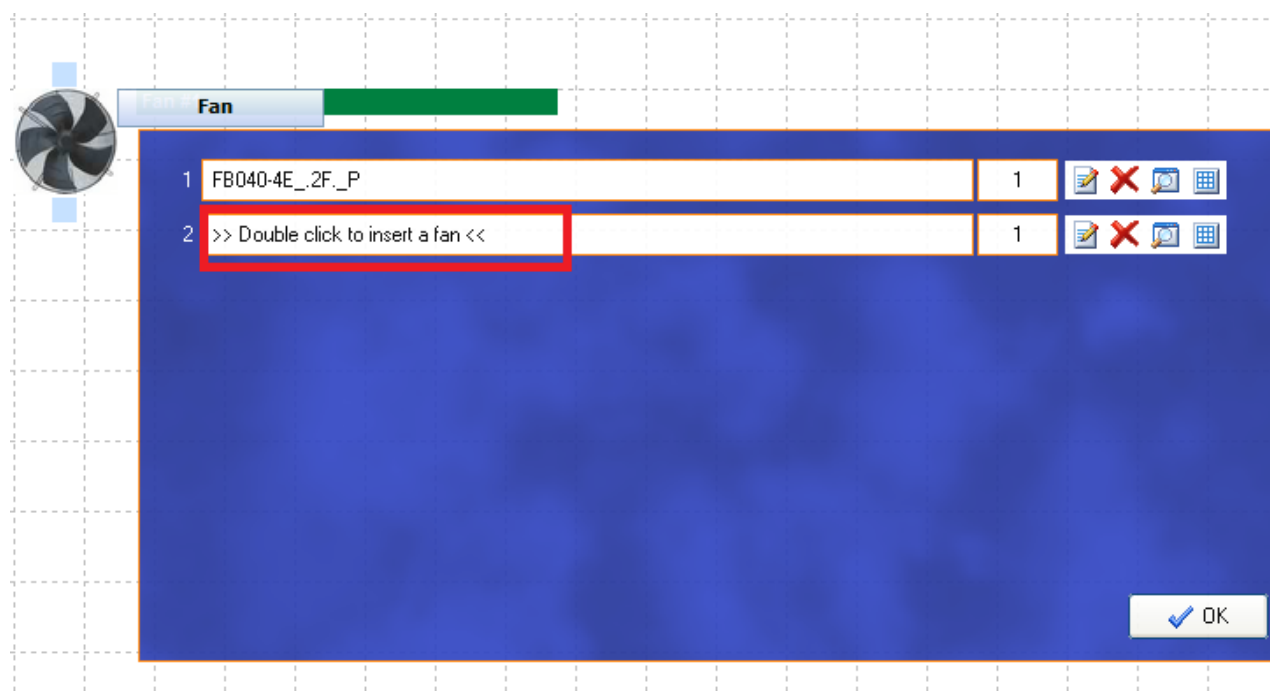
Click on "Double click to insert a fan":



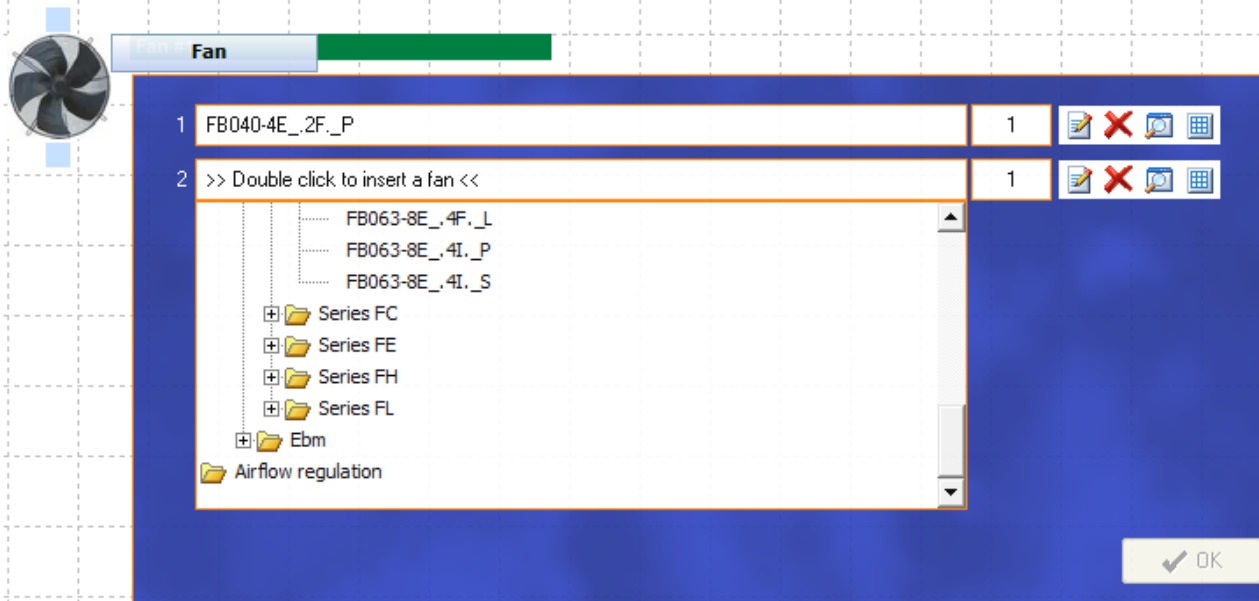
Click on "Fan" to choose a model:



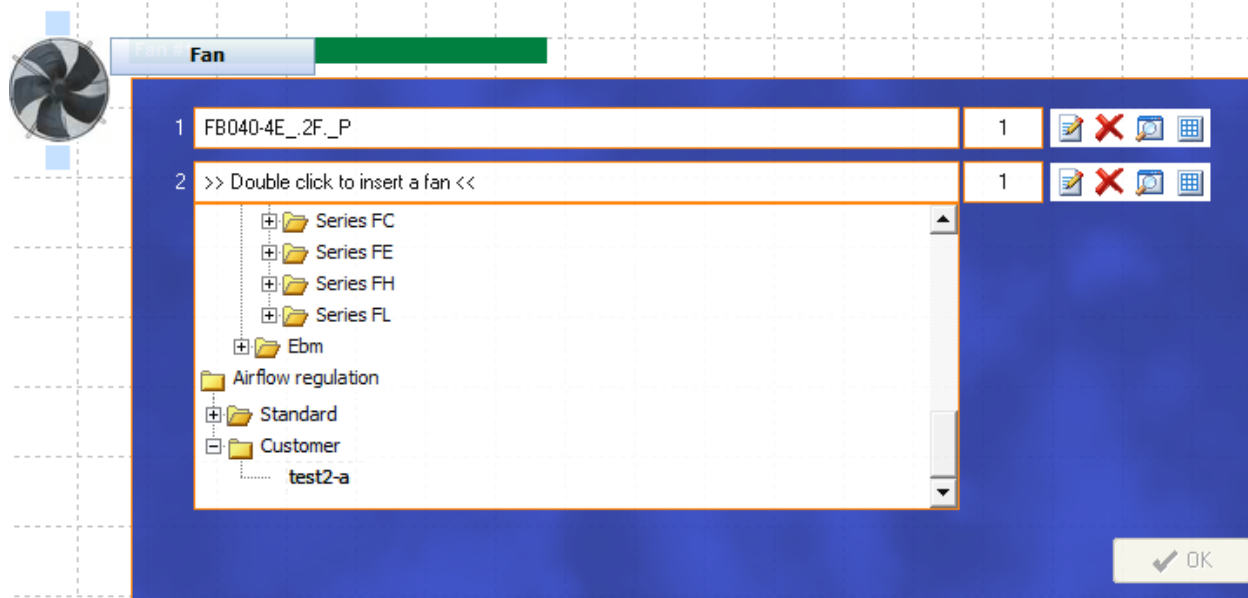
Then, click on:



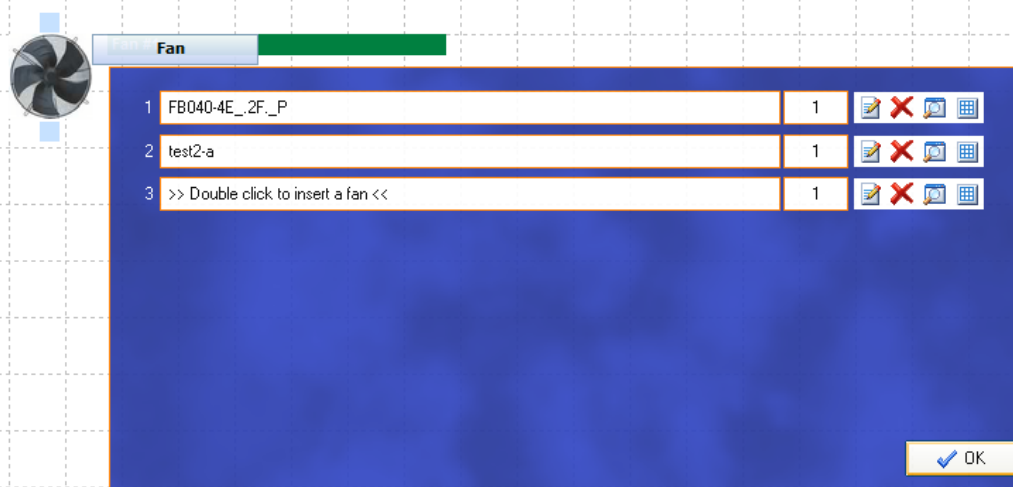
And on Airflow regulation:



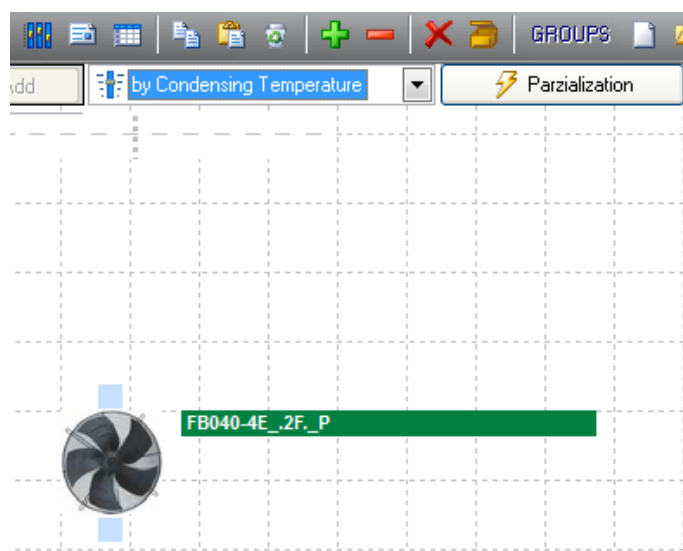
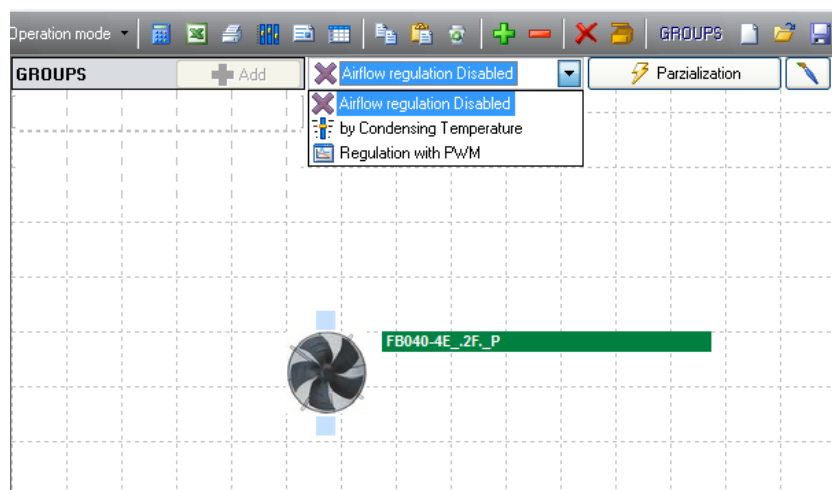
Airflow regulation ->Customer-> test2-a



In the end, click on "OK".



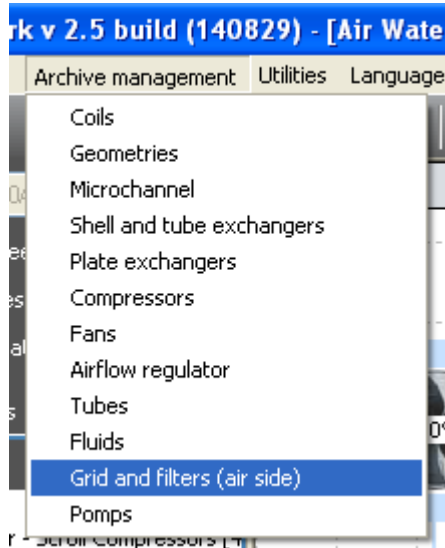
Click to choose from "Airflow regulation Disabled" to "by Condensing Temperature":



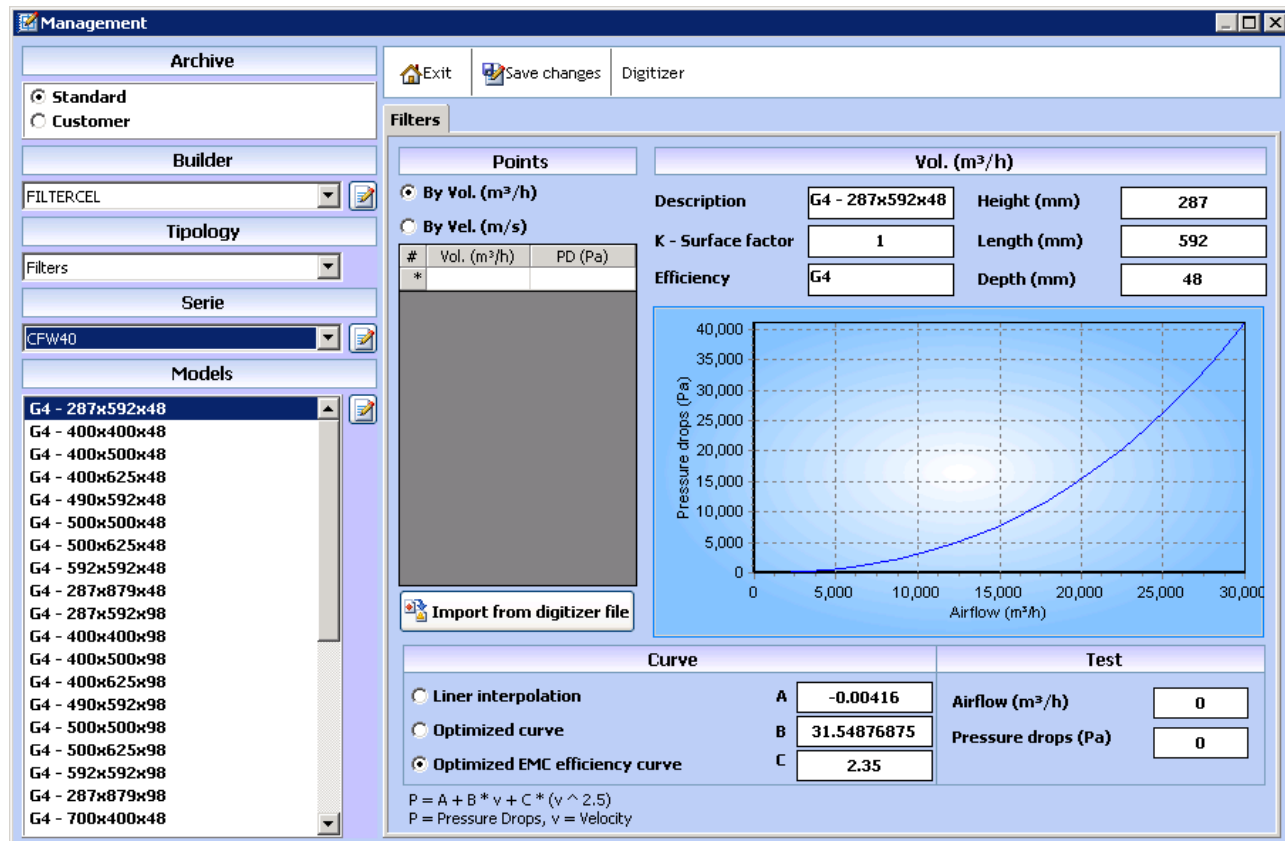
Now the program will simulate the action of the air flow regulator.

How to add an air filter

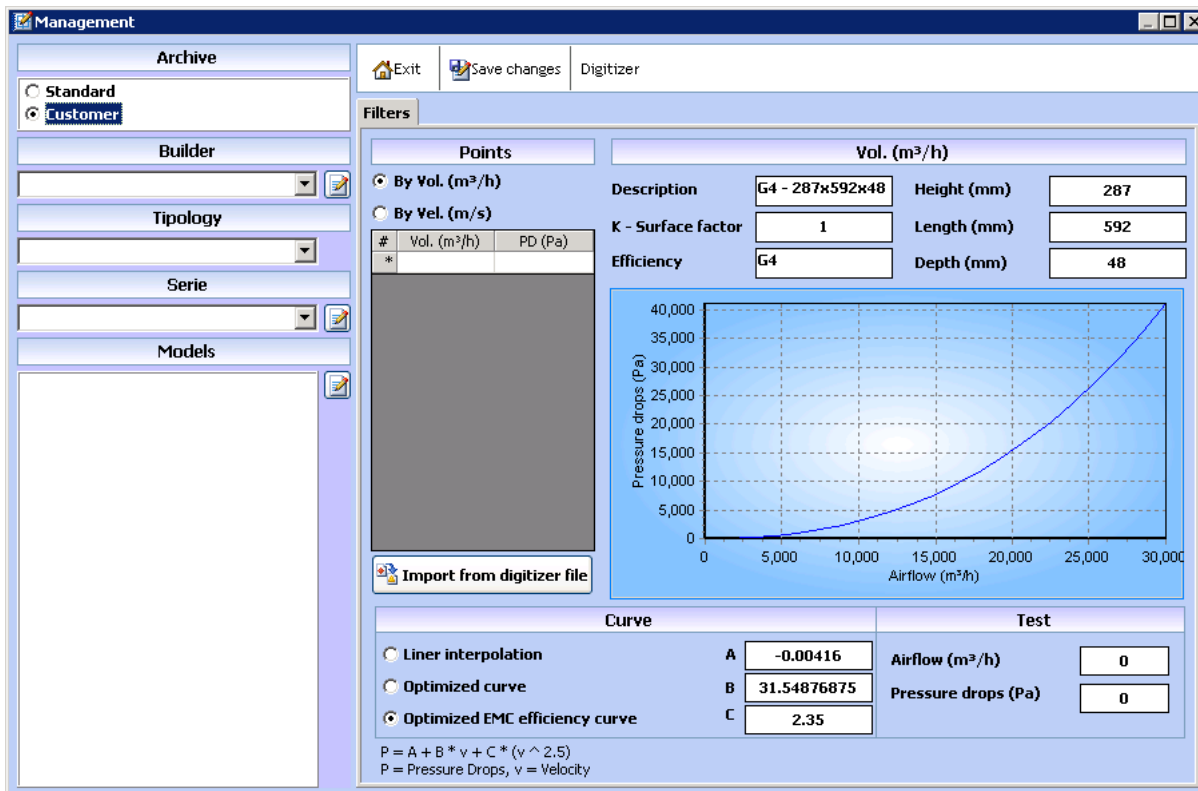
To add a filter in shark we click on "Archive Management", then on Grid And filters (Air side)



And we obtain:



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



Management

Archive

Standard

Customer

Builder

Tipology

Serie

Models

Filters

Points

By Vol. (m³/h)

By Vel. (m/s)

#	Vol. (m³/h)	PD (Pa)
*		

Import from digitizer file

Vol. (m³/h)

Description

G4 - 287x592x48

Height (mm)

287

Length (mm)

592

Depth (mm)

48

K - Surface factor

1

Efficiency

G4

Pressure drops (Pa)

Airflow (m³/h)

Curve

Liner interpolation

Optimized curve

Optimized EMC efficiency curve

A

-0.00416

B

31.54876875

C

2.35

Test

Airflow (m³/h)

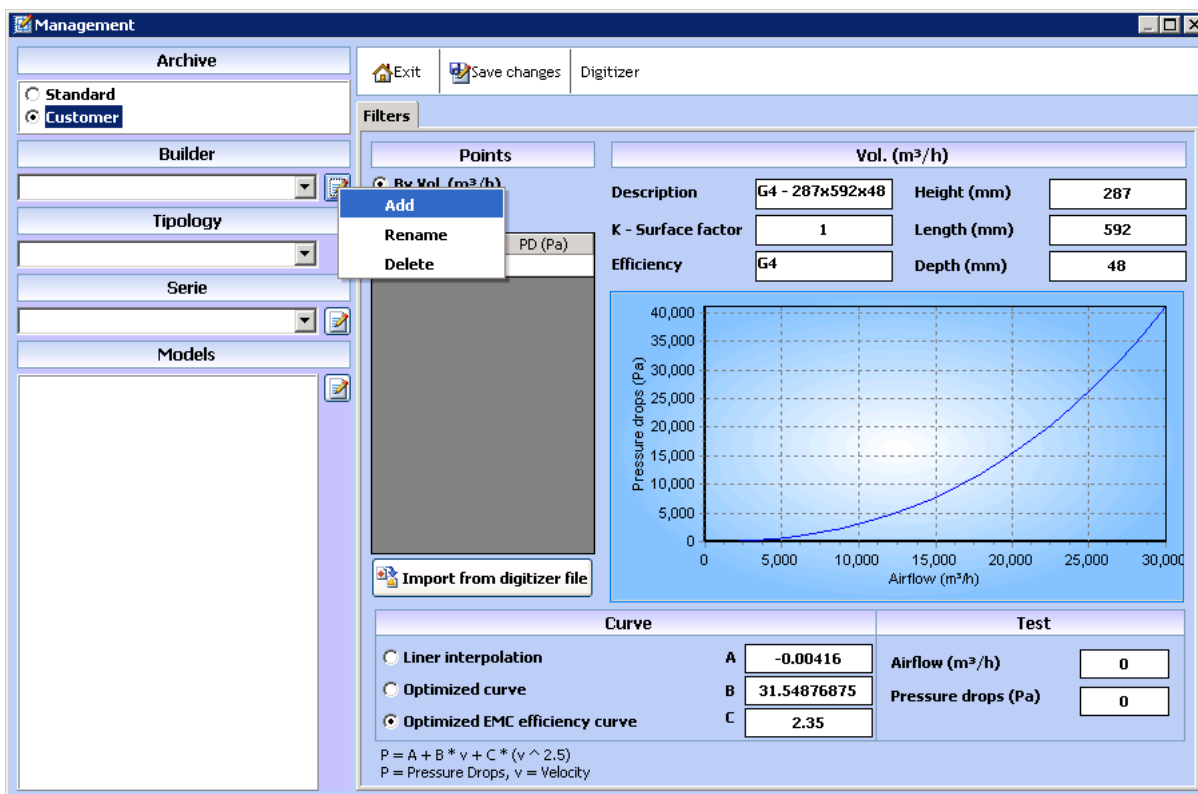
0

Pressure drops (Pa)

0

$P = A + B * v + C * (v ^ 2.5)$
P = Pressure Drops, v = Velocity

Then on "Series" and we click on Add



Management

Archive

Standard

Customer

Builder

Tipology

Serie

Models

Filters

Points

By Vol. (m³/h)

Add

Rename

Delete

PD (Pa)

Vol. (m³/h)

Description

G4 - 287x592x48

Height (mm)

287

Length (mm)

592

Depth (mm)

48

K - Surface factor

1

Efficiency

G4

Pressure drops (Pa)

Airflow (m³/h)

Curve

Liner interpolation

Optimized curve

Optimized EMC efficiency curve

A

-0.00416

B

31.54876875

C

2.35

Test

Airflow (m³/h)

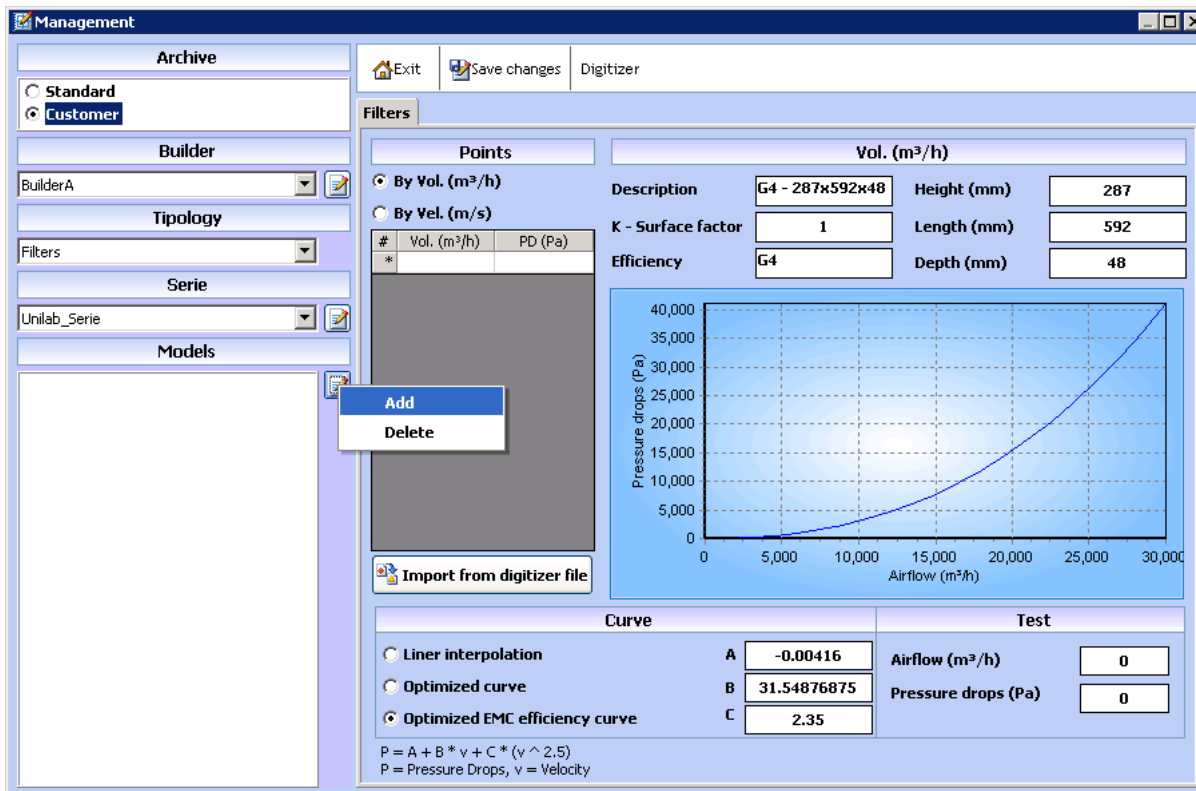
0

Pressure drops (Pa)

0

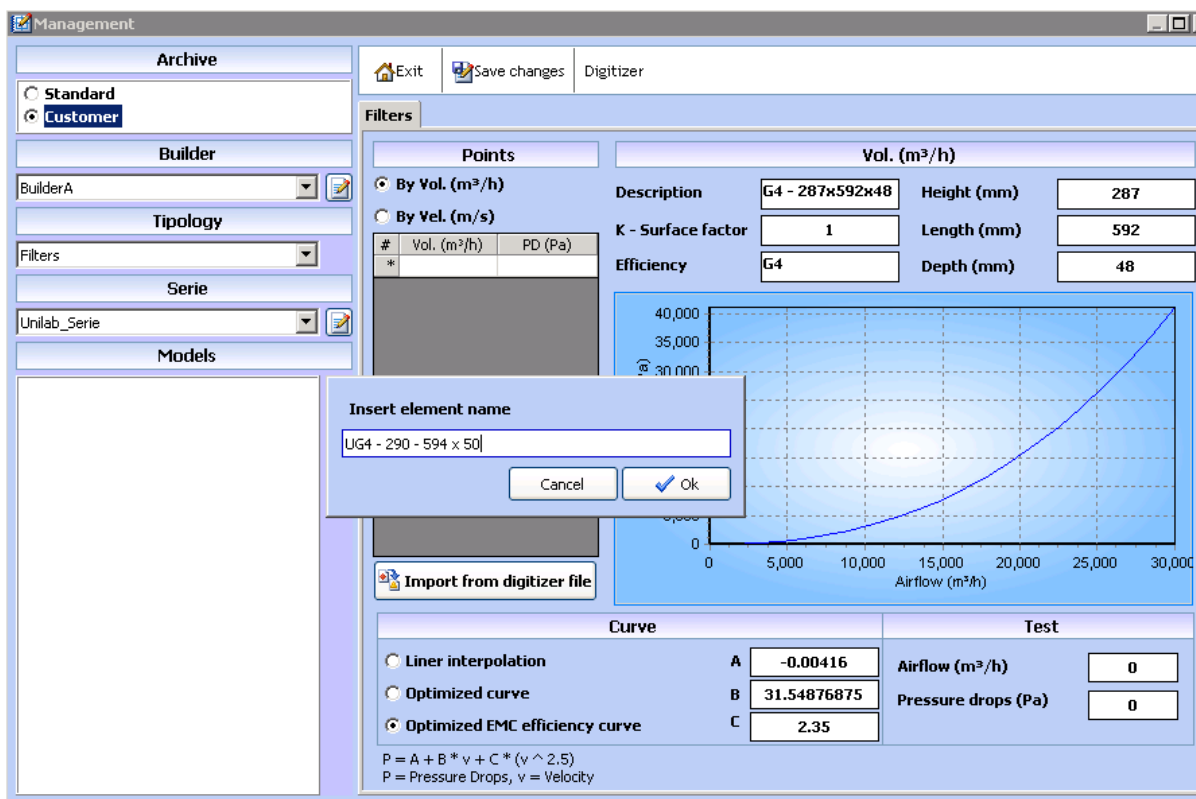
$P = A + B * v + C * (v ^ 2.5)$
P = Pressure Drops, v = Velocity

Then on "Models" and we click on Add



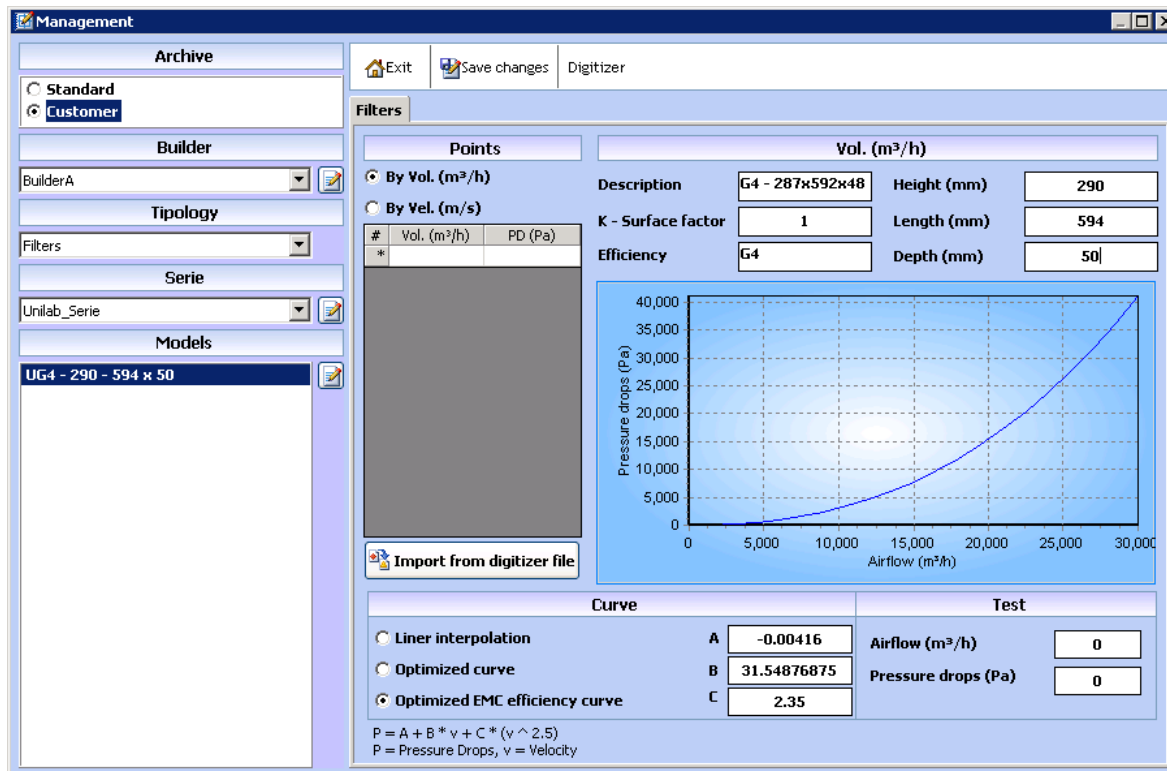
The screenshot shows the 'Management' window with the 'Models' tab selected. On the left, there are filters for 'Builder' (BuilderA), 'Tipology', 'Serie' (Unilab_Serie), and 'Models'. In the center, there is a table with columns '#', 'Vol. (m³/h)', and 'PD (Pa)'. An 'Add' button is highlighted over the table. To the right, there is a 'Vol. (m³/h)' section with a graph of 'Pressure drops (Pa)' vs 'Airflow (m³/h)'. Below the graph, there are 'Curve' and 'Test' sections with various parameters and a formula: $P = A + B * v + C * (v \wedge 2.5)$ where P = Pressure Drops, v = Velocity.

Then we can add the details:



The screenshot shows the 'Management' window with the 'Models' tab selected. A dialog box titled 'Insert element name' is open, showing the text 'UG4 - 290 - 594 x 50'. The background interface is the same as the previous screenshot, showing the 'Models' section with an 'Add' button highlighted.

As you can see:



The screenshot shows the 'Management' window with the 'Customer' tab selected. The 'Builder' is set to 'BuilderA'. The 'Tipology' is set to 'Filters'. The 'Serie' is set to 'Unilab_Serie'. The 'Models' list shows 'UG4 - 290 - 594 x 50' selected.

The 'Filters' section is active, showing 'By Vol. (m³/h)' selected. The 'Points' table is empty. The 'Vol. (m³/h)' section shows a description of 'G4 - 287x592x48', a height of 290 mm, a length of 594 mm, and a depth of 50 mm. The 'K - Surface factor' is 1, and the 'Efficiency' is G4.

The 'Curve' section shows 'Optimized EMC efficiency curve' selected. The 'Test' section shows 'Airflow (m³/h)' and 'Pressure drops (Pa)' both set to 0.

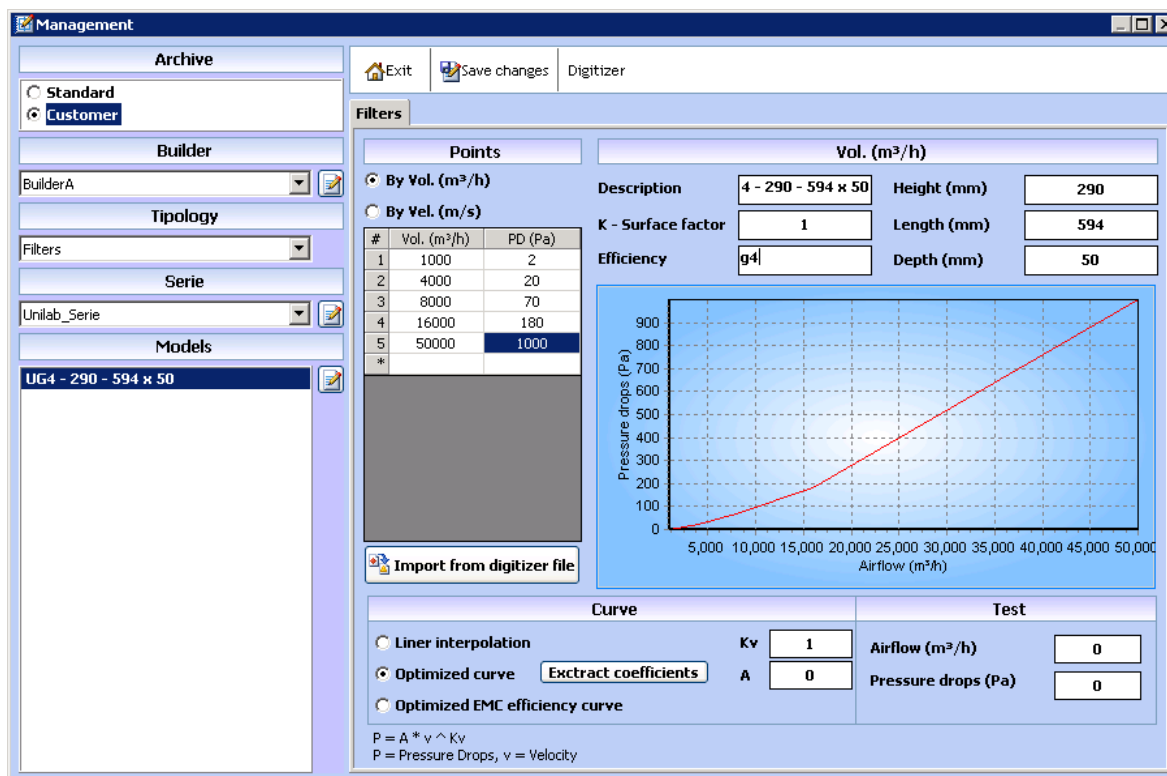
The graph shows 'Pressure drops (Pa)' on the y-axis (0 to 40,000) and 'Airflow (m³/h)' on the x-axis (0 to 30,000). The curve is a blue line starting at (0,0) and rising steeply.

Below the graph, the 'Curve' section shows the following coefficients:

Curve	A	B	C
Liner interpolation	-0.00416		
Optimized curve	31.54876875		
Optimized EMC efficiency curve	2.35		

The formula $P = A + B \cdot v + C \cdot (v \wedge 2.5)$ is shown, where P is Pressure Drops and v is Velocity.

Then we insert the height, length, and depth:



The screenshot shows the 'Management' window with the 'Customer' tab selected. The 'Builder' is set to 'BuilderA'. The 'Tipology' is set to 'Filters'. The 'Serie' is set to 'Unilab_Serie'. The 'Models' list shows 'UG4 - 290 - 594 x 50' selected.

The 'Filters' section is active, showing 'By Vol. (m³/h)' selected. The 'Points' table is updated with the following data:

#	Vol. (m³/h)	PD (Pa)
1	1000	2
2	4000	20
3	8000	70
4	16000	180
5	50000	1000

The 'Vol. (m³/h)' section shows a description of '4 - 290 - 594 x 50', a height of 290 mm, a length of 594 mm, and a depth of 50 mm. The 'K - Surface factor' is 1, and the 'Efficiency' is g4.

The 'Curve' section shows 'Optimized curve' selected. The 'Test' section shows 'Airflow (m³/h)' and 'Pressure drops (Pa)' both set to 0.

The graph shows 'Pressure drops (Pa)' on the y-axis (0 to 900) and 'Airflow (m³/h)' on the x-axis (0 to 50,000). The curve is a red line starting at (0,0) and rising steeply.

Below the graph, the 'Curve' section shows the following coefficients:

Curve	Kv	A
Liner interpolation	1	
Optimized curve	0	
Optimized EMC efficiency curve		

The formula $P = A \cdot v \wedge Kv$ is shown, where P is Pressure Drops and v is Velocity.

Then we click on the Extract coefficients.

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

Management

Archive

☐ Standard
☒ Customer

Builder

BuilderA

Tipology

Filters

Serie

Unilab_Serie

Models

UG4 - 290 - 594 x 50

Exit Save changes Digitizer

Filters

Points

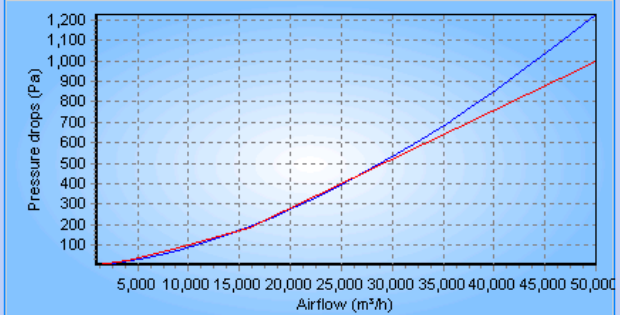
☒ By Vol. (m³/h)
☐ By Vel. (m/s)

#	Vol. (m³/h)	PD (Pa)
1	1000	2
2	4000	20
3	8000	70
4	16000	180
5	50000	1000
*		

Import from digitizer file

Vol. (m³/h)

Description: 4 - 290 - 594 x 50
Height (mm): 290
K - Surface factor: 1
Length (mm): 594
Efficiency: g4
Depth (mm): 50



Curve

☐ Liner interpolation
☒ Optimized curve
☐ Optimized EMC efficiency curve

Extract coefficients

Kv: 1.64
A: 0.92

Test

Airflow (m³/h): 0
Pressure drops (Pa): 0

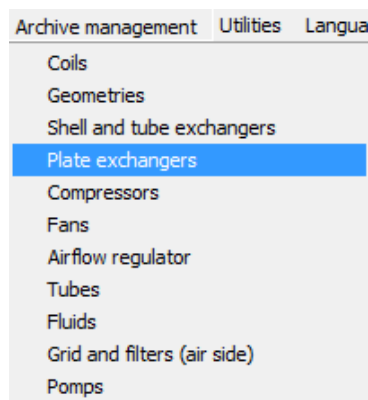
$P = A * v^{\wedge} Kv$
P = Pressure Drops, v = Velocity

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:

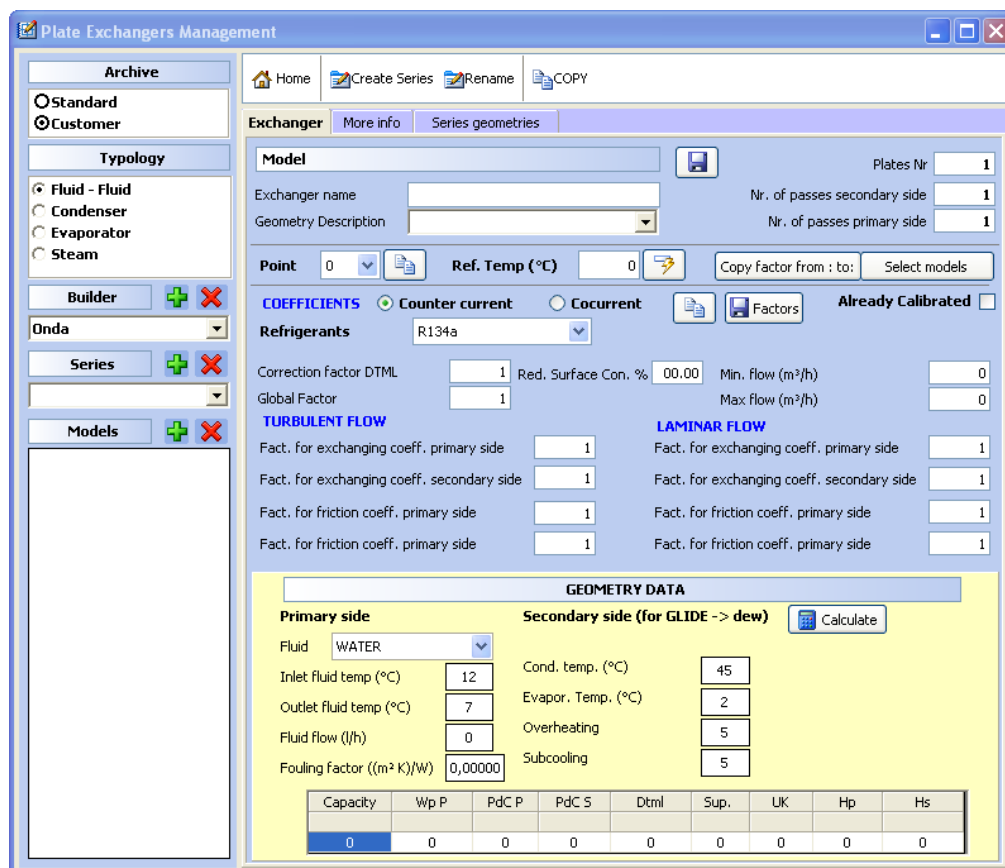


Plate Exchangers Management

Archive: ☐ Standard ☒ Customer

Typology: ☒ Fluid - Fluid ☐ Condenser ☐ Evaporator ☐ Steam

Builder:

Series:

Home Create Series Rename COPY

Exchanger More info Series geometries

Model Plates Nr.

Exchanger name Nr. of passes secondary side

Geometry Description Nr. of passes primary side

Point Ref. Temp (°C) Copy factor from : to:

COEFFICIENTS ☒ Counter current ☐ Cocurrent

Refrigerants

Correction factor DTML Red. Surface Con. % Min. flow (m³/h)

Global Factor Max flow (m³/h)

TURBULENT FLOW **LAMINAR FLOW**

Fact. for exchanging coeff. primary side Fact. for exchanging coeff. primary side

Fact. for exchanging coeff. secondary side Fact. for exchanging coeff. secondary side

Fact. for friction coeff. primary side Fact. for friction coeff. primary side

Fact. for friction coeff. primary side Fact. for friction coeff. primary side

GEOMETRY DATA

Primary side Secondary side (for GLIDE -> dew)

Fluid

Inlet fluid temp (°C) Cond. temp. (°C)

Outlet fluid temp (°C) Evapor. Temp. (°C)

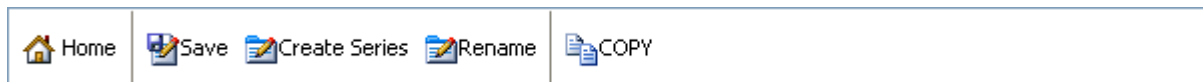
Fluid flow (l/h) Overheating

Fouling factor ((m² K)/W) Subcooling

Capacity	Wp P	PdC P	PdC S	Dtml	Sup.	UK	Hp	Hs
0	0	0	0	0	0	0	0	0

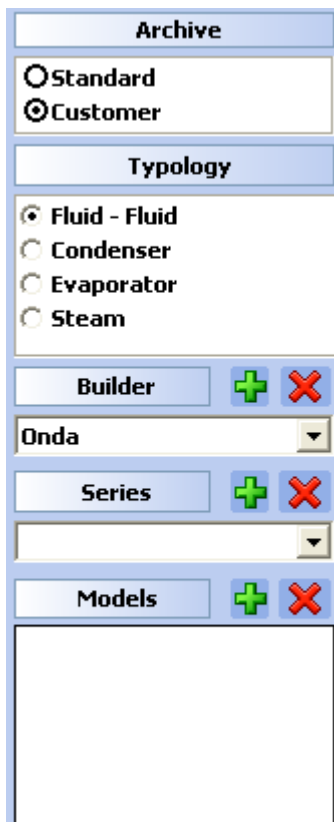
The mask will be divided in the three main parts.

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.

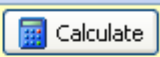
Series: to select the series of the heat exchanger (AC, ACH, WP, etc.). The "+" and "X" are used respectively to add a new series or delete the selected one.

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:

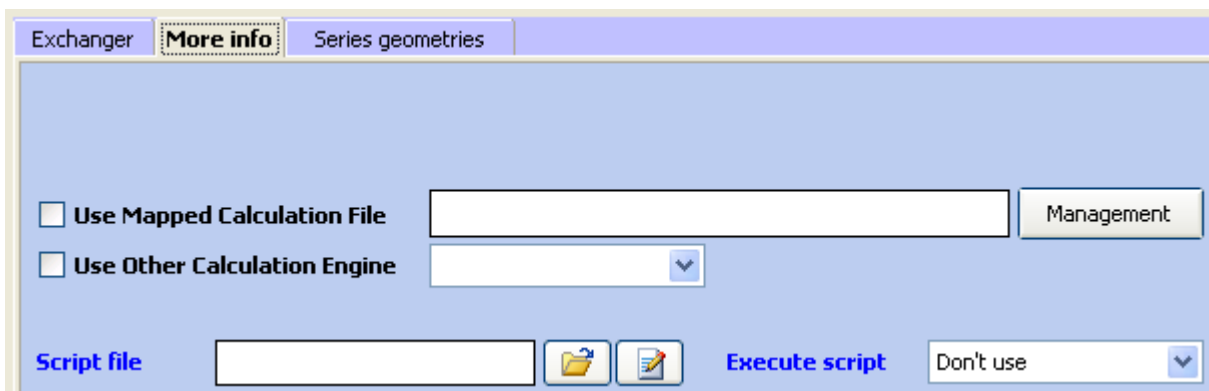
Model				Plates Nr	<input type="text" value="1"/>
Exchanger name		<input type="text"/>		Nr. of passes secondary side	<input type="text" value="1"/>
Geometry Description		<input type="text"/>		Nr. of passes primary side	<input type="text" value="1"/>
Point	<input type="text" value="0"/>		Ref. Temp (°C)	<input type="text" value="0"/>	
			Copy factor from : to:	<input type="text" value="Select models"/>	
COEFFICIENTS		<input checked="" type="radio"/> Counter current <input type="radio"/> Cocurrent		  Factors	
Refrigerants		<input type="text" value="R134a"/>			
Correction factor DTML	<input type="text" value="1"/>	Red. Surface Con. %	<input type="text" value="00.00"/>	Min. flow (m³/h)	<input type="text" value="0"/>
Global Factor	<input type="text" value="1"/>			Max flow (m³/h)	<input type="text" value="0"/>
TURBULENT FLOW			LAMINAR FLOW		
Fact. for exchanging coeff. primary side	<input type="text" value="1"/>	Fact. for exchanging coeff. primary side	<input type="text" value="1"/>		
Fact. for exchanging coeff. secondary side	<input type="text" value="1"/>	Fact. for exchanging coeff. secondary side	<input type="text" value="1"/>		
Fact. for friction coeff. primary side	<input type="text" value="1"/>	Fact. for friction coeff. primary side	<input type="text" value="1"/>		
Fact. for friction coeff. primary side	<input type="text" value="1"/>	Fact. for friction coeff. primary side	<input type="text" value="1"/>		

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:

GEOMETRY DATA							
Primary side				Secondary side (for GLIDE -> dew)			
Fluid	<input type="text" value="WATER"/>						
Inlet fluid temp (°C)	<input type="text" value="12"/>	Cond. temp. (°C)	<input type="text" value="45"/>				
Outlet fluid temp (°C)	<input type="text" value="7"/>	Evapor. Temp. (°C)	<input type="text" value="2"/>				
Fluid flow (l/h)	<input type="text" value="0"/>	Overheating	<input type="text" value="5"/>				
Fouling factor ((m² K)/W)	<input type="text" value="0,00000"/>	Subcooling	<input type="text" value="5"/>				
Capacity	Wp P	PdC P	PdC S	Dtml	Sup.	UK	Hp
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

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:



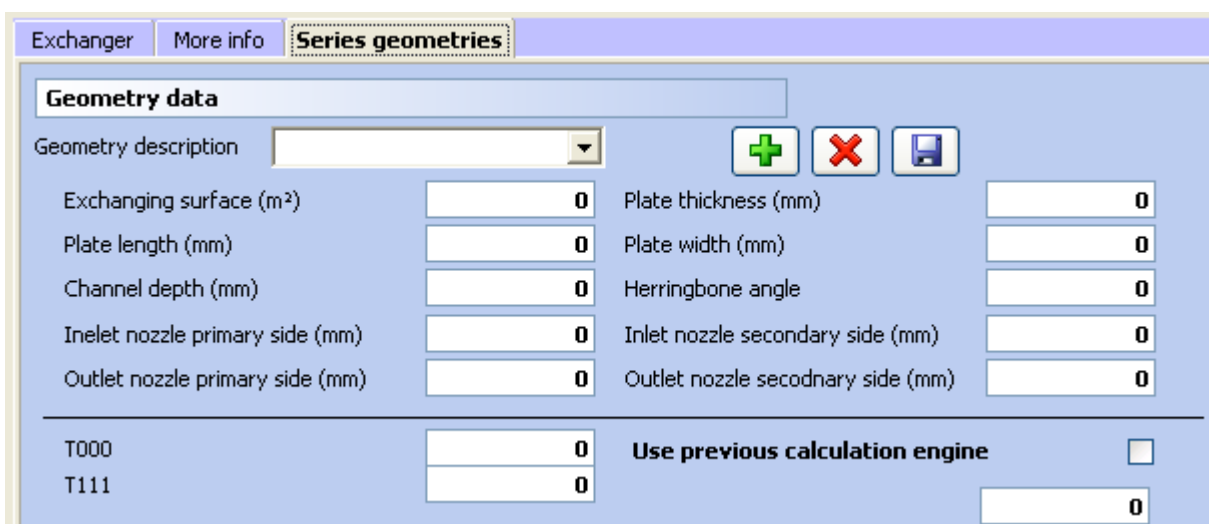
Exchanger **More info** Series geometries

☐ Use Mapped Calculation File Management

☐ Use Other Calculation Engine




Script file   Execute script Don't use

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



Exchanger **More info** **Series geometries**

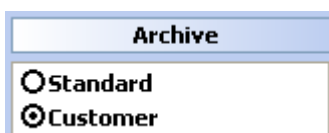
Geometry data

Geometry description   

Exchanging surface (m ²)	<input type="text"/>	Plate thickness (mm)	<input type="text"/>
Plate length (mm)	<input type="text"/>	Plate width (mm)	<input type="text"/>
Channel depth (mm)	<input type="text"/>	Herringbone angle	<input type="text"/>
Inlet nozzle primary side (mm)	<input type="text"/>	Inlet nozzle secondary side (mm)	<input type="text"/>
Outlet nozzle primary side (mm)	<input type="text"/>	Outlet nozzle secondary side (mm)	<input type="text"/>
T000	<input type="text"/>	Use previous calculation engine	<input type="checkbox"/>
T111	<input type="text"/>		<input type="text"/>

Insertion of a new Plate Heat Exchanger

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

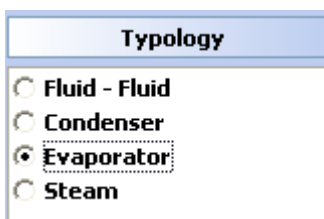


Archive

☐ Standard

☒ Customer

Then the typology:



Typology

☐ Fluid - Fluid

☐ Condenser

☒ Evaporator

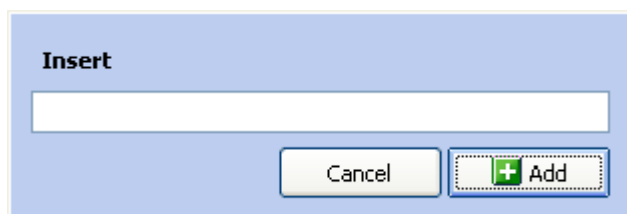
☐ Steam

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.

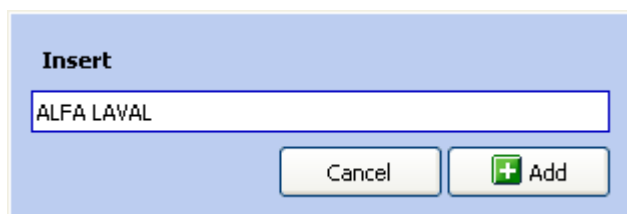
We add the builder Alfa Laval in the builder voice. We click on "+" on the builder:



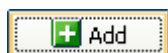
The following will appear:



We insert Alfa Laval in the field:



We click on Add:



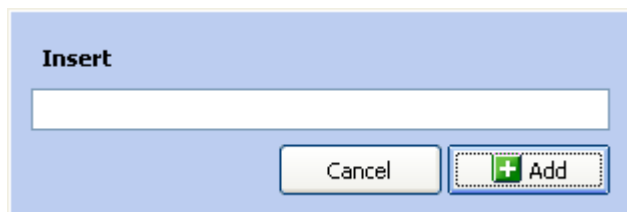
As you can see from the figure below, the manufacturer has been successfully added to:



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:

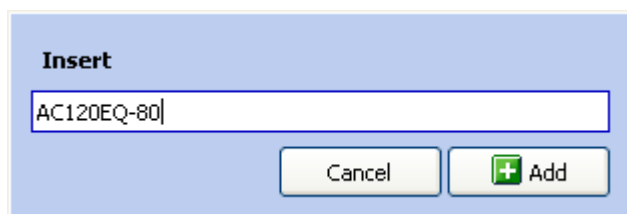
As can be noted from the mask, the series has been added successfully:



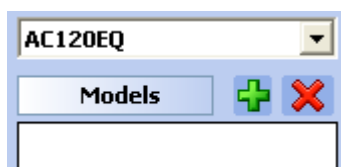
Let us now add the template AC120EQ with 80 plates. Let's click on the add button like before:



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:



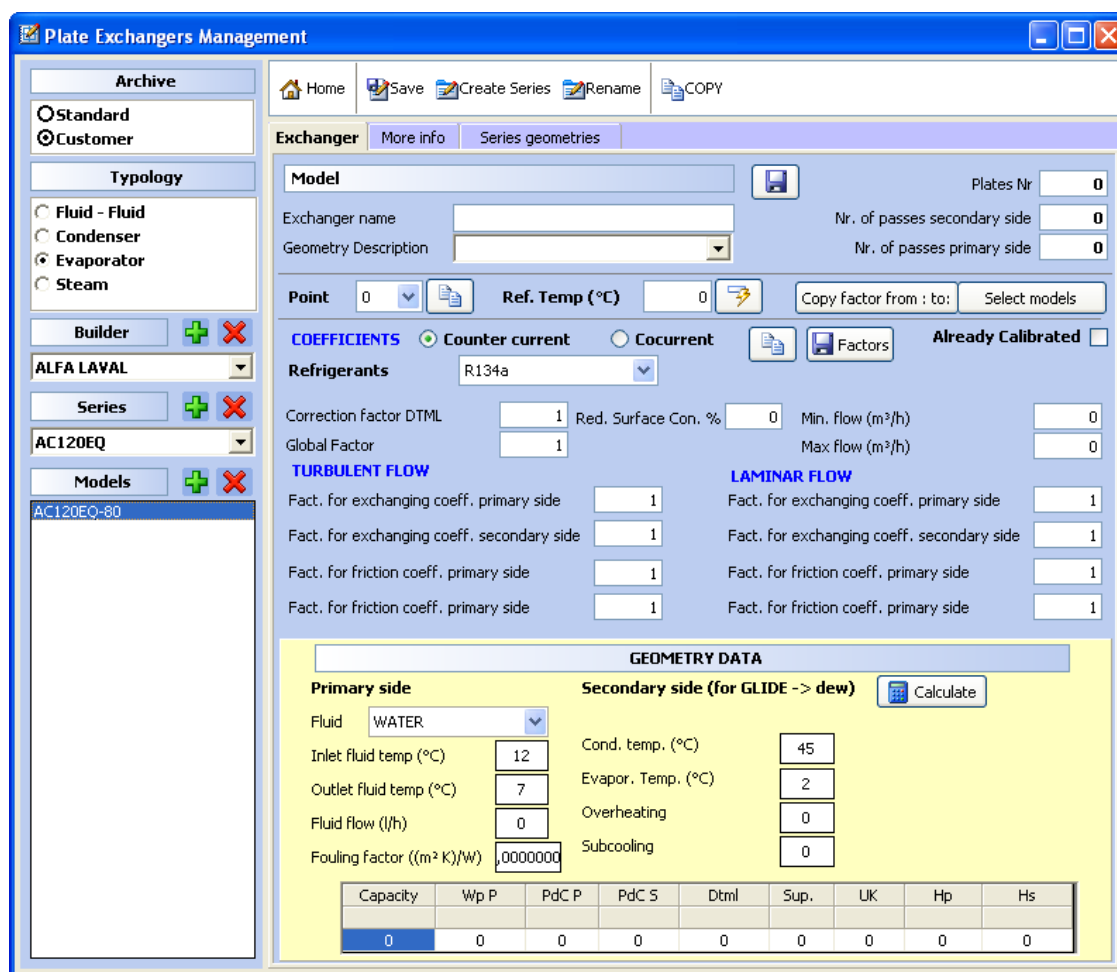
In this case, click on the box of the series and re-select the series AC120EQ:



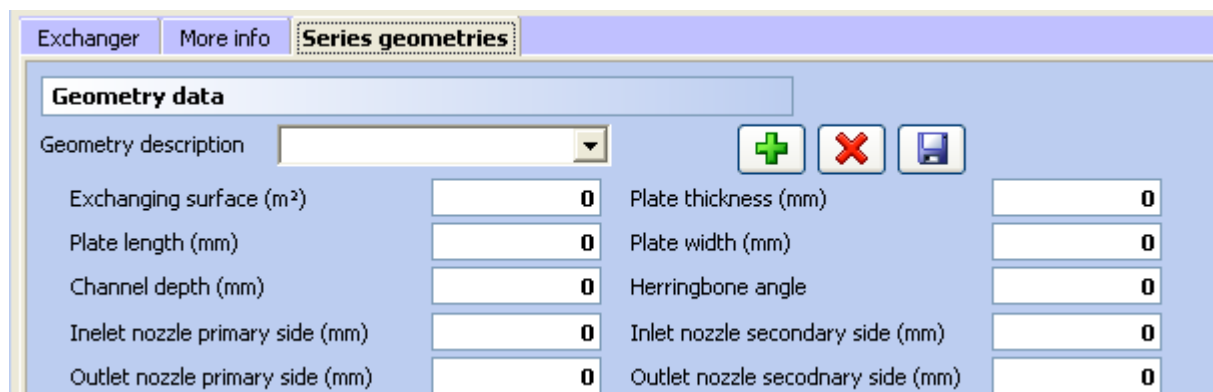
The model will automatically appear:



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:

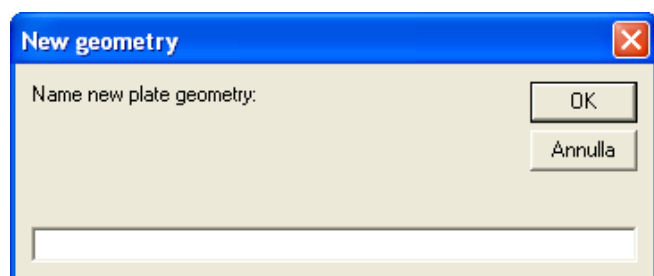
Inlet primary side

Outlet primary side

- Inlet secondary side
- Outlet secondary side

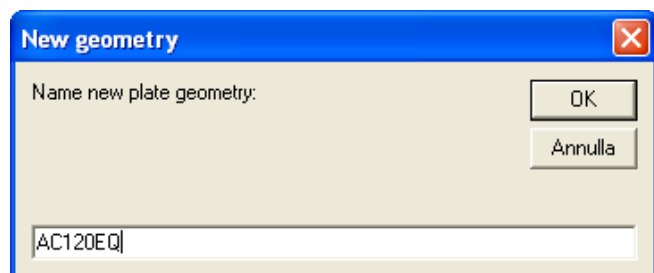
To add a geometry, click the add button: 

You will see the following screen:



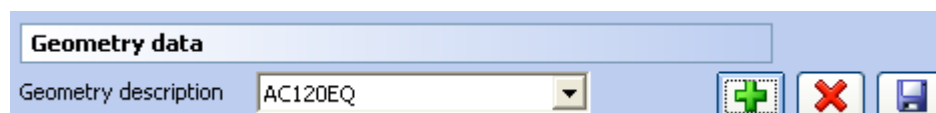
A dialog box titled "New geometry" with a close button (X) in the top right corner. It contains a text input field labeled "Name new plate geometry:" and two buttons: "OK" and "Annulla".

Specify the name of the geometry AC120EQ:



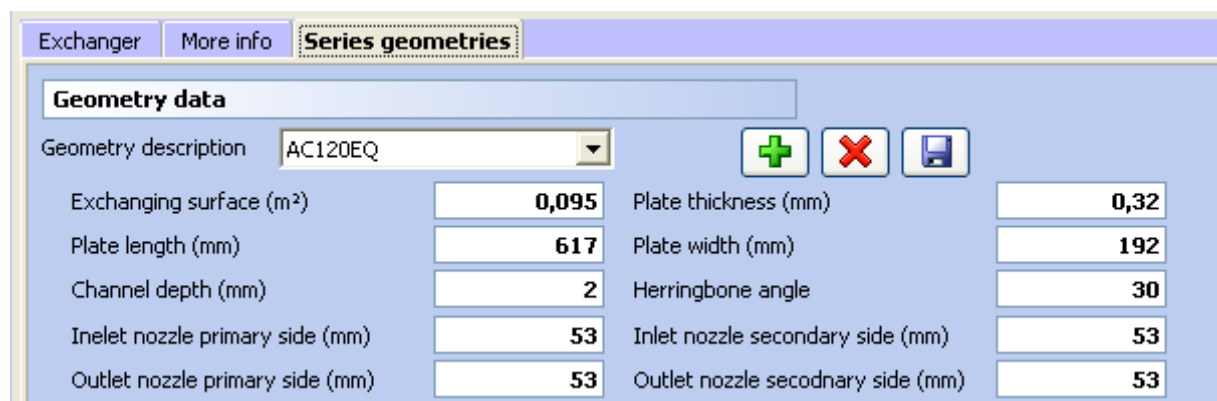
A dialog box titled "New geometry" with a close button (X) in the top right corner. It contains a text input field labeled "Name new plate geometry:" with the text "AC120EQ" entered. There are "OK" and "Annulla" buttons.

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



A section titled "Geometry data" with a dropdown menu showing "AC120EQ". To the right of the dropdown are three buttons: a green plus sign, a red X, and a floppy disk icon.

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



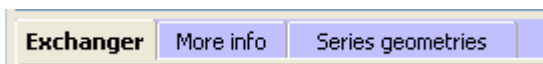
A window titled "Series geometries" with tabs for "Exchanger", "More info", and "Series geometries". The "Series geometries" tab is active. It contains a "Geometry data" section with a dropdown menu showing "AC120EQ" and three buttons: a green plus sign, a red X, and a floppy disk icon. Below this are two columns of input fields for various parameters:

Exchanging surface (m ²)	0,095	Plate thickness (mm)	0,32
Plate length (mm)	617	Plate width (mm)	192
Channel depth (mm)	2	Herringbone angle	30
Inlet nozzle primary side (mm)	53	Inlet nozzle secondary side (mm)	53
Outlet nozzle primary side (mm)	53	Outlet nozzle secondary side (mm)	53

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:

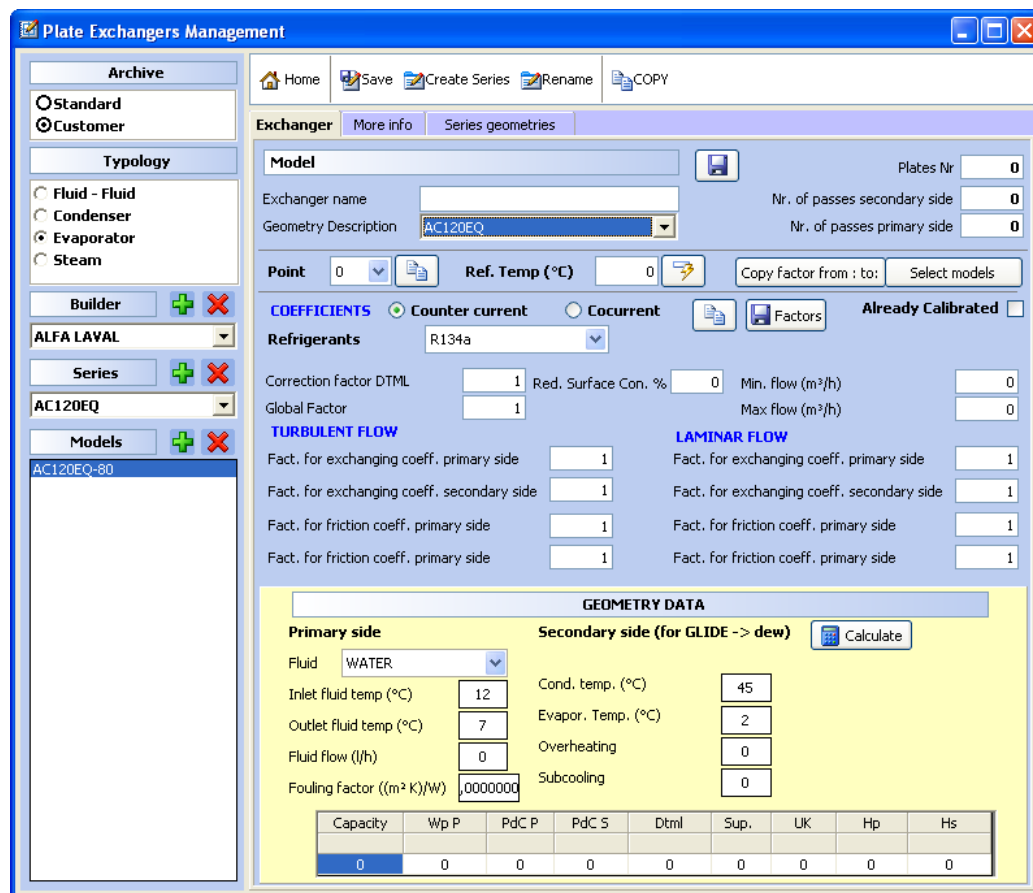



Plate Exchangers Management

Home Save Create Series Rename COPY


Exchanger More info Series geometries

Model  Plates Nr

Exchanger name

Geometry Description Nr. of passes secondary side
Nr. of passes primary side

Point Ref. Temp (°C) Copy Factor from : to:

COEFFICIENTS ☒ Counter current ☐ Cocurrent  **Already Calibrated** ☐


Refrigerants

Correction factor DTML Red. Surface Con. % Min. flow (m³/h)
Global Factor Max flow (m³/h)

TURBULENT FLOW **LAMINAR FLOW**

Fact. for exchanging coeff. primary side Fact. for exchanging coeff. primary side
Fact. for exchanging coeff. secondary side Fact. for exchanging coeff. secondary side
Fact. for friction coeff. primary side Fact. for friction coeff. primary side
Fact. for friction coeff. primary side Fact. for friction coeff. primary side

GEOMETRY DATA

Primary side **Secondary side (for GLIDE -> dew)** 


Fluid Cond. temp. (°C)
Inlet fluid temp (°C) Evapor. Temp. (°C)
Outlet fluid temp (°C) Overheating
Fluid flow (l/h) Subcooling
Fouling Factor ((m² K)/W)

Capacity	Wp P	PdC P	PdC S	Dtml	Sup.	UK	Hp	Hs
0	0	0	0	0	0	0	0	0

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

Descrizione Geometria

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

Model  Plates Nr


Exchanger name

Geometry Description Nr. of passes secondary side
Nr. of passes primary side

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:

Model			Plates Nr	80
Exchanger name	AC120EQ-80		Nr. of passes secondary side	1
Geometry Description	AC120EQ		Nr. of passes primary side	1

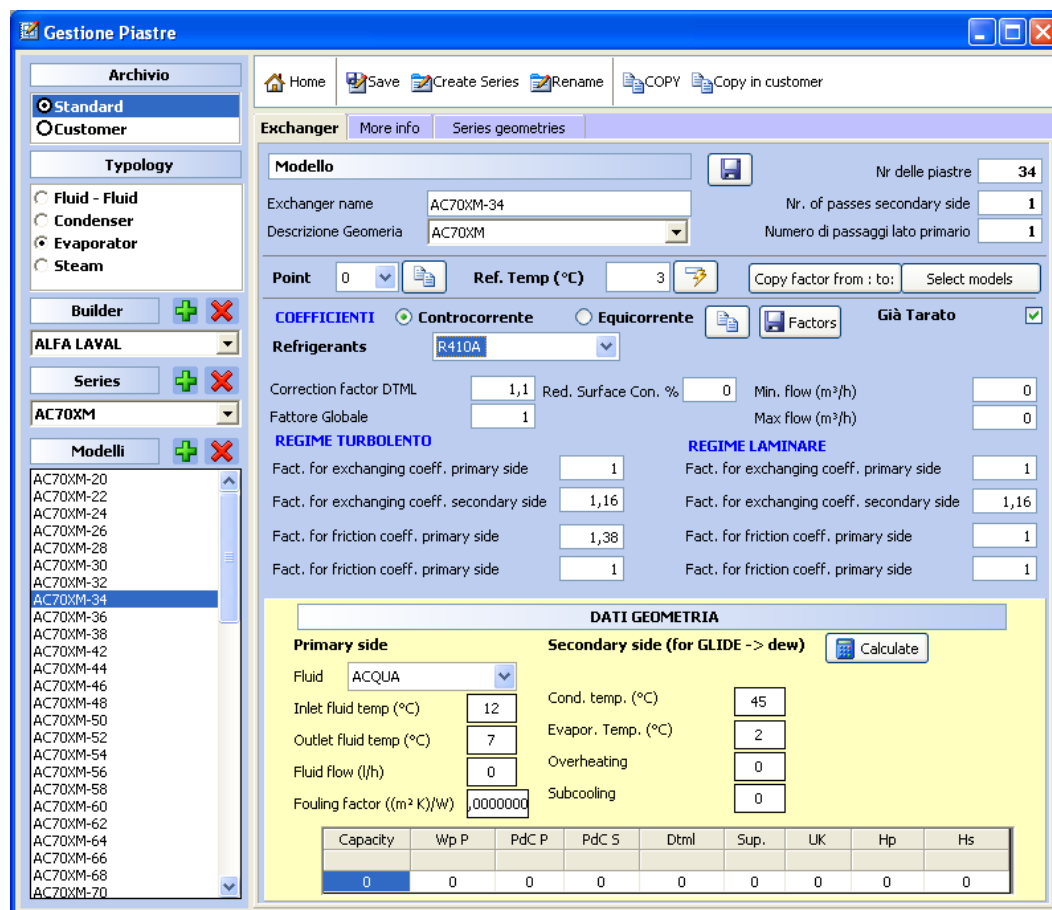
And finally we click on the Save button next to the word Model: 

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

 Home	 Save	 Create Series	 Rename	 COPY
--	--	---	--	--

Calibration of a heat exchanger

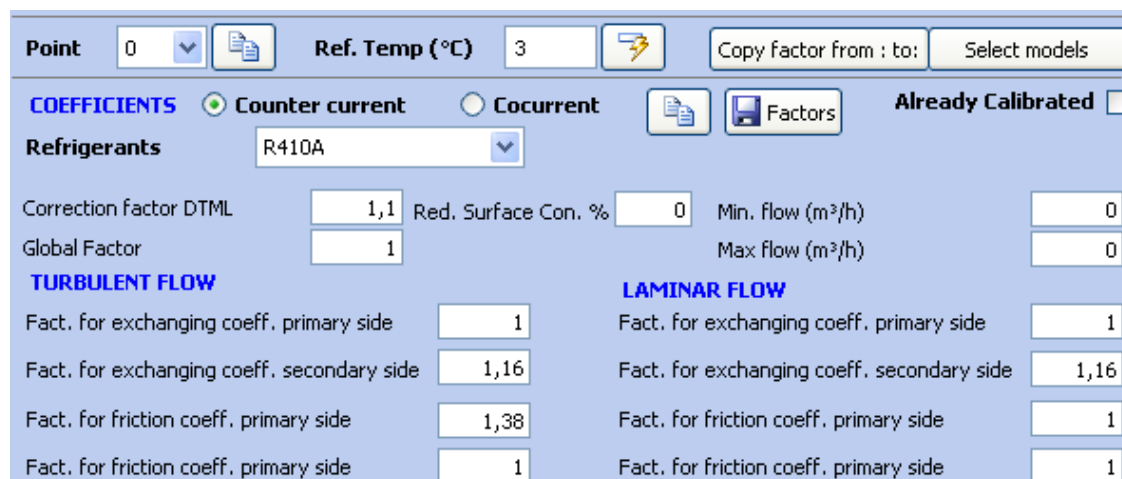
The calibration of a heat exchanger can be made on a single point or multiple points. Involves inserting, by the user, of a given set of factors that act on the mathematical model, based on: the calculation in countercurrent / cocurrent, refrigerant, turbulent / laminar flow. These factors are accessible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



The screenshot shows the 'Gestione Piastre' software interface. The left sidebar contains a tree view with 'Archivio' (Standard, Customer), 'Typology' (Fluid-Fluid, Condenser, Evaporator, Steam), 'Builder' (ALFA LAVAL), 'Series' (AC70XM), and 'Modelli' (a list of models from AC70XM-20 to AC70XM-70). The main window is titled 'Exchanger' and contains the following sections:

- Modello**: Exchanger name (AC70XM-34), Descrizione Geometria (AC70XM), Nr delle piastre (34), Nr. of passes secondary side (1), Numero di passaggi lato primario (1).
- Point**: 0, Ref. Temp (°C): 3, Copy factor from : to: Select models.
- COEFFICIENTI**: ☒ Controcorrente, ☐ Equicorrente, . **Refrigerants**: R410A.
- Correction factor DTML**: 1,1, **Red. Surface Con. %**: 0, **Min. flow (m³/h)**: 0, **Max flow (m³/h)**: 0.
- REGIME TURBOLENTO**: 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).
- REGIME LAMINARE**: 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).
- DATI GEOMETRIA**: **Primary side** (Fluid: ACQUA, Inlet fluid temp (°C): 12, Outlet fluid temp (°C): 7, Fluid flow (l/h): 0, Fouling factor ((m² K)/W): 0,000000), **Secondary side (for GLIDE -> dew)** (Cond. temp. (°C): 45, Evapor. Temp. (°C): 2, Overheating: 0, Subcooling: 0). **Calculate** button.
- Table**: Capacity, Wp P, PdC P, PdC S, Dtml, Sup., UK, Hp, Hs. Values: 0, 0, 0, 0, 0, 0, 0, 0, 0.

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:



This detailed view shows the calibration factors and options. The top section includes 'Point' (0), 'Ref. Temp (°C)' (3), and 'Copy factor from : to: Select models'. Below this are the 'COEFFICIENTS' section with ☒ Counter current and ☐ Cocurrent, and 'Refrigerants' (R410A). The 'Correction factor DTML' is 1,1, 'Red. Surface Con. %' is 0, 'Min. flow (m³/h)' is 0, and 'Max flow (m³/h)' is 0. The 'TURBULENT FLOW' section shows factors for exchanging and friction coefficients for both primary and secondary sides. The 'LAMINAR FLOW' section shows similar factors. The 'Already Calibrated' checkbox is unchecked.

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:

COEFFICIENTS ☒ Counter current ☐ Cocurrent

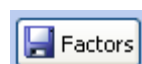
Refrigerants

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

Correction factor DTML	<input type="text" value="1,1"/>	Red. Surface Con. %	<input type="text" value="0"/>	Min. flow (m³/h)	<input type="text" value="0"/>
Global Factor	<input type="text" value="1"/>			Max flow (m³/h)	<input type="text" value="0"/>
TURBULENT FLOW			LAMINAR FLOW		
Fact. for exchanging coeff. primary side	<input type="text" value="1"/>	Fact. for exchanging coeff. primary side	<input type="text" value="1"/>		
Fact. for exchanging coeff. secondary side	<input type="text" value="1,16"/>	Fact. for exchanging coeff. secondary side	<input type="text" value="1,16"/>		
Fact. for friction coeff. primary side	<input type="text" value="1,38"/>	Fact. for friction coeff. primary side	<input type="text" value="1"/>		
Fact. for friction coeff. primary side	<input type="text" value="1"/>	Fact. for friction coeff. primary side	<input type="text" value="1"/>		

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 Red. Surface Con. %

Global Factor

- 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	<input type="text" value="1"/>
Fact. for exchanging coeff. secondary side	<input type="text" value="1,16"/>
Fact. for friction coeff. primary side	<input type="text" value="1,38"/>
Fact. for friction coeff. primary side	<input type="text" value="1"/>

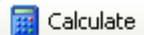
Factor on the exchange coefficient primary side (user)
 Factor on the exchange coefficient secondary side (refrigerant)
 Factor on the pressure drops primary side (user)
 Factor on the pressure drops coefficient secondary side (refrigerant)

Factors for the Laminar Flow:

Fact. for exchanging coeff. primary side	<input type="text" value="1"/>
Fact. for exchanging coeff. secondary side	<input type="text" value="1,16"/>
Fact. for friction coeff. primary side	<input type="text" value="1"/>
Fact. for friction coeff. primary side	<input type="text" value="1"/>

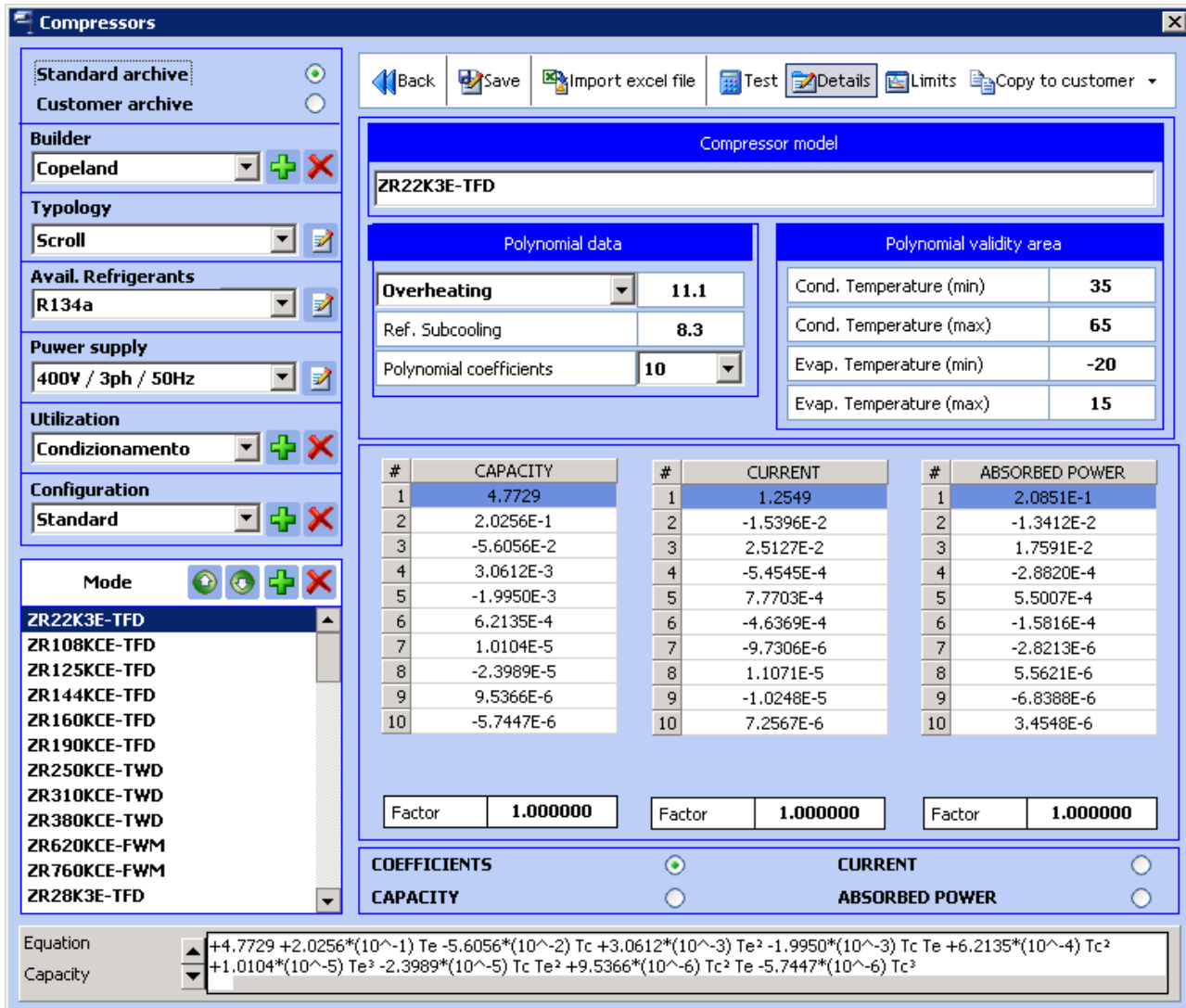
The same as the above

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

GEOMETRY DATA								
Primary side			Secondary side (for GLIDE -> dew)					
Fluid	<input type="text" value="WATER"/>							
Inlet fluid temp (°C)	<input type="text" value="12"/>	Cond. temp. (°C)	<input type="text" value="45"/>					
Outlet fluid temp (°C)	<input type="text" value="7"/>	Evapor. Temp. (°C)	<input type="text" value="2"/>					
Fluid flow (l/h)	<input type="text" value="0"/>	Overheating	<input type="text" value="0"/>					
Fouling factor ((m² K)/W)	<input type="text" value=",0000000"/>	Subcooling	<input type="text" value="0"/>					
Capacity	Wp P	PdC P	PdC S	Dtml	Sup.	UK	Hp	Hs
0	0	0	0	0	0	0	0	0

How to insert a compressor

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



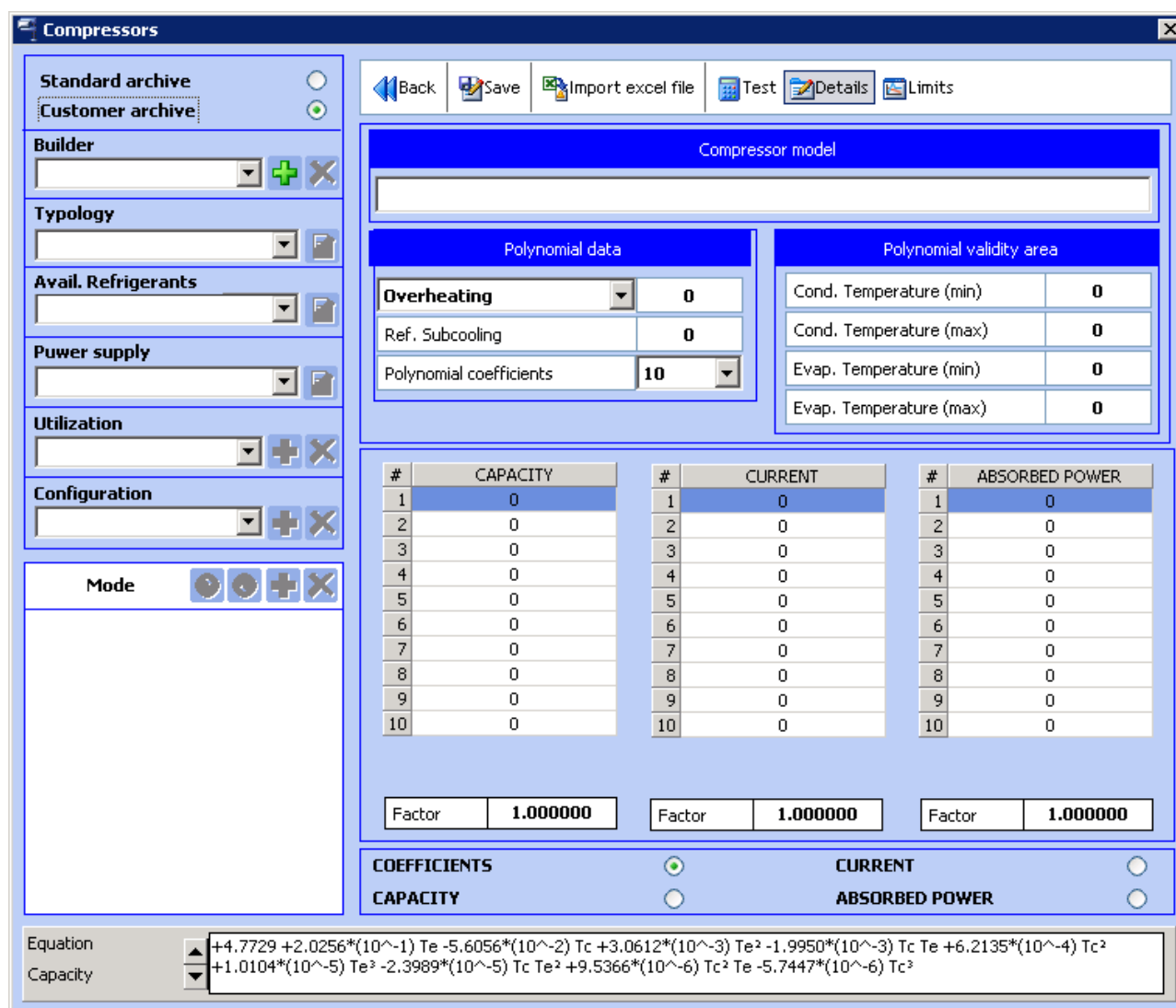
The screenshot shows the 'Compressors' window with the following configuration:

- Standard archive:** ☒ **Customer archive:** ☐
- Builder:** Copeland
- Typology:** Scroll
- Avail. Refrigerants:** R134a
- Power supply:** 400V / 3ph / 50Hz
- Utilization:** Condizionamento
- Configuration:** Standard
- Mode:** ZR22K3E-TFD
- Compressor model:** ZR22K3E-TFD
- Polynomial data:**
 - Overheating: 11.1
 - Ref. Subcooling: 8.3
 - Polynomial coefficients: 10
- Polynomial validity area:**

Cond. Temperature (min)	35
Cond. Temperature (max)	65
Evap. Temperature (min)	-20
Evap. Temperature (max)	15
- Tables:**

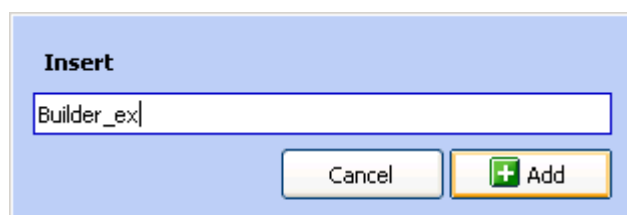
#	CAPACITY	#	CURRENT	#	ABSORBED POWER
1	4.7729	1	1.2549	1	2.0851E-1
2	2.0256E-1	2	-1.5396E-2	2	-1.3412E-2
3	-5.6056E-2	3	2.5127E-2	3	1.7591E-2
4	3.0612E-3	4	-5.4545E-4	4	-2.8820E-4
5	-1.9950E-3	5	7.7703E-4	5	5.5007E-4
6	6.2135E-4	6	-4.6369E-4	6	-1.5816E-4
7	1.0104E-5	7	-9.7306E-6	7	-2.8213E-6
8	-2.3989E-5	8	1.1071E-5	8	5.5621E-6
9	9.5366E-6	9	-1.0248E-5	9	-6.8388E-6
10	-5.7447E-6	10	7.2567E-6	10	3.4548E-6
- Factor:** 1.000000
- COEFFICIENTS:** ☒ CAPACITY ☐ CURRENT ☐ ABSORBED POWER
- Equation:** $+4.7729 + 2.0256 \cdot (10^{-1}) T_e - 5.6056 \cdot (10^{-2}) T_c + 3.0612 \cdot (10^{-3}) T_e^2 - 1.9950 \cdot (10^{-3}) T_c T_e + 6.2135 \cdot (10^{-4}) T_c^2$
- Capacity:** $+1.0104 \cdot (10^{-5}) T_e^3 - 2.3989 \cdot (10^{-5}) T_c T_e^2 + 9.5366 \cdot (10^{-6}) T_c^2 T_e - 5.7447 \cdot (10^{-6}) T_c^3$

Then we click on "Customer Archive":



The screenshot shows the 'Compressors' application window. It features a sidebar on the left with sections for 'Standard archive', 'Customer archive', 'Builder', 'Typology', 'Avail. Refrigerants', 'Power supply', 'Utilization', and 'Configuration'. The main area contains a 'Compressor model' section with a text input field. Below this are two panels: 'Polynomial data' and 'Polynomial validity area'. The 'Polynomial data' panel includes dropdowns for 'Overheating' (set to 0), 'Ref. Subcooling' (set to 0), and 'Polynomial coefficients' (set to 10). The 'Polynomial validity area' panel includes four input fields for 'Cond. Temperature (min)', 'Cond. Temperature (max)', 'Evap. Temperature (min)', and 'Evap. Temperature (max)', all set to 0. Below these are three tables: 'CAPACITY', 'CURRENT', and 'ABSORBED POWER', each with 10 rows and columns for '#', 'CAPACITY', 'CURRENT', and 'ABSORBED POWER'. All values in these tables are 0. At the bottom, there are three 'Factor' input fields, all set to 1.000000. Below the tables are radio buttons for 'COEFFICIENTS' (selected), 'CURRENT', and 'CAPACITY'. At the very bottom, there are two text areas for 'Equation' and 'Capacity', containing complex polynomial equations.

We add the builder:



The screenshot shows the 'Insert' dialog box. It has a text input field containing 'Builder_ex|'. Below the input field are two buttons: 'Cancel' and '+ Add'.

Then we add the refrigerant of the compressor:

Please select the available freon

- ☐ R134a
- ☐ R404A
- ☐ R22
- ☐ R407C - Dew
- ☐ R407C - Middle
- ☐ R410A
- ☐ R717 (AMMONIA)
- ☐ R744 (CO2)

Cancel OK

Then we add the power supply:

Please select the available power supp


- ☒ 400V / 3ph / 50Hz
- ☐ 230V / 3ph / 60Hz
- ☐ 380V / 3ph / 60Hz
- ☐ 460V / 3ph / 60Hz
- ☐ 230V / 3ph / 50Hz
- ☐ 230V / 1ph / 60Hz
- ☐ 230V / 1ph / 50Hz
- ☐ 208V / 3ph / 60Hz
- ☐ 200V / 3ph / 50Hz

Cancel OK

Then we choose the usage of the same:

Insert

Refrigeration

Cancel  Add

Then we add the configuration and the use separately.

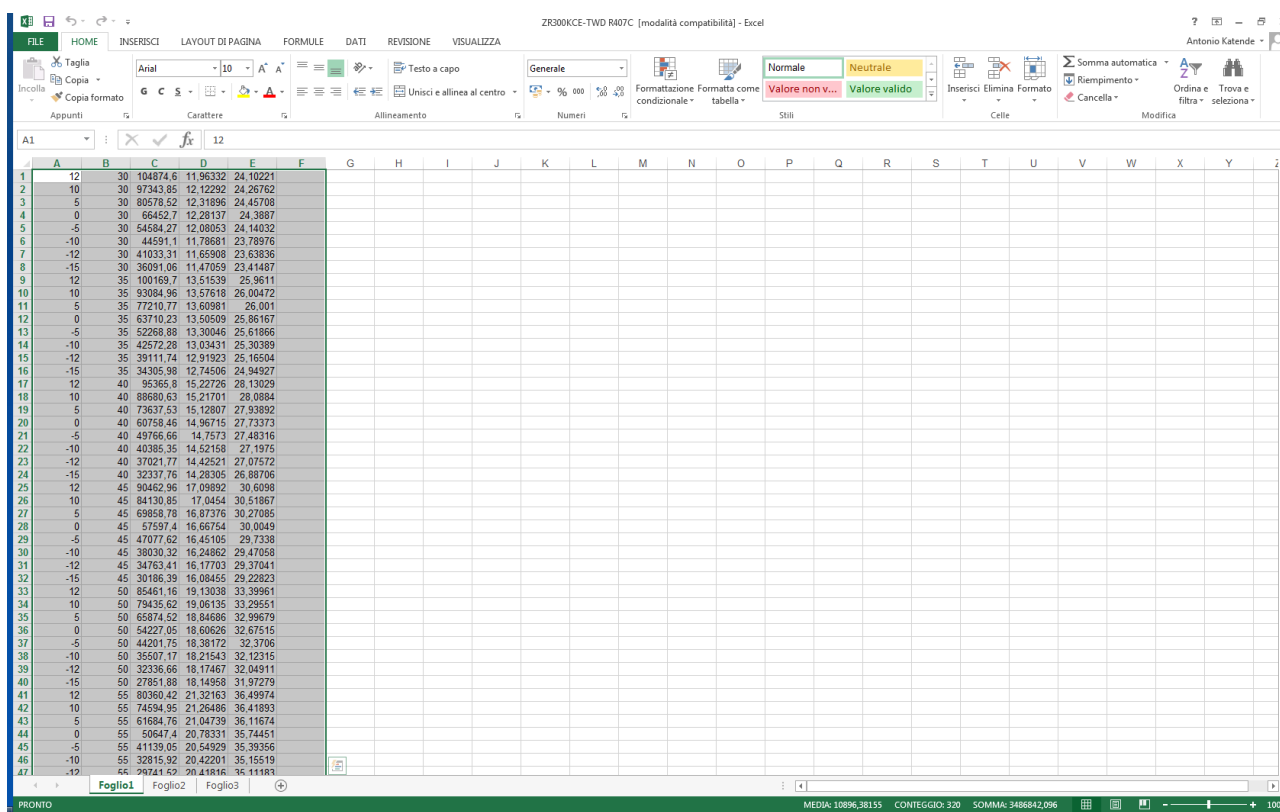
Then we insert the compressor model:

Insert

Compressor1

Cancel Add

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:



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	12	30	104874.6	11.96332	24.10221																					
2	10	30	97343.85	12.12292	24.26762																					
3	5	30	80678.52	12.31896	24.45708																					
4	0	30	66452.7	12.28137	24.3887																					
5	-5	30	54584.27	12.08053	24.14032																					
6	-10	30	44591.1	11.78681	23.78976																					
7	-12	30	41033.31	11.65908	23.63836																					
8	-15	30	36991.06	11.47859	23.41487																					
9	12	35	100169.7	13.51539	25.9611																					
10	10	35	93084.96	13.57618	26.00472																					
11	5	35	77210.77	13.60981	26.001																					
12	0	35	63710.23	13.50509	25.86167																					
13	-5	35	52268.88	13.30046	25.61866																					
14	-10	35	42572.28	13.03431	25.30389																					
15	-12	35	39111.74	12.91923	25.16504																					
16	-15	35	34305.98	12.74506	24.94927																					
17	12	40	95365.8	15.22726	28.13029																					
18	10	40	88690.63	15.21701	28.0884																					
19	5	40	73637.53	15.12807	27.93892																					
20	0	40	60758.46	14.96715	27.73373																					
21	-5	40	49766.66	14.7573	27.48316																					
22	-10	40	40385.35	14.52158	27.1975																					
23	-12	40	37021.77	14.42521	27.07572																					
24	-15	40	32337.76	14.26305	26.88706																					
25	12	45	90462.96	17.09892	30.6098																					
26	10	45	84130.85	17.0454	30.51867																					
27	5	45	69858.78	16.87376	30.27085																					
28	0	45	57597.4	16.66754	30.0049																					
29	-5	45	47077.62	16.45105	29.7338																					
30	-10	45	38030.32	16.24862	29.47058																					
31	-12	45	34763.41	16.17703	29.37041																					
32	-15	45	30186.39	16.08455	29.22823																					
33	12	50	85461.16	19.13038	33.9961																					
34	10	50	79435.62	19.08135	33.29551																					
35	5	50	65874.52	18.84686	32.99679																					
36	0	50	54227.05	18.60626	32.67515																					
37	-5	50	44201.75	18.38172	32.3706																					
38	-10	50	35507.17	18.21543	32.12315																					
39	-12	50	32336.66	18.17467	32.04911																					
40	-15	50	27851.88	18.14958	31.97279																					
41	12	55	80360.42	21.32163	36.49974																					
42	10	55	74594.95	21.26486	36.41893																					
43	5	55	61684.76	21.04739	36.11674																					
44	0	55	50647.4	20.78331	35.74451																					
45	-5	55	41139.05	20.54929	35.39356																					
46	-10	55	32815.92	20.42201	35.15519																					
47	-12	55	29741.62	20.41816	35.11183																					

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:

Compressors

Standard archive

Customer archive

Builder

Builder_ex

Typology

Scroll

Avail. Refrigerants

R407C - Middle

Power supply

400V / 3ph / 50Hz

Utilization

Refrigeration

Configuration

1

Mode

Compressor1

Back

Save

Extract polynomial

Test

Details

Limits

Compressor model

Compressor1

Polynomial data

Overheating

0.0

Ref. Subcooling

0.0

Polynomial coefficients

12

Polynomial validity area

Cond. Temperature (min)

0

Cond. Temperature (max)

0

Evap. Temperature (min)

0

Evap. Temperature (max)

0

	A	B	C	D	E	F	G
1	12.00000	30.00000	104874.64447	11.96332	24.10221		
2	10.00000	30.00000	97343.85065	12.12292	24.26762		
3	5.00000	30.00000	80578.51768	12.31896	24.45708		
4	.00000	30.00000	66452.69956	12.28137	24.38870		
5	-5.00000	30.00000	54584.26919	12.08053	24.14032		
6	-10.00000	30.00000	44591.09946	11.78681	23.78976		
7	-12.00000	30.00000	41033.30807	11.65908	23.63836		
8	-15.00000	30.00000	36091.06326	11.47059	23.41487		
9	12.00000	35.00000	100169.69747	13.51539	25.96110		
10	10.00000	35.00000	93084.96483	13.57618	26.00472		
11	5.00000	35.00000	77210.77492	13.60981	26.00100		
12	.00000	35.00000	63710.22939	13.50509	25.86167		
13	-5.00000	35.00000	52268.88071	13.30046	25.61866		
14	-10.00000	35.00000	42572.28134	13.03431	25.30389		

COEFFICIENTS

CAPACITY

CURRENT

ABSORBED POWER

Equation

Capacity

+0 +0 Tc +0 Tc² +0 Te +0 Tc Te +0 Tc² Te +0 Te² +0 Tc Te² +0 Tc² Te² +0 Te³ +0 Te³ Tc +0 Te³ Tc²

Then we click on "Extract Polynomial":

☒ Forward Method
☐ Backward Method
☐ Stepwise Method

Tc Min - Max

To Min - Max

R² =

R² =

R² =

CAPACITY

Ref. Power (kW)

Te

ABSORBED POWER

Abs. Power (kW)

Te

CURRENT

Current (A)

Te

Equation

Capacity

$+0 +0 T_c +0 T_c^2 +0 T_e +0 T_c T_e +0 T_c^2 T_e +0 T_e^2 +0 T_c T_e^2 +0 T_c^2 T_e^2 +0 T_e^3 +0 T_e^3 T_c +0 T_e^3 T_c^2$

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

Standard archive
Customer archive

Builder
Builder_ex

Typology
Scroll

Avail. Refrigerants
R407C - Middle

Power supply
400V / 3ph / 50Hz

Utilization
Refrigeration

Configuration
1

Mode
Compressor1

Back Save Import excel file Test Details Limits

Compressor model
Compressor1

Polynomial data
Overheating 0.0
Ref. Subcooling 0.0
Polynomial coefficients 12

Polynomial validity area
Cond. Temperature (min) 30
Cond. Temperature (max) 65
Evap. Temperature (min) -15
Evap. Temperature (max) 12

#	CAPACITY	#	CURRENT	#	ABSORBED POWER
1	78970	1	23.648	1	8.8901
2	-295.73	2	-2.1085E-1	2	-1.8536E-2
3	-3.9923	3	7.8359E-3	3	4.2820E-3
4	3400.1	4	-1.1689E-1	4	-1.0261E-1
5	-27.666	5	6.2254E-3	5	5.4473E-3
6	5.0939E-2	6	-4.7721E-5	6	-4.6746E-5
7	71.824	7	-1.5310E-2	7	-3.0500E-3
8	-1.1323	8	5.3703E-4	8	0
9	7.0643E-3	9	-4.6245E-6	9	1.0433E-6
10	0	10	0	10	0
11	9.7550E-3	11	0	11	1.3152E-6
12	0	12	-5.4524E-8	12	-6.7968E-8

Factor 1.000000

Factor 1.000000

Factor 1.000000

COEFFICIENTS
CAPACITY

CURRENT
ABSORBED POWER

Equation
Capacity

+78970 -295.73 Tc -3.9923 Tc² +3400.1 Te -27.666 Tc Te +5.0939*(10⁻²) Tc² Te +71.824 Te² -1.1323 Tc Te² +7.0643*(10⁻³) Tc² Te² +0 Te³ +9.7550*(10⁻³) Te³ Tc +0 Te³ Tc²

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

Standard archive ☐
Customer archive ☒

Builder
Builder_ex

Typology
Scroll

Avail. Refrigerants
R407C - Middle

Power supply
400V / 3ph / 50Hz

Utilization
Refrigeration

Configuration
1

Mode

Compressor1

Back Save Import excel file Test Details Limits

Compressor model
Compressor1

Polynomial data
Overheating 11.1
Ref. Subcooling 8.3
Polynomial coefficients 12

Polynomial validity area
Cond. Temperature (min) 30
Cond. Temperature (max) 65
Evap. Temperature (min) -15
Evap. Temperature (max) 12

#	CAPACITY	#	CURRENT	#	ABSORBED POWER
1	78970	1	23.648	1	8.8901
2	-295.73	2	-2.1085E-1	2	-1.8536E-2
3	-3.9923	3	7.8359E-3	3	4.2820E-3
4	3400.1	4	-1.1689E-1	4	-1.0261E-1
5	-27.666	5	6.2254E-3	5	5.4473E-3
6	5.0939E-2	6	-4.7721E-5	6	-4.6746E-5
7	71.824	7	-1.5310E-2	7	-3.0500E-3
8	-1.1323	8	5.3703E-4	8	0
9	7.0643E-3	9	-4.6245E-6	9	1.0433E-6
10	0	10	0	10	0
11	9.7550E-3	11	0	11	1.3152E-6
12	0	12	-5.4524E-8	12	-6.7968E-8

Factor 1.000000

Factor 1.000000

Factor 1.000000

COEFFICIENTS
CAPACITY

CURRENT
ABSORBED POWER

Equation
Capacity

+78970 -295.73 Tc -3.9923 Tc² +3400.1 Te -27.666 Tc Te +5.0939*(10⁻²) Tc² Te +71.824 Te² -1.1323 Tc Te² +7.0643*(10⁻³) Tc² Te² +0 Te³ +9.7550*(10⁻³) Te³ Tc +0 Te³ Tc²

Then we can click on "Save".

Multiple Envelopes in SHARK

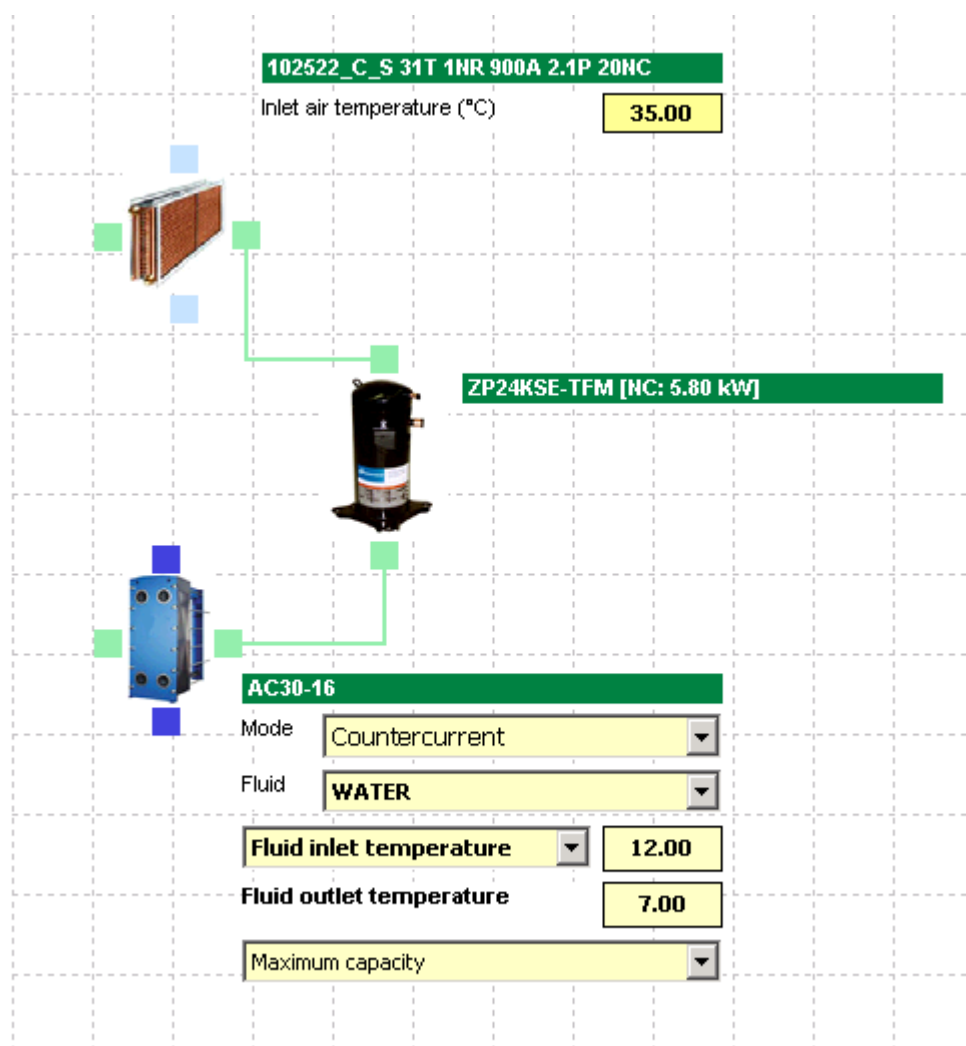
SHARK gives the possibility to link to a certain compressor one or more polygon or different "envelopes"; so that we can choose which polygon we can use in the calculation phase and simulate the unit outside the default envelope.

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".

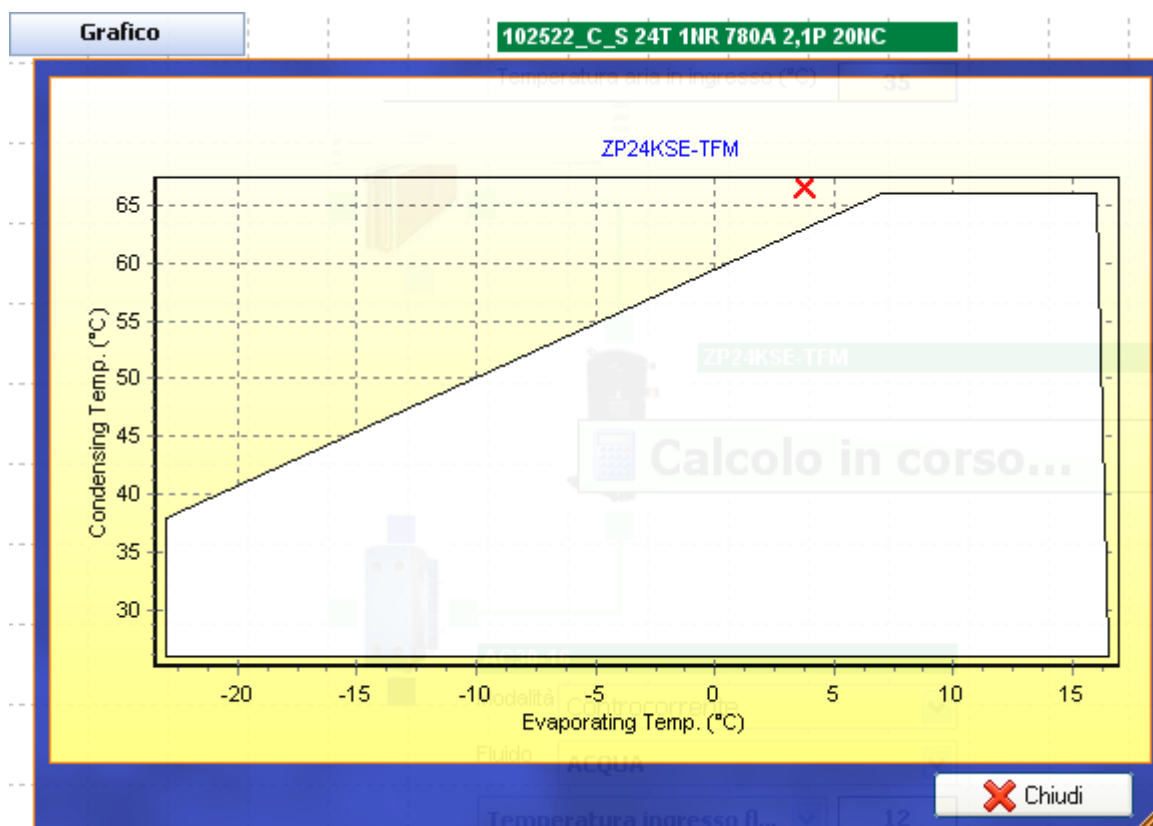
Each time that the user wants to calculate a project that uses a compressor to which different envelopes are linked, SHARK will ask which polygon to use, and it will save such setting in the project, so that in the project the chosen envelope will be calculated.

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:

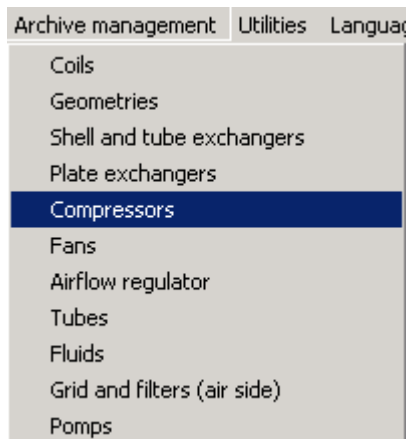
Calculation Data		
Refrigeration circuit - side 1		
Evaporating Temperature:	3,73	°C
Condensing Temperature:	66,52	°C
Cooling Capacity:	3,56	kW

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:

Standard archive
Customer archive

Builder
Copeland

Typology
Scroll

Avail. Refrigerants
R134a

Power supply
400V / 3ph / 50Hz

Utilization
Condizionamento

Configuration
Standard

Mode
ZR22K3E-TFD
ZR108KCE-TFD
ZR125KCE-TFD
ZR144KCE-TFD
ZR160KCE-TFD
ZR190KCE-TFD
ZR250KCE-TWD
ZR310KCE-TWD
ZR380KCE-TWD
ZR620KCE-FWM
ZR760KCE-FWM
ZR28K3E-TFD

Back Save Import excel file Test Details Limits Copy to customer

Compressor model
ZR22K3E-TFD

Polynomial data
Overheating 11.1
Ref. Subcooling 8.3
Polynomial coefficients 10

Polynomial validity area
Cond. Temperature (min) 35
Cond. Temperature (max) 65
Evap. Temperature (min) -20
Evap. Temperature (max) 15

#	CAPACITY	#	CURRENT	#	ABSORBED POWER
1	4.7729	1	1.2549	1	2.0851E-1
2	2.0256E-1	2	-1.5396E-2	2	-1.3412E-2
3	-5.6056E-2	3	2.5127E-2	3	1.7591E-2
4	3.0612E-3	4	-5.4545E-4	4	-2.8820E-4
5	-1.9950E-3	5	7.7703E-4	5	5.5007E-4
6	6.2135E-4	6	-4.6369E-4	6	-1.5816E-4
7	1.0104E-5	7	-9.7306E-6	7	-2.8213E-6
8	-2.3989E-5	8	1.1071E-5	8	5.5621E-6
9	9.5366E-6	9	-1.0248E-5	9	-6.8388E-6
10	-5.7447E-6	10	7.2567E-6	10	3.4548E-6

Factor 1.000000 Factor 1.000000 Factor 1.000000

COEFFICIENTS
CAPACITY



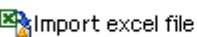
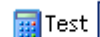

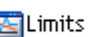
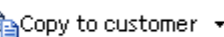
CURRENT
ABSORBED POWER

Equation
Capacity

$$+4.7729 + 2.0256 \cdot (10^{-1}) T_e - 5.6056 \cdot (10^{-2}) T_c + 3.0612 \cdot (10^{-3}) T_e^2 - 1.9950 \cdot (10^{-3}) T_c T_e + 6.2135 \cdot (10^{-4}) T_c^2$$

$$+ 1.0104 \cdot (10^{-5}) T_e^3 - 2.3989 \cdot (10^{-5}) T_c T_e^2 + 9.5366 \cdot (10^{-6}) T_c^2 T_e - 5.7447 \cdot (10^{-6}) T_c^3$$

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

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

Standard archive
Customer archive

Builder
Copeland

Typology
Scroll

Avail. Refrigerants
R134a

Power supply
400V / 3ph / 50Hz

Utilization
Condizionamento

Configuration
Standard

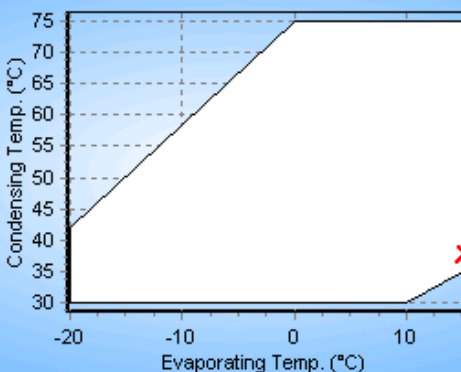
Mode
ZR22K3E-TFD
ZR108KCE-TFD
ZR125KCE-TFD
ZR144KCE-TFD
ZR160KCE-TFD
ZR190KCE-TFD
ZR250KCE-TWD
ZR310KCE-TWD
ZR380KCE-TWD
ZR620KCE-FWM
ZR760KCE-FWM
ZR28K3E-TFD

Compressor limits

Nr	Evap. Temp. (°C)	Cond. Temp. (°C)
	-20	30
	10	30
	15	35
	15	75
	0	75
	-20	42

Poligono originale da catalogo
...
Add point
Delete points
Delete polygon
Save polygon

Operating limits



COEFFICIENTS
CAPACITY

CURRENT
ABSORBED POWER

Equation
Capacity

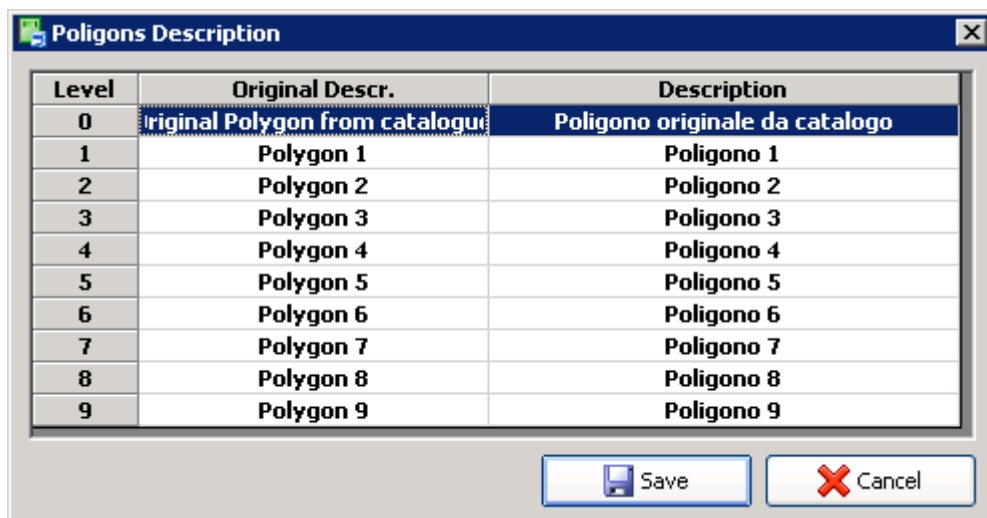
$$+4.7729 + 2.0256 \cdot (10^{-1}) T_e - 5.6056 \cdot (10^{-2}) T_c + 3.0612 \cdot (10^{-3}) T_e^2 - 1.9950 \cdot (10^{-3}) T_c T_e + 6.2135 \cdot (10^{-4}) T_c^2$$

$$+ 1.0104 \cdot (10^{-5}) T_e^3 - 2.3989 \cdot (10^{-5}) T_c T_e^2 + 9.5366 \cdot (10^{-6}) T_c^2 T_e - 5.7447 \cdot (10^{-6}) T_c^3$$

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

Poligono originale da catalogo
...

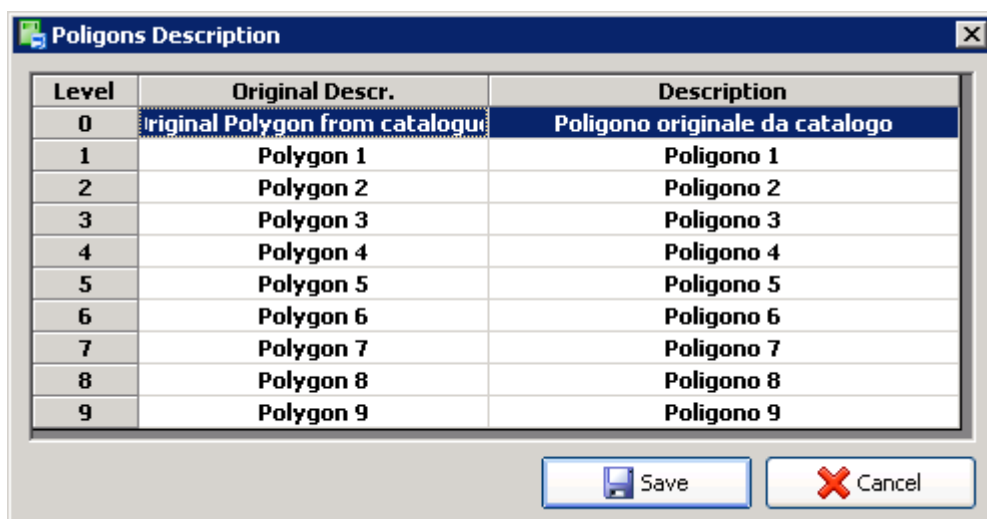
A new window in which to modify the descriptions:



Level	Original Descr.	Description
0	Original Polygon from catalogue	Poligono originale da catalogo
1	Polygon 1	Poligono 1
2	Polygon 2	Poligono 2
3	Polygon 3	Poligono 3
4	Polygon 4	Poligono 4
5	Polygon 5	Poligono 5
6	Polygon 6	Poligono 6
7	Polygon 7	Poligono 7
8	Polygon 8	Poligono 8
9	Polygon 9	Poligono 9

Save Cancel

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":



Level	Original Descr.	Description
0	Original Polygon from catalogue	Poligono originale da catalogo
1	Polygon 1	Poligono 1
2	Polygon 2	Poligono 2
3	Polygon 3	Poligono 3
4	Polygon 4	Poligono 4
5	Polygon 5	Poligono 5
6	Polygon 6	Poligono 6
7	Polygon 7	Poligono 7
8	Polygon 8	Poligono 8
9	Polygon 9	Poligono 9

Save Cancel

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":



Salva

Association of a new envelope

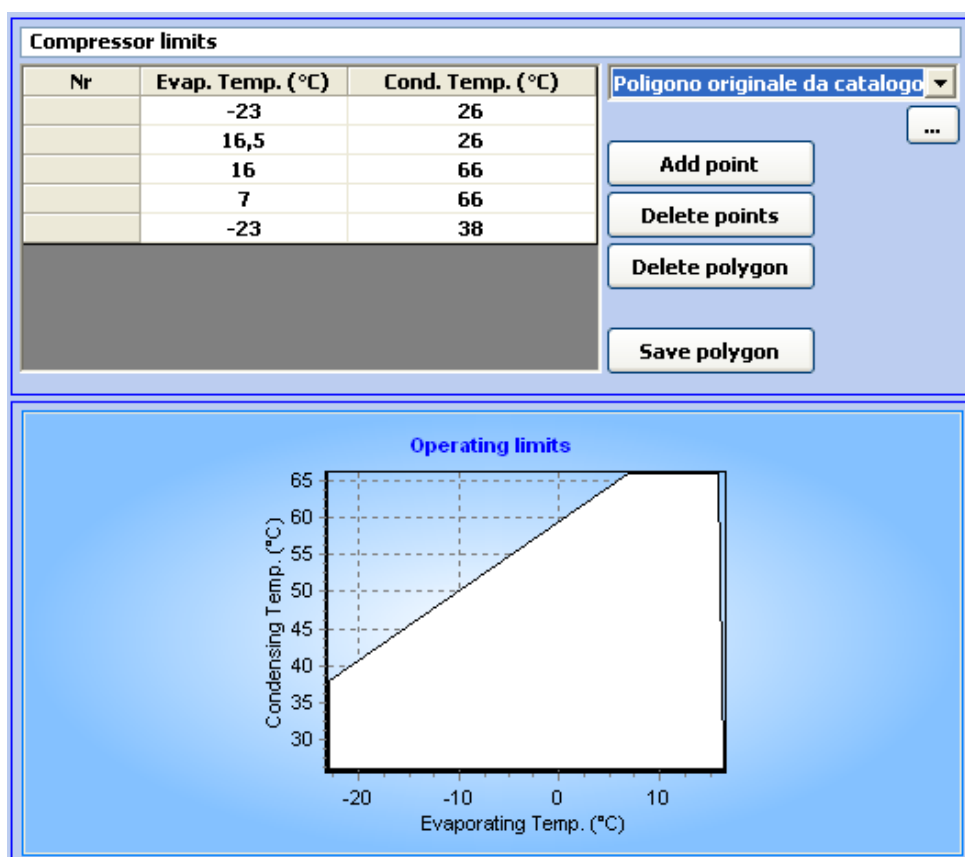
Select then the compressor that we want to modify:



The screenshot shows a software window with several configuration sections:

- Standard archive** (selected) and **Customer archive** (unselected) radio buttons.
- Builder** dropdown menu set to **Copeland**, with green (+) and red (X) icons.
- Typology** dropdown menu set to **Scroll**, with a green (+) icon.
- Avail. Refrigerants** dropdown menu set to **R410A**, with a green (+) icon.
- Power supply** dropdown menu set to **400V / 3ph / 50Hz**, with a green (+) icon.
- Utilization** dropdown menu set to **Condizionamento**, with green (+) and red (X) icons.
- Configuration** dropdown menu set to **Standard**, with green (+) and red (X) icons.
- Mode** section with three icons: a green circle with a white arrow, a green circle with a white 'X', and a green circle with a white plus sign.
- A list of compressor models: **ZP24KSE-TFM** (highlighted), **ZP29KSE-TFM**, **ZP31KSE-TFM**, **ZP36KSE-TFM**, **ZP42KSE-TFM**, **ZP54KSE-TFM**, **ZP61KCE-TFD**, **ZP67KCE-TFD**, **ZP72KCE-TFD**, **ZP83KCE-TFD**, **ZP90KCE-TFD**, and **ZP103KCE-TFD**.

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 66 °C. To insert a new envelope and not modify the default one, we click on list on the polygons like below:

Cond. Temp. (°C)	Poligono originale da catalogo
26	Poligono originale da catalogo
26	2 ° C Increase Envelope
66	Poligono 2
66	Poligono 3
38	Poligono 4
	Poligono 5
	Poligono 6
	Poligono 7
	Poligono 8

And we choose "2° C Increase Envelope "

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:

Compressors

Standard archive

Customer archive

Builder

Copeland

Typology

Scroll

Avail. Refrigerants

R410A

Power supply

400V / 3ph / 50Hz

Utilization

Condizionamento

Configuration

Standard

Mode

ZP24KSE-TFM

ZP29KSE-TFM

ZP31KSE-TFM

ZP36KSE-TFM

ZP42KSE-TFM

ZP54KSE-TFM

ZP61KCE-TFD

ZP67KCE-TFD

ZP72KCE-TFD

ZP83KCE-TFD

ZP90KCE-TFD

ZP103KCE-TFD

Equation

Capacity

+7.9237 +2.9612*(10^-1) Te -7.2312*(10^-2) Tc +3.5522*(10^-3) Te^2 -2.7542*(10^-3) Tc Te +4.2190*(10^-4) Tc^2

+3.5789*(10^-6) Te^3 -2.7177*(10^-5) Tc Te^2 +1.0138*(10^-5) Tc^2 Te -5.7920*(10^-6) Tc^3

Back

Save

Import excel file

Test

Details

Limits

Copy to customer

Compressor limits

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

2 ° C Increase Envelope

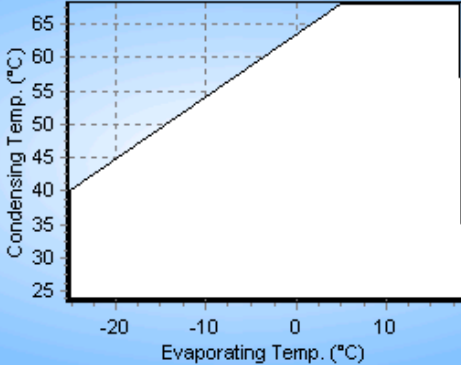
Add point

Delete points

Delete polygon

Save polygon

Operating limits



COEFFICIENTS

CAPACITY

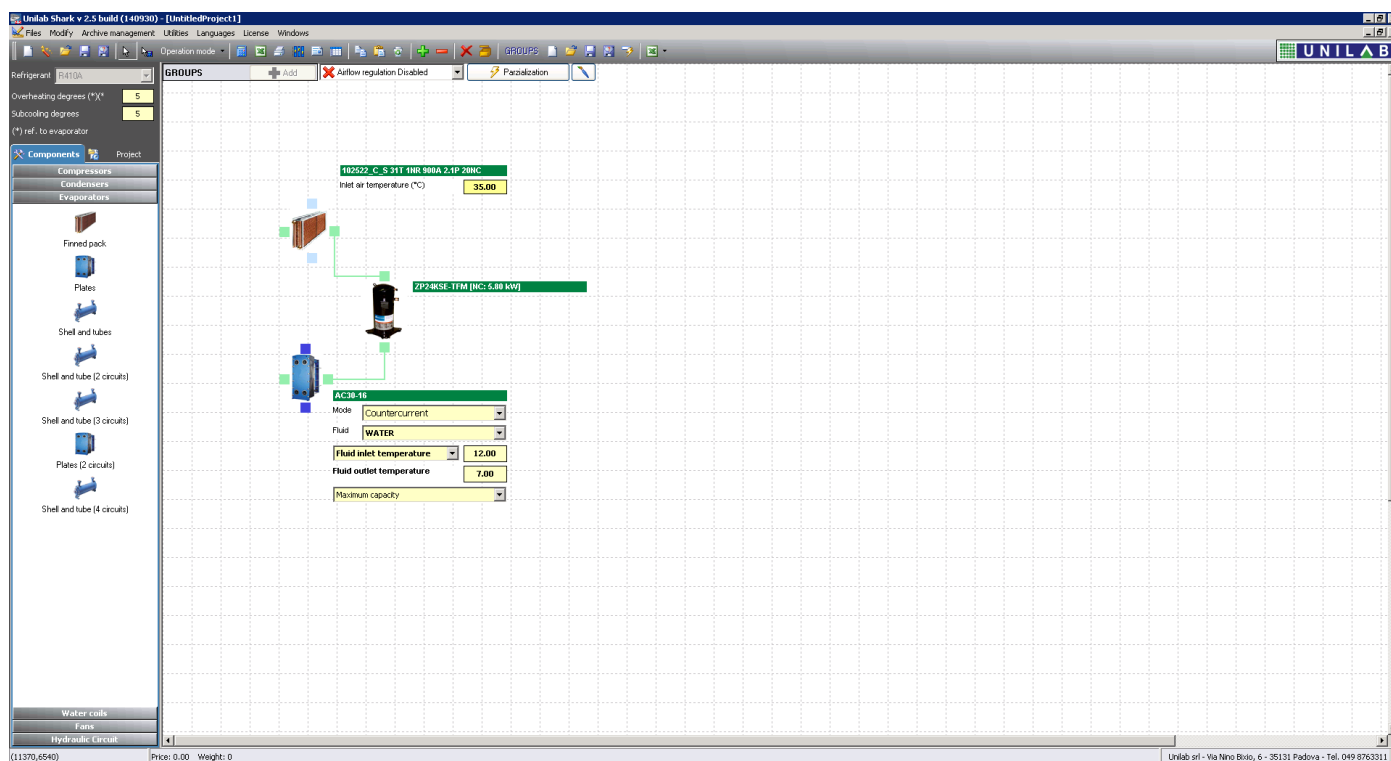
CURRENT

ABSORBED POWER

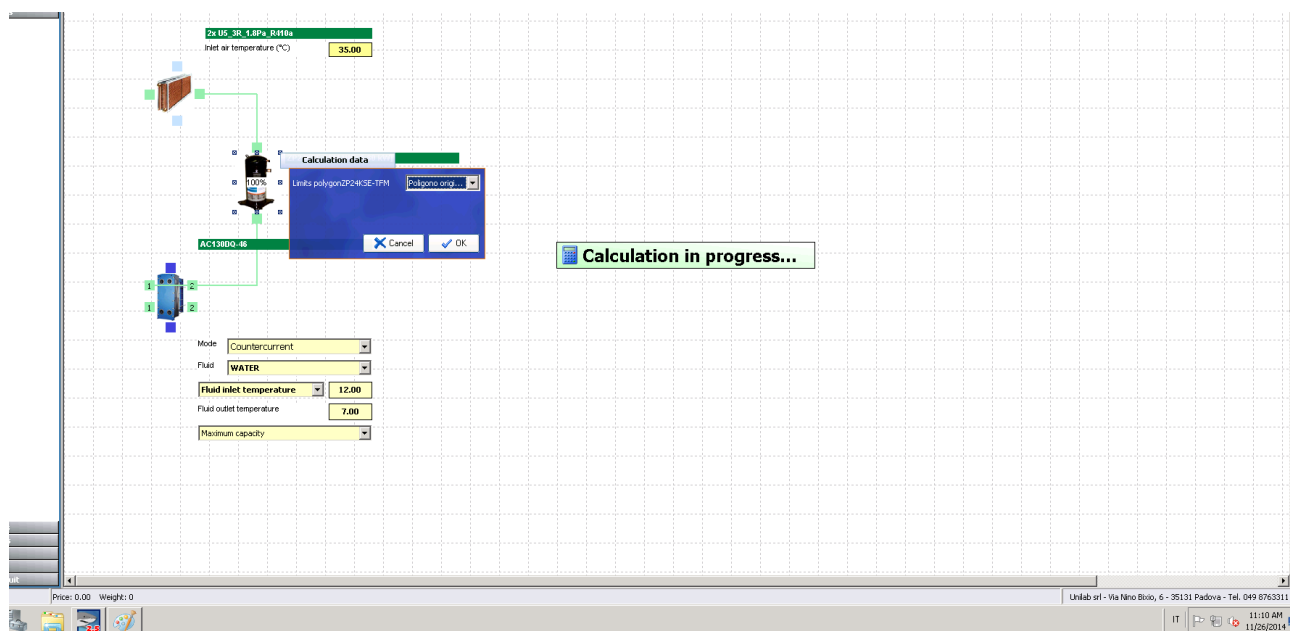
At this point, the compressor ZP24KSE-TFM is associated two envelopes, the default 1 and "Polygon 1", that has higher limits.

Calculation

We open again the project that we were simulating:



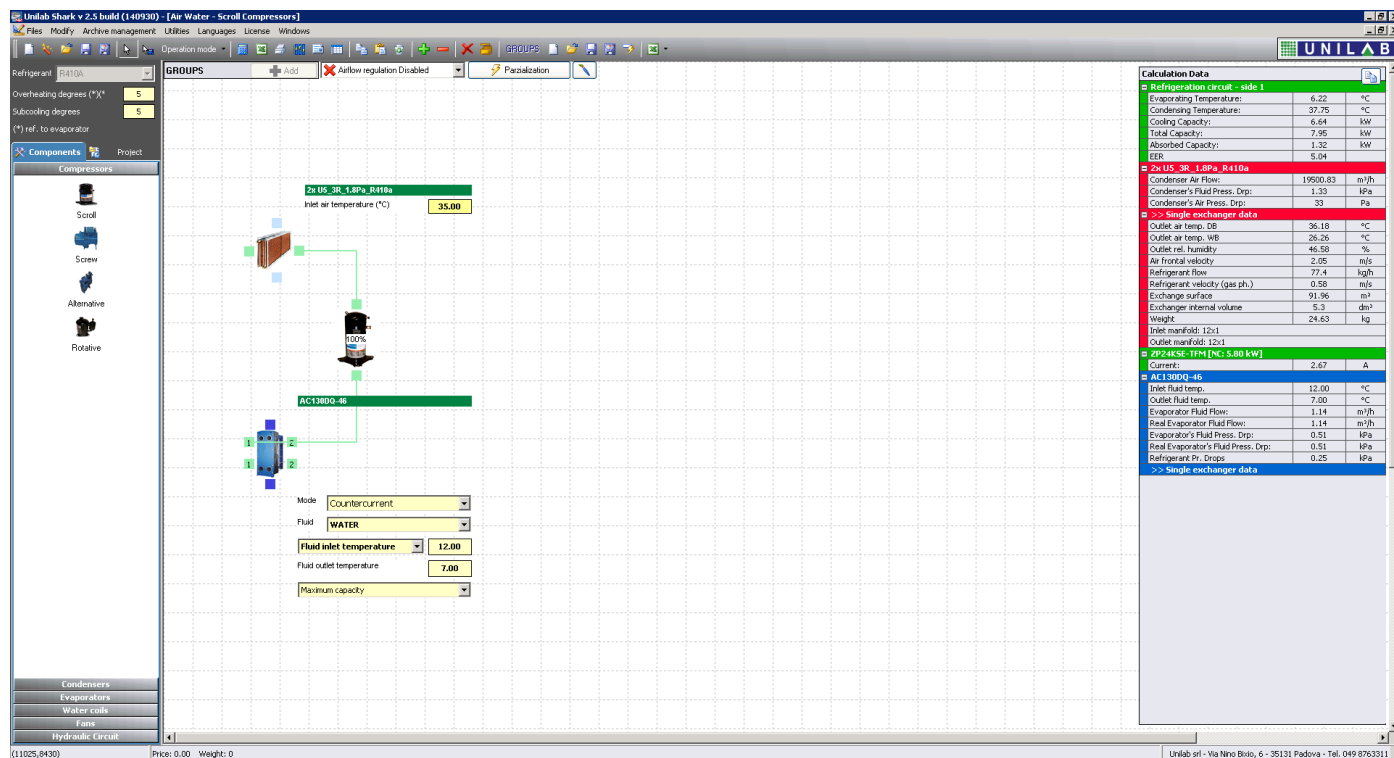
We do the calculation. At this point the software will query which envelope to use:



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

Poligono origi...
 Poligono originale da catalogo
 Maggiorazione 2°C Envelope

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



The screenshot displays the UNILAB Shark v 2.5 build (140930) interface. The main workspace shows a refrigeration circuit diagram with a compressor (2x US 3R 1.8Pa R410a) and a condenser (AC1300Q-46). The inlet air temperature is set to 35.00°C. The fluid is set to WATER, and the mode is Countercurrent. The fluid inlet temperature is 12.00°C and the fluid outlet temperature is 7.00°C. The maximum capacity is set to 1.00.

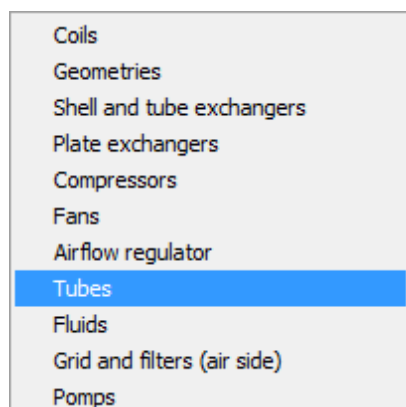
The right-hand panel shows the Calculation Data for the Refrigeration circuit - side 1:

Refrigeration circuit - side 1	
Evaporating Temperature:	6.22 °C
Condensing Temperature:	37.75 °C
Cooling Capacity:	6.84 kW
Total Capacity:	7.95 kW
Absorbed Capacity:	1.32 kW
ICP	5.04
2x US 3R 1.8Pa R410a	
Condenser Air Flow:	19500.83 m³/h
Condenser's Fluid Press. Dp:	1.33 kPa
Condenser's Air Press. Dp:	33 Pa
>> Single exchanger data	
Outlet air temp. DB	36.18 °C
Outlet air temp. WB	26.25 °C
Outlet rel. humidity	46.58 %
Air Frontal velocity	2.85 m/s
Refrigerant flow	77.4 kg/h
Refrigerant velocity (gas ph.)	0.58 m/s
Exchange surface	91.96 m²
Exchanger internal volume	5.3 dm³
Weight	24.63 kg
Inlet manifold: 12x1	
Outlet manifold: 12x1	
2P24KSE-TFM [NC: 5.80 kW]	
Current	2.67 A
AC1300Q-46	
Inlet fluid temp.	12.00 °C
Outlet fluid temp.	7.00 °C
Evaporator Fluid Flow	1.14 m³/h
Real Evaporator Fluid Flow	1.14 m³/h
Evaporator's Fluid Press. Dp:	0.51 kPa
Real Evaporator's Fluid Press. Dp:	0.51 kPa
Refrigerant Ph. Dp:	0.25 kPa
>> Single exchanger data	

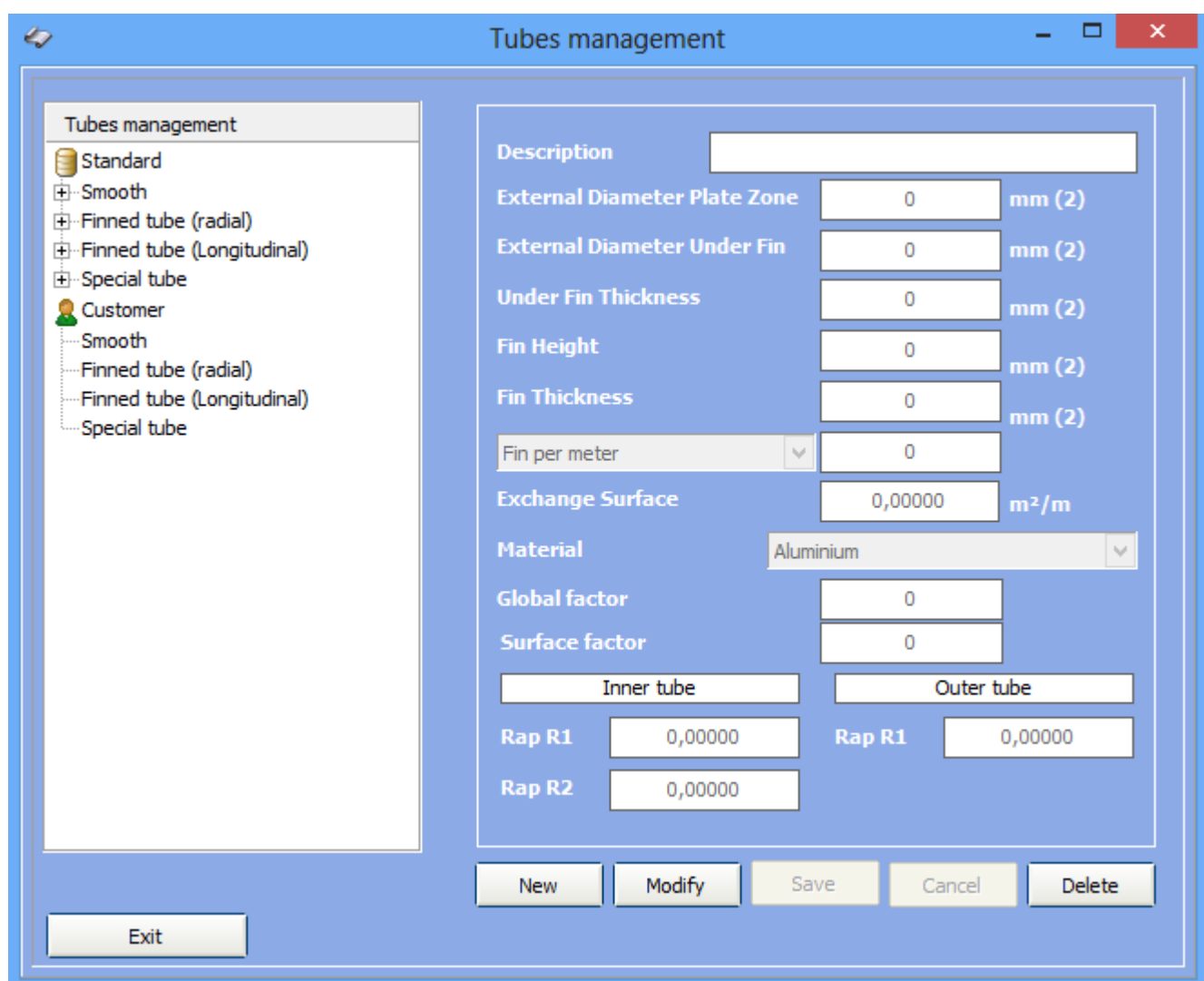
Besides the choice of the envelope will be saved in the project and I twill remain also while opening SHARK and doing other calculations (single, tables, etc) at other conditions.

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:



Tubes management

Tubes management

- Standard
 - + Smooth
 - + Finned tube (radial)
 - + Finned tube (Longitudinal)
 - + Special tube
- Customer
 - Smooth
 - Finned tube (radial)
 - Finned tube (Longitudinal)
 - Special tube

Description

External Diameter Plate Zone mm (2)

External Diameter Under Fin mm (2)

Under Fin Thickness mm (2)

Fin Height mm (2)

Fin Thickness mm (2)

Fin per meter

Exchange Surface m²/m

Material

Global factor

Surface factor

Inner tube Outer tube

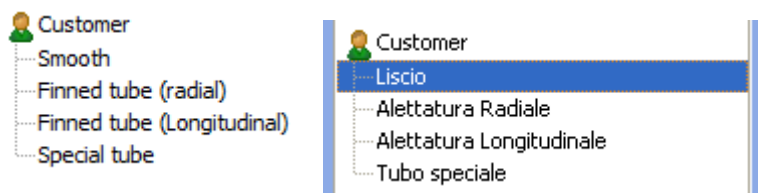
Rap R1 Rap R1

Rap R2

New Modify Save Cancel Delete

Exit

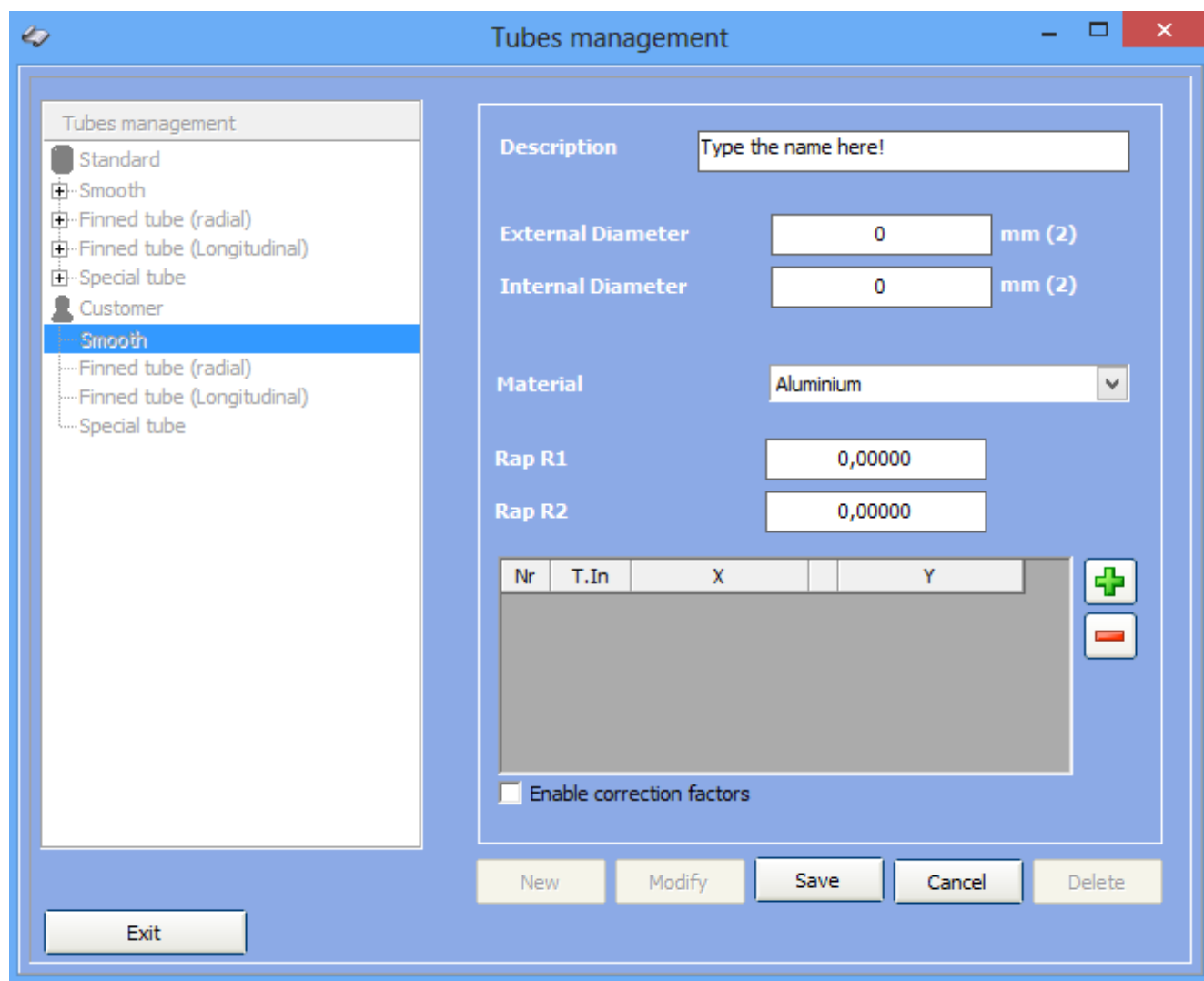
We go to customer "Customer" and decide the type tube, for example "smooth":



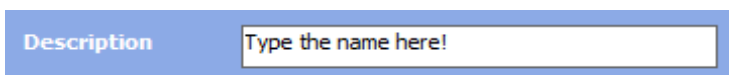
We click on "New" to insert the tube:



Now we can modify the insertion fields:




The first field is the description of the tube:



We have the external and internal diameter:

External Diameter	<input type="text" value="0"/>	mm (2)
Internal Diameter	<input type="text" value="0"/>	mm (2)

You choose the material from a list:

Material	<input type="text" value="Aluminium"/>	
----------	--	---



The factors R1 and R2:

Rap R1	<input type="text" value="0,00000"/>
Rap R2	<input type="text" value="0,00000"/>

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:

Nr	T.In	X	Y

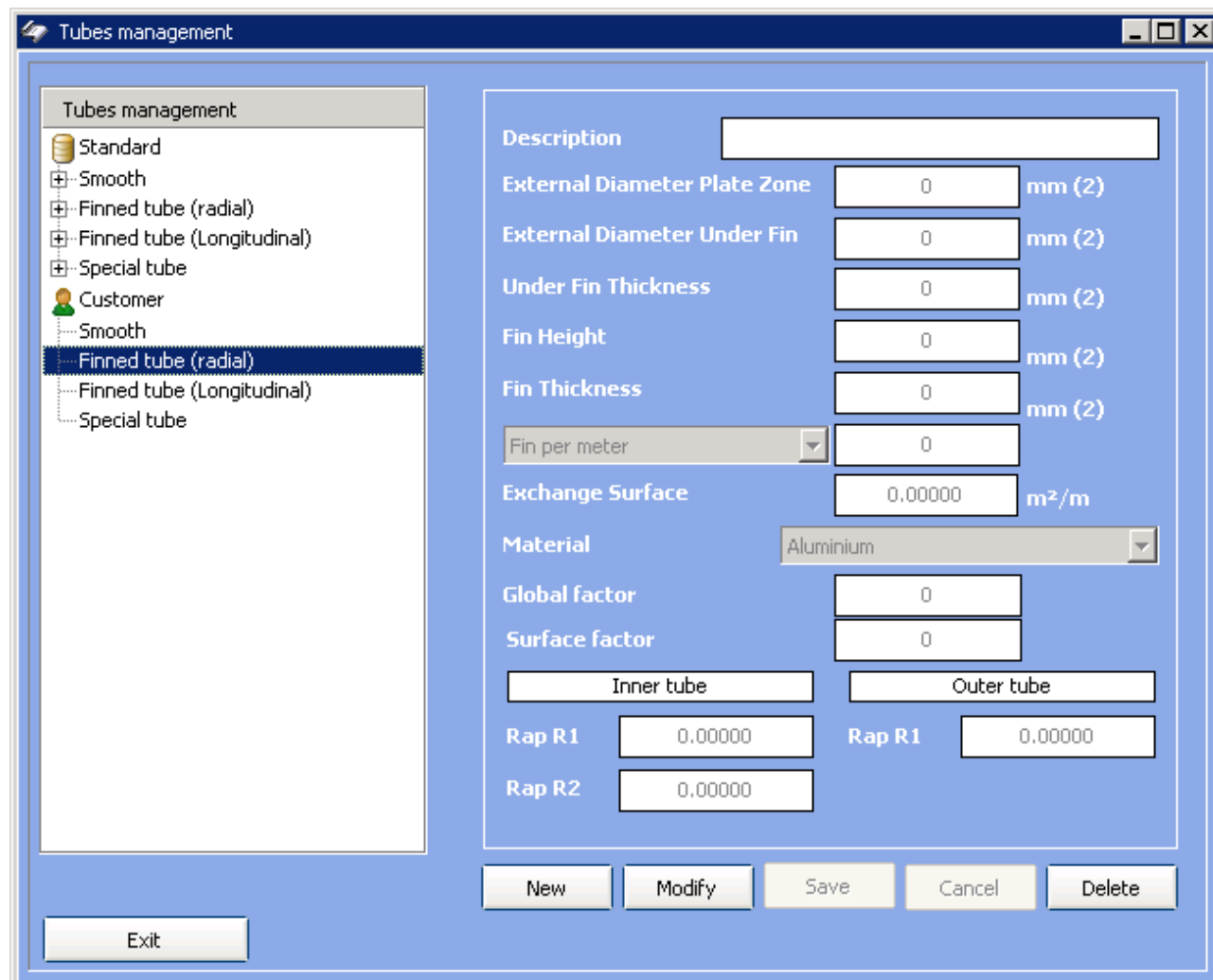
☐ Enable correction factors

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

We insert now the following example values:

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



Tubes management

Tubes management

- Standard
 - Smooth
 - Finned tube (radial)
 - Finned tube (Longitudinal)
 - Special tube
- Customer
 - Smooth
 - Finned tube (radial)**
 - Finned tube (Longitudinal)
 - Special tube

Description

External Diameter Plate Zone mm (2)

External Diameter Under Fin mm (2)

Under Fin Thickness mm (2)

Fin Height mm (2)

Fin Thickness mm (2)

Fin per meter

Exchange Surface m²/m

Material

Global factor

Surface factor

Inner tube **Outer tube**

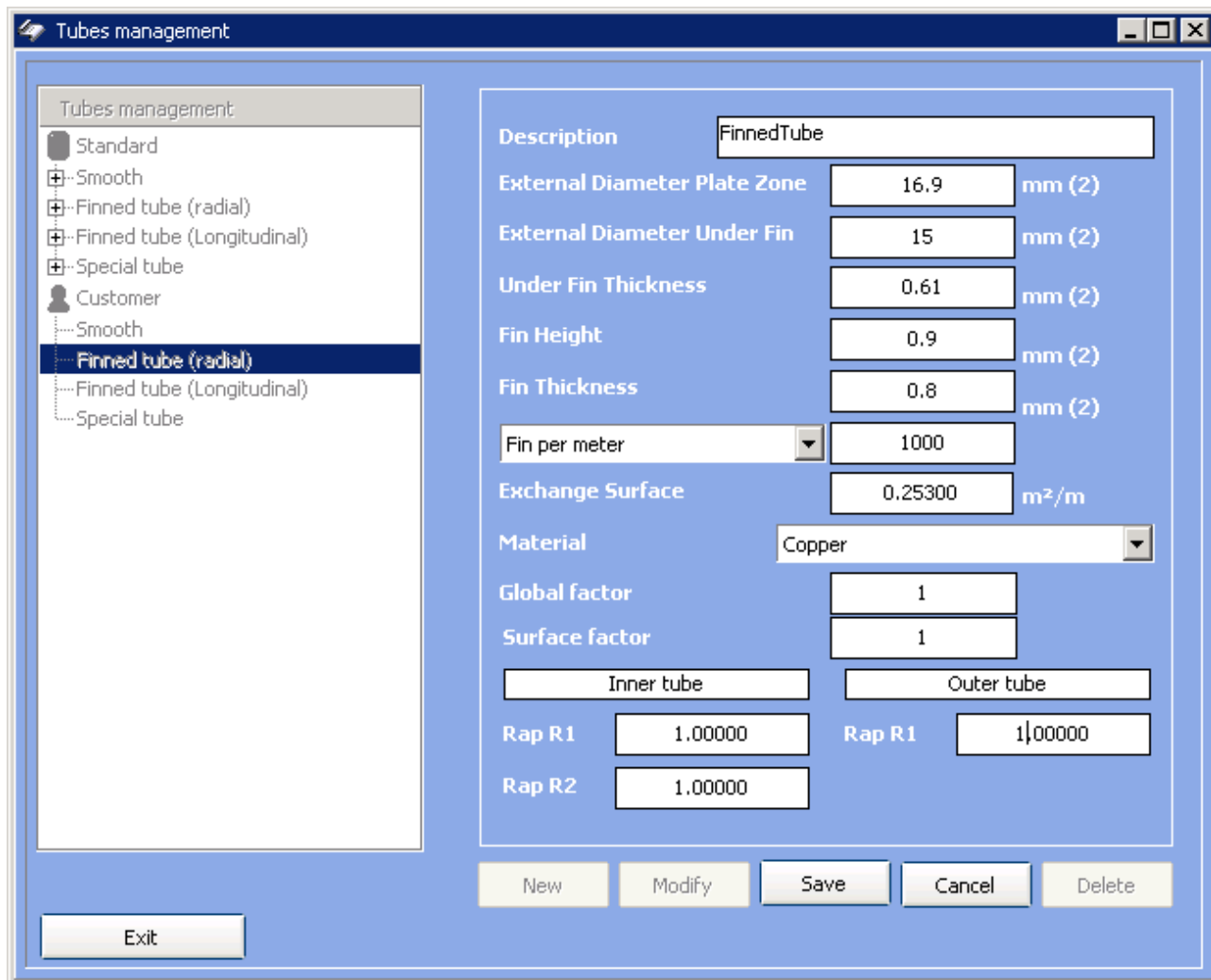
Rap R1 **Rap R1**

Rap R2

New **Modify** **Save** **Cancel** **Delete**

Exit

Let's insert the following data:



Tubes management

Tubes management

- Standard
 - Smooth
 - Finned tube (radial)
 - Finned tube (Longitudinal)
 - Special tube
- Customer
 - Smooth
 - Finned tube (radial)**
 - Finned tube (Longitudinal)
 - Special tube

Description

External Diameter Plate Zone mm (2)

External Diameter Under Fin mm (2)

Under Fin Thickness mm (2)

Fin Height mm (2)

Fin Thickness mm (2)

Fin per meter

Exchange Surface m²/m

Material

Global factor

Surface factor

Inner tube

Outer tube

Rap R1 **Rap R1**

Rap R2

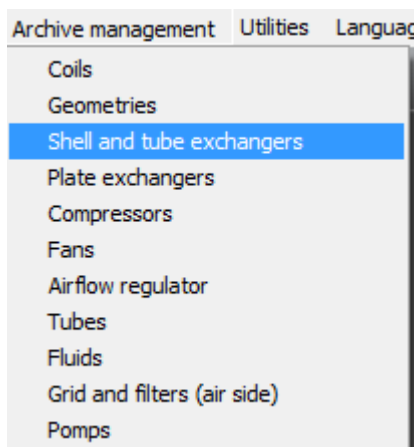
Then we click on the save button.

Shell and Tube Insertion

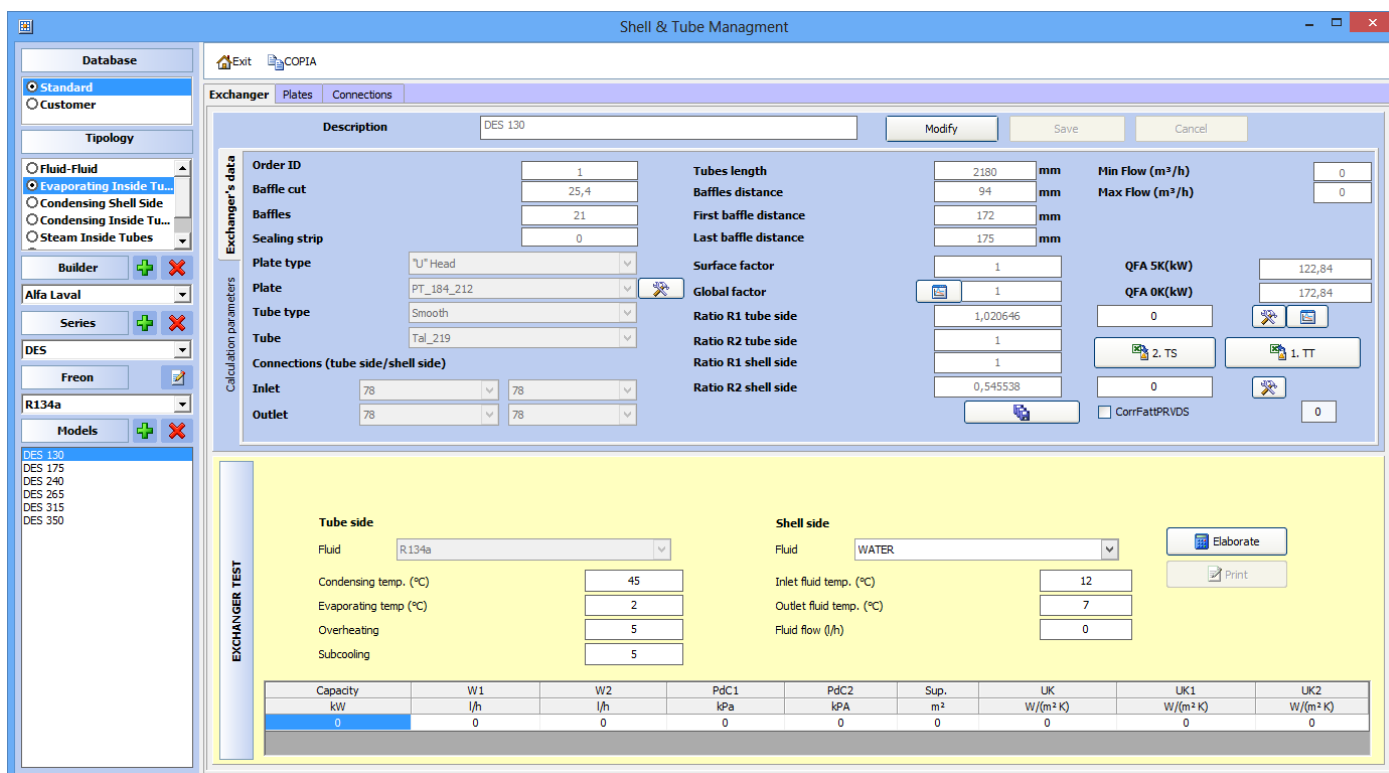
SHARK 2.5 provides the ability to insert tube heat exchangers in the archives CUSTOMER. It is important to follow the following order to enter the data:

- 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:



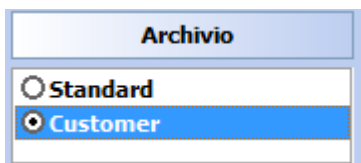
The 'Shell & Tube Management' window displays the following data:

Exchanger's data		Tubes length		Baffles distance		First baffle distance		Last baffle distance		Min Flow (m³/h)		Max Flow (m³/h)	
Order ID	1		2180		94		172		175		0		0
Baffle cut	25,4												
Baffles	21												
Sealing strip	0												
Plate type	U" Head												
Plate	PT_184_212												
Tube type	Smooth												
Tube	Tal_219												
Connections (tube side/shell side)													
Inlet	78		78										
Outlet	78		78										
Surface factor			1										
Global factor			1										
Ratio R1 tube side			1,020646										
Ratio R2 tube side			1										
Ratio R1 shell side			1										
Ratio R2 shell side			0,545538										
QFA 5K(kW)			122,84										
QFA 0K(kW)			172,84										
2. TS													
1. TT													
CorrFattPRVDS			0										

Tube side		Shell side	
Fluid	R134a	Fluid	WATER
Condensing temp. (°C)	45	Inlet fluid temp. (°C)	12
Evaporating temp (°C)	2	Outlet fluid temp. (°C)	7
Overheating	5	Fluid flow (l/h)	0
Subcooling	5		

Capacity	W1	W2	PdC1	PdC2	Sup.	UK	UK1	UK2
kW	l/h	l/h	kPa	kPa	m³	W/(m² K)	W/(m² K)	W/(m² K)
0	0	0	0	0	0	0	0	0

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

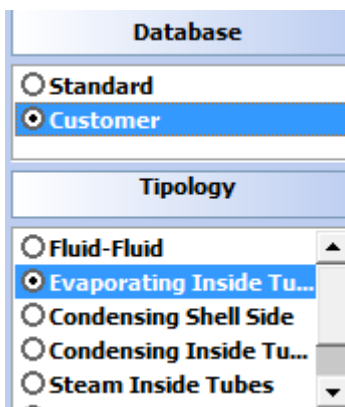


Archivio

☐ Standard

☒ Customer

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



Database

☐ Standard

☒ Customer

Tipology

☐ Fluid-Fluid

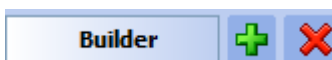
☒ Evaporating Inside Tu...



☐ Condensing Shell Side

☐ Condensing Inside Tu...

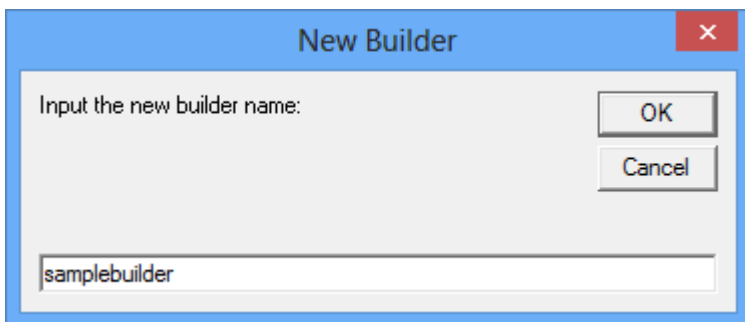
☐ Steam Inside Tubes

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



Builder  

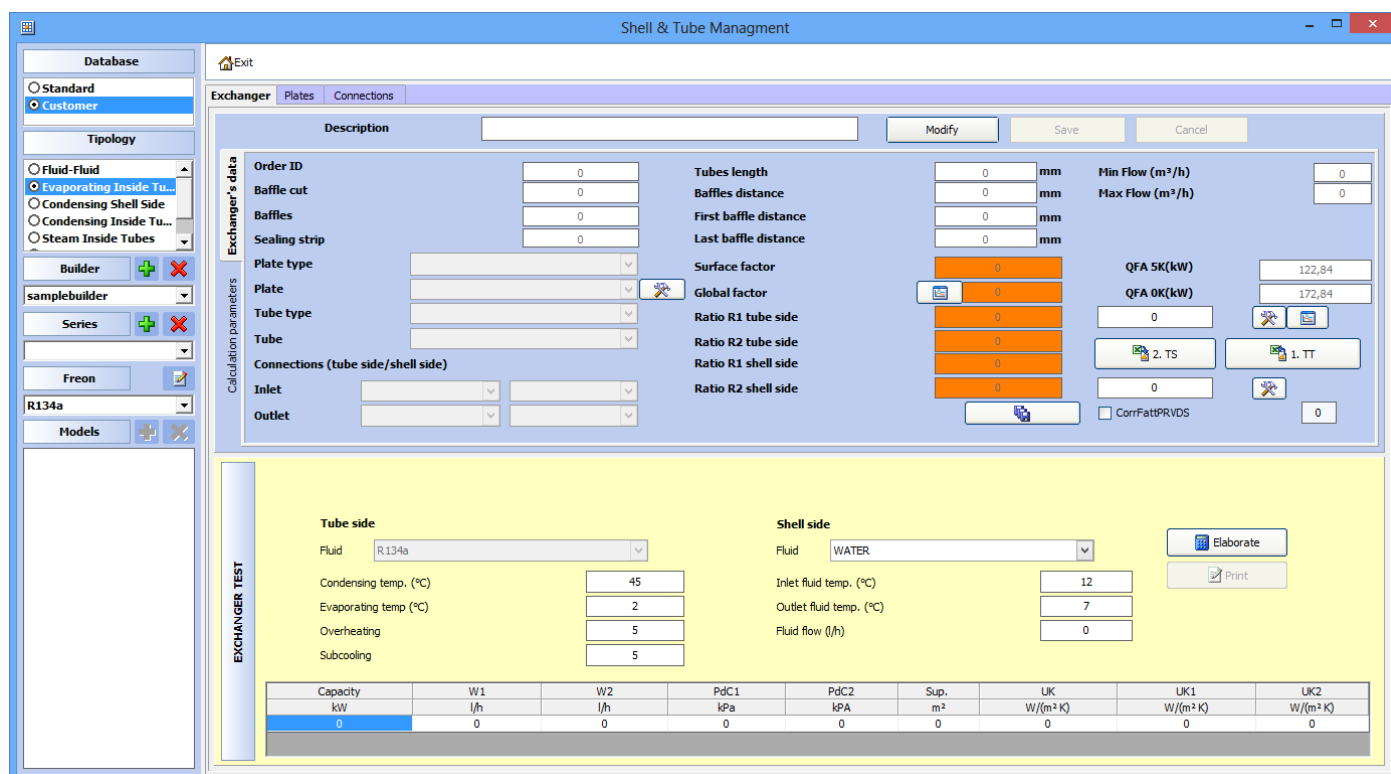
Let's insert the name of the new builder:



New Builder

Input the new builder name:

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



Database

- Standard
- Customer

Tipology

- Fluid-Fluid
- Evaporating Inside Tu...
- Condensing Shell Side
- Condensing Inside Tu...
- Steam Inside Tubes

Builder + -

samplebuilder

Series + -

Freon

R134a

Models + -

Exchanger's data

Description

Order ID: 0

Baffle cut: 0

Baffles: 0

Sealing strip: 0

Plate type: [dropdown]

Plate: [dropdown]

Tube type: [dropdown]

Tube: [dropdown]

Connections (tube side/shell side)

Inlet: [dropdown]

Outlet: [dropdown]

Tubes length: 0 mm

Baffles distance: 0 mm

First baffle distance: 0 mm

Last baffle distance: 0 mm

Surface factor: 0

Global factor: 0

Ratio R1 tube side: 0

Ratio R2 tube side: 0

Ratio R1 shell side: 0

Ratio R2 shell side: 0

Min Flow (m³/h): 0

Max Flow (m³/h): 0

QFA 5K(kW): 122,84

QFA 0K(kW): 172,84

2. TS

1. TT

CorrFattPRVDS: 0

Calculation parameters

EXCHANGER TEST

Tube side

Fluid: R134a

Condensing temp. (°C): 45

Evaporating temp (°C): 2

Overheating: 5

Subcooling: 5

Shell side

Fluid: WATER

Inlet fluid temp. (°C): 12

Outlet fluid temp. (°C): 7

Fluid flow (l/h): 0

Elaborate

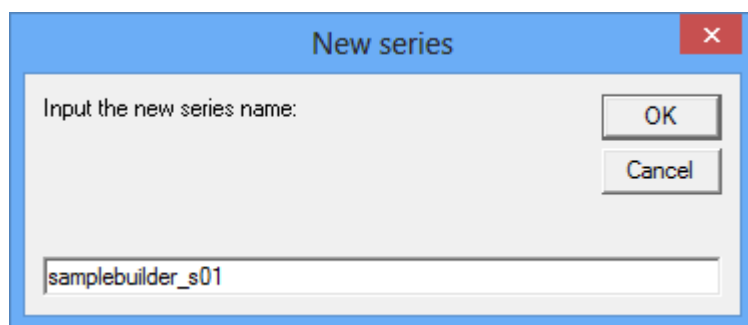
Print

Capacity	W1	W2	PdC1	PdC2	Sup.	UK	UK1	UK2
kW	l/h	l/h	kPa	kPa	m³	W/(m² K)	W/(m² K)	W/(m² K)
0	0	0	0	0	0	0	0	0

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

Series

Specify the name of the new series



New series

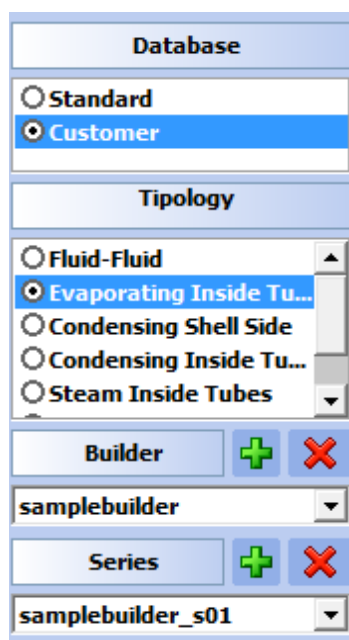
Input the new series name:

OK

Cancel

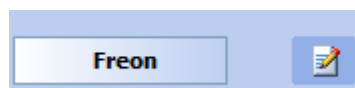
samplebuilder_s01

We click "OK".



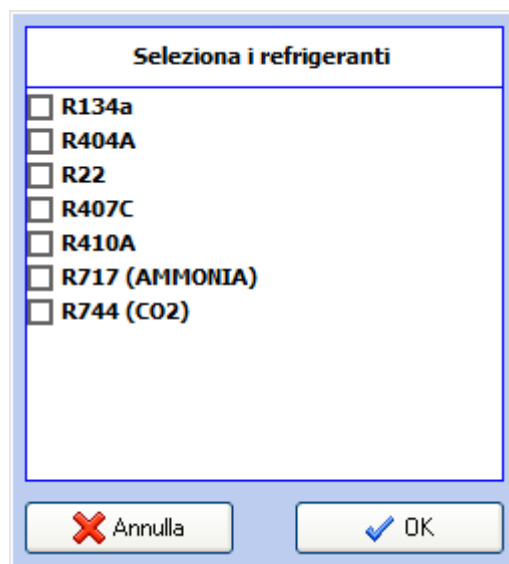
The screenshot shows a software window with two main sections: "Database" and "Tipology". In the "Database" section, there are two radio buttons: "Standard" and "Customer", with "Customer" selected. In the "Tipology" section, there are five radio buttons: "Fluid-Fluid", "Evaporating Inside Tu...", "Condensing Shell Side", "Condensing Inside Tu...", and "Steam Inside Tubes", with "Evaporating Inside Tu..." selected. Below these sections, there are two buttons labeled "Builder" and "Series", each with a green plus icon and a red minus icon. Below the "Builder" button is a dropdown menu showing "samplebuilder". Below the "Series" button is a dropdown menu showing "samplebuilder_s01".

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



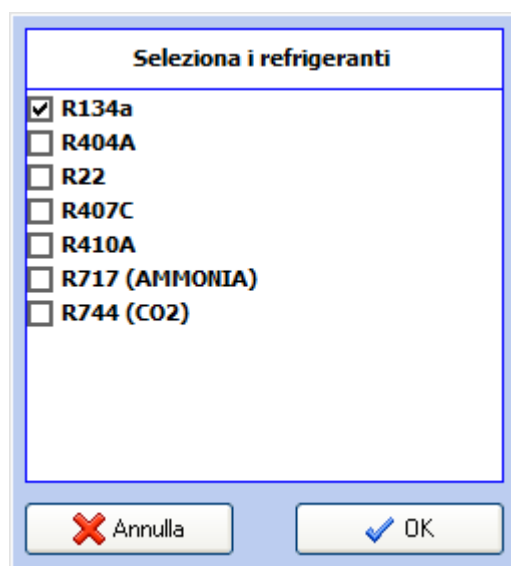
The screenshot shows a button labeled "Freon" with a small icon of a document with a pencil next to it.

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

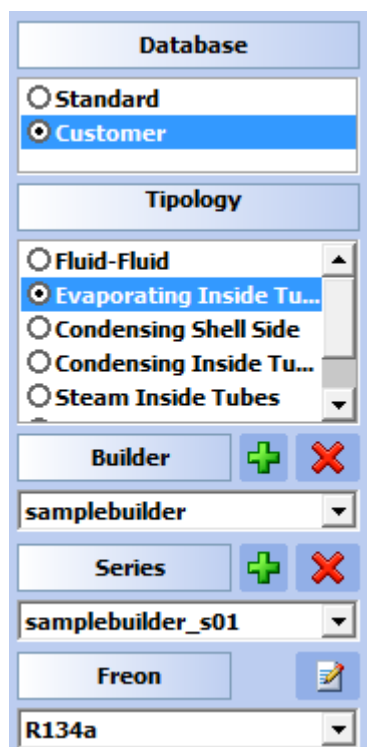


The screenshot shows a dialog box titled "Seleziona i refrigeranti". It contains a list of refrigerants with checkboxes next to them: R134a, R404A, R22, R407C, R410A, R717 (AMMONIA), and R744 (CO2). At the bottom of the dialog box, there are two buttons: "Annulla" (with a red X icon) and "OK" (with a blue checkmark icon).

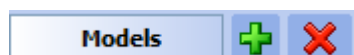
We choose R134a:



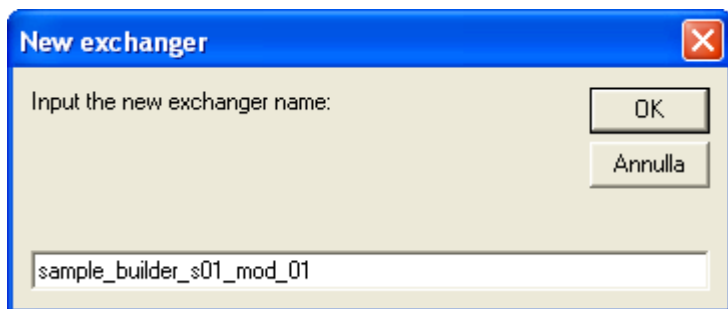
Let's click on "Ok", and the refrigerant will be shown in the list below:



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:



New exchanger

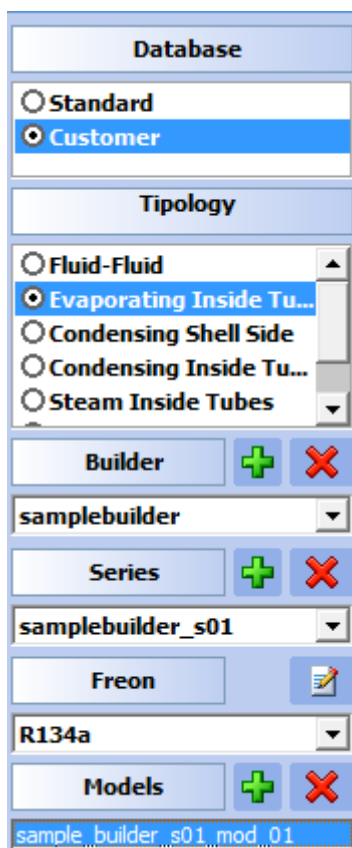
Input the new exchanger name:

OK

Annulla

sample_builder_s01_mod_01

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



Database

☐ Standard

☒ Customer

Tipology

☐ Fluid-Fluid

☒ Evaporating Inside Tu...

☐ Condensing Shell Side

☐ Condensing Inside Tu...


☐ Steam Inside Tubes

Builder + -

samplebuilder

Series + -

samplebuilder_s01

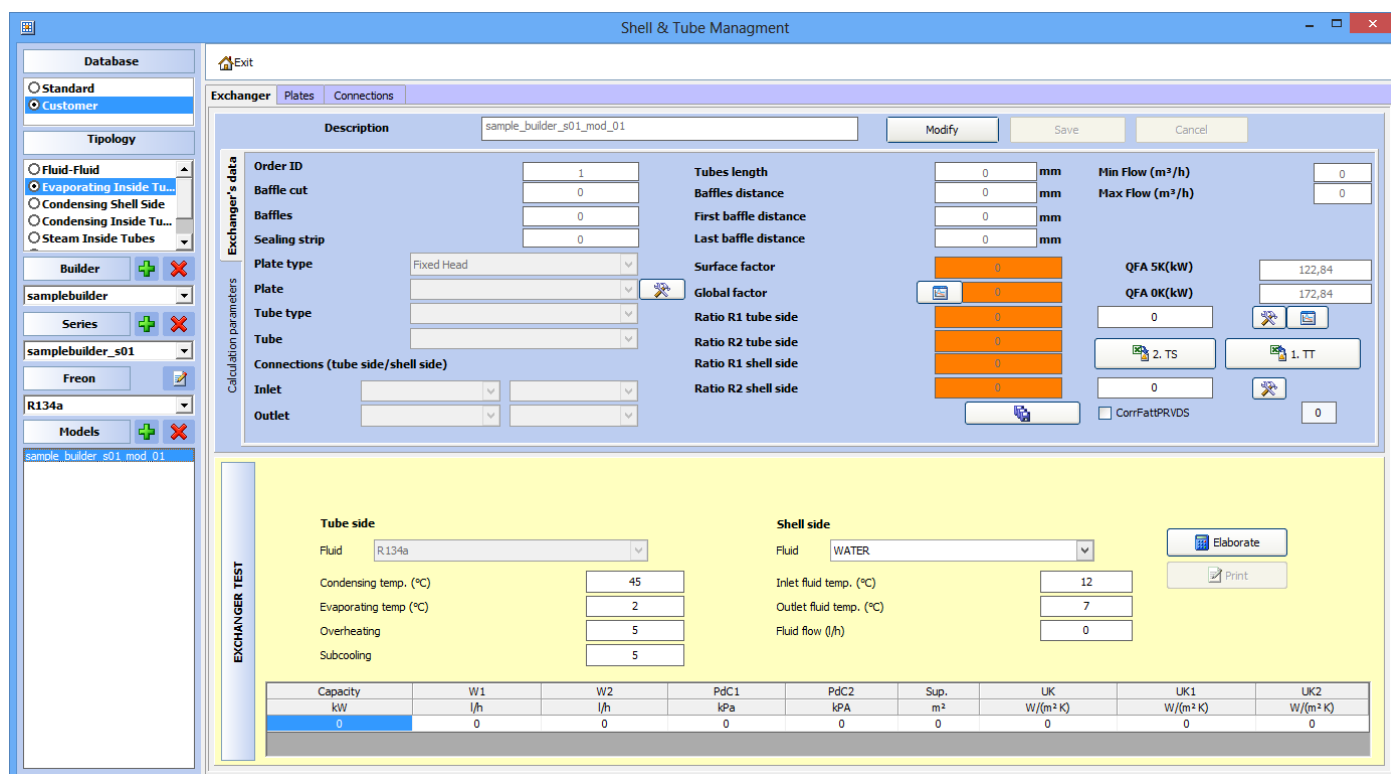
Freon 

R134a

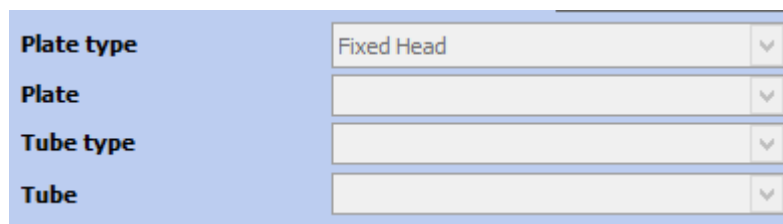
Models + -

sample_builder_s01_mod_01

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:

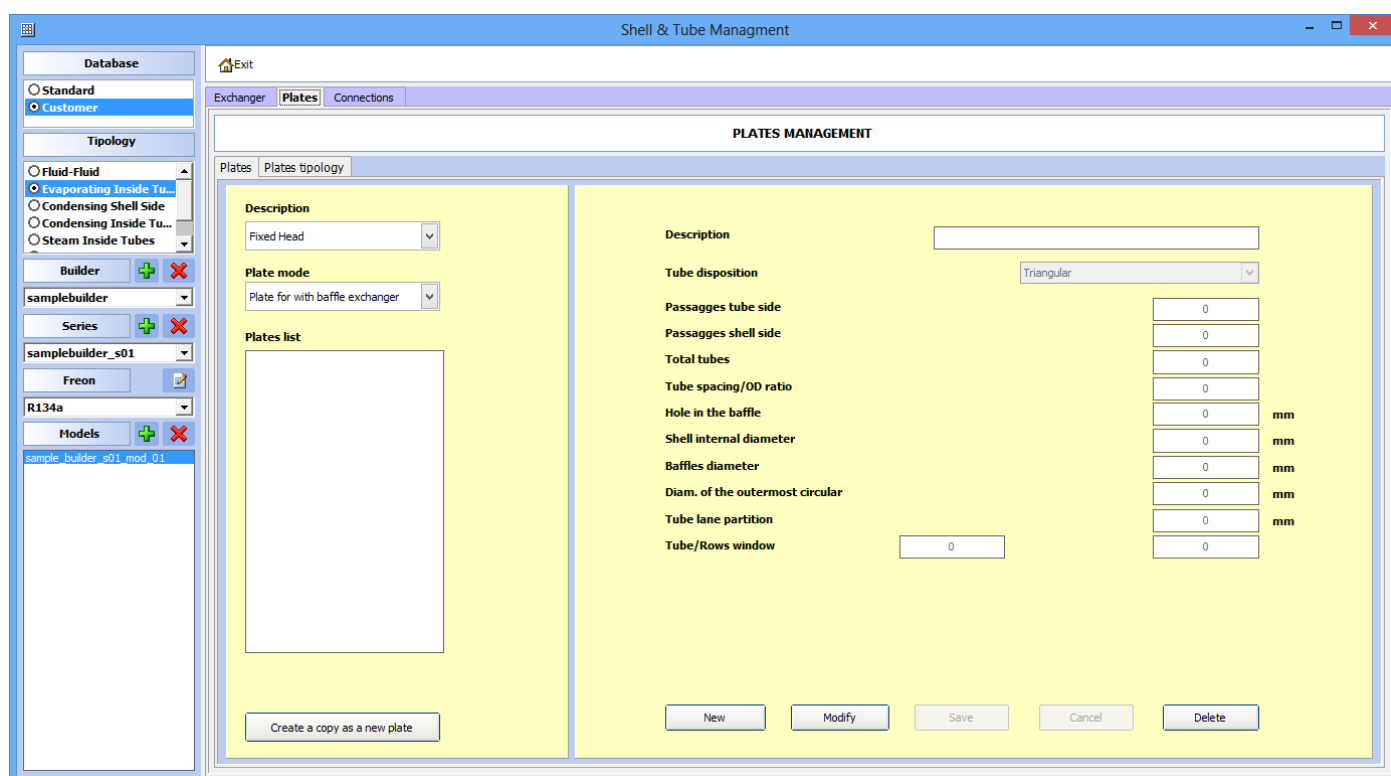


NB: This assumes that the data is already present!

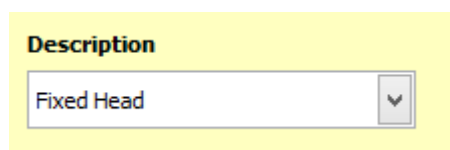
Therefore, we proceed by inserting the tube plate. Let's move on then to the "plates":



Panel for the management of plates will be displayed:



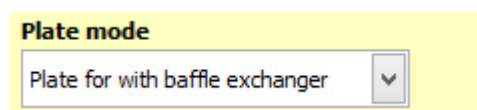
We can find the type of plate:



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

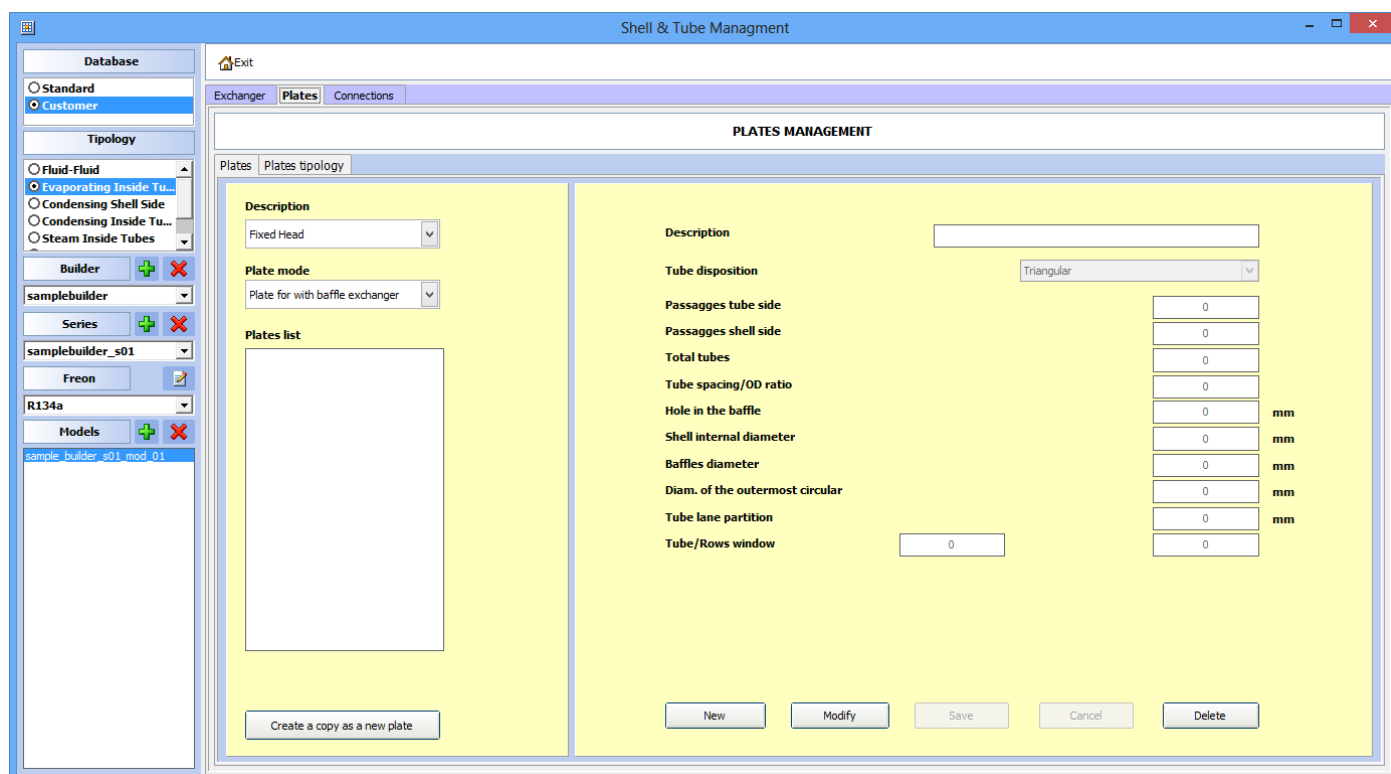
Then we find the field "Plate mode":



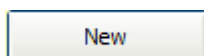
This option includes:

- 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:



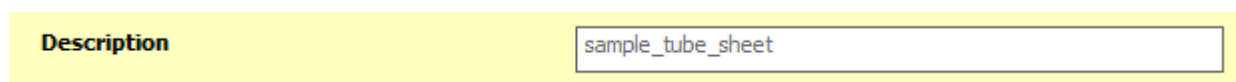
To insert a new plate we click on:



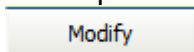
Insert the name of the new plate:



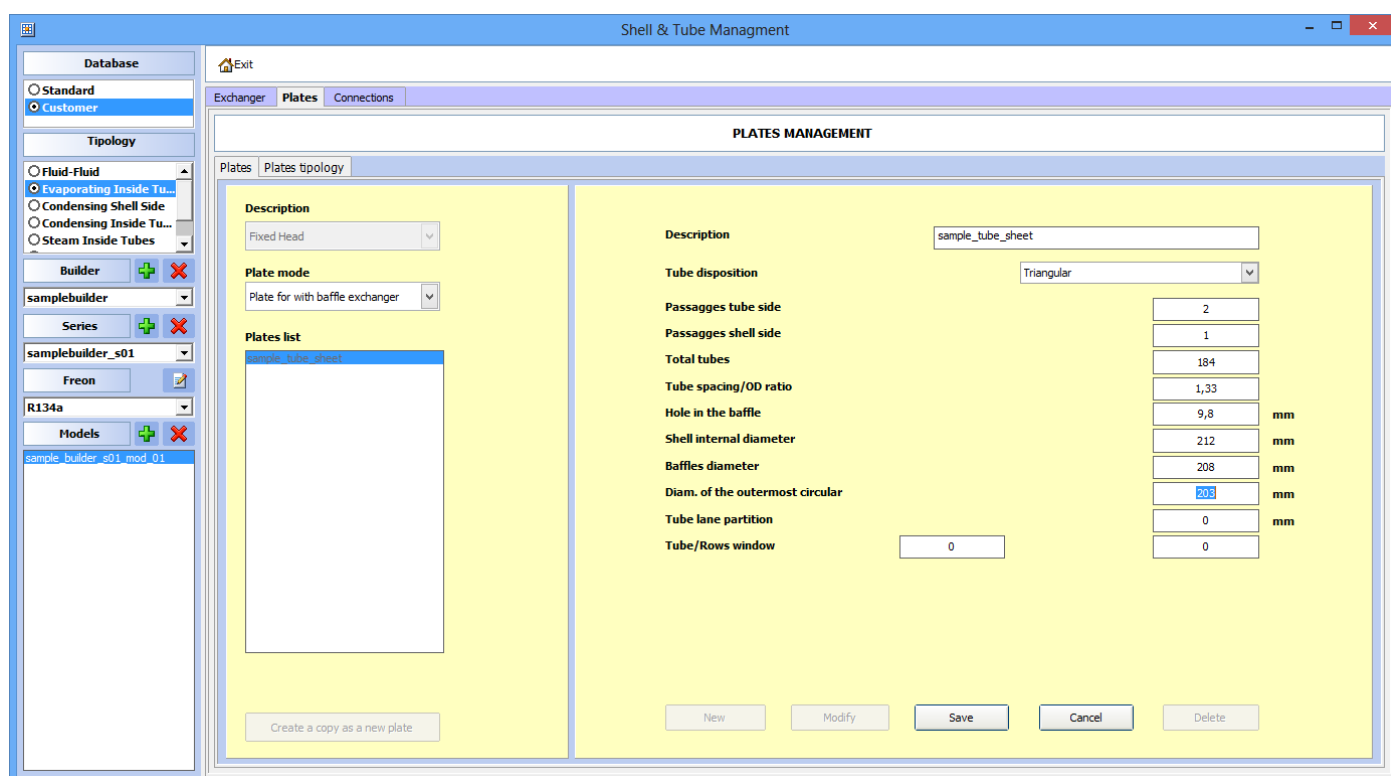
That is placed in the description field:



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



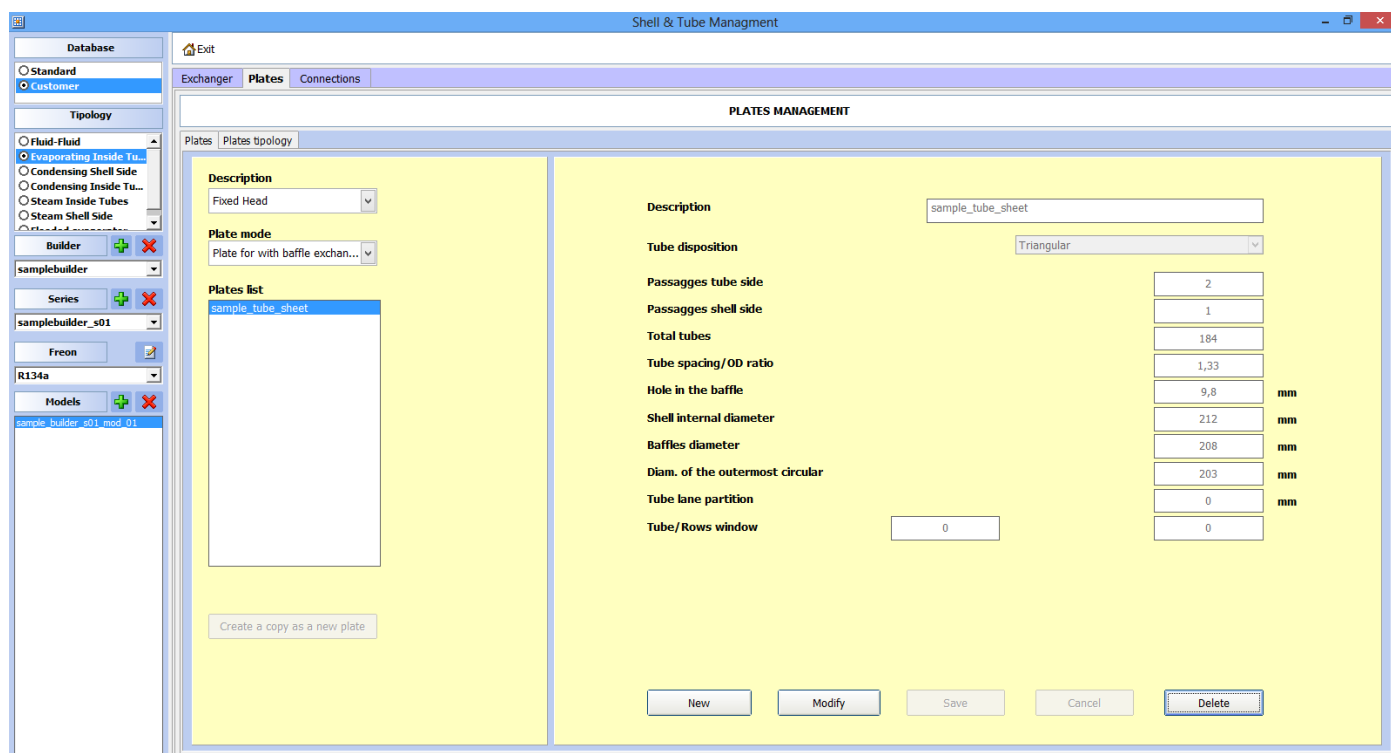
We insert the following sample data:



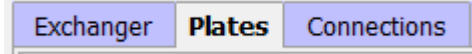
Then we click on Save:

Save

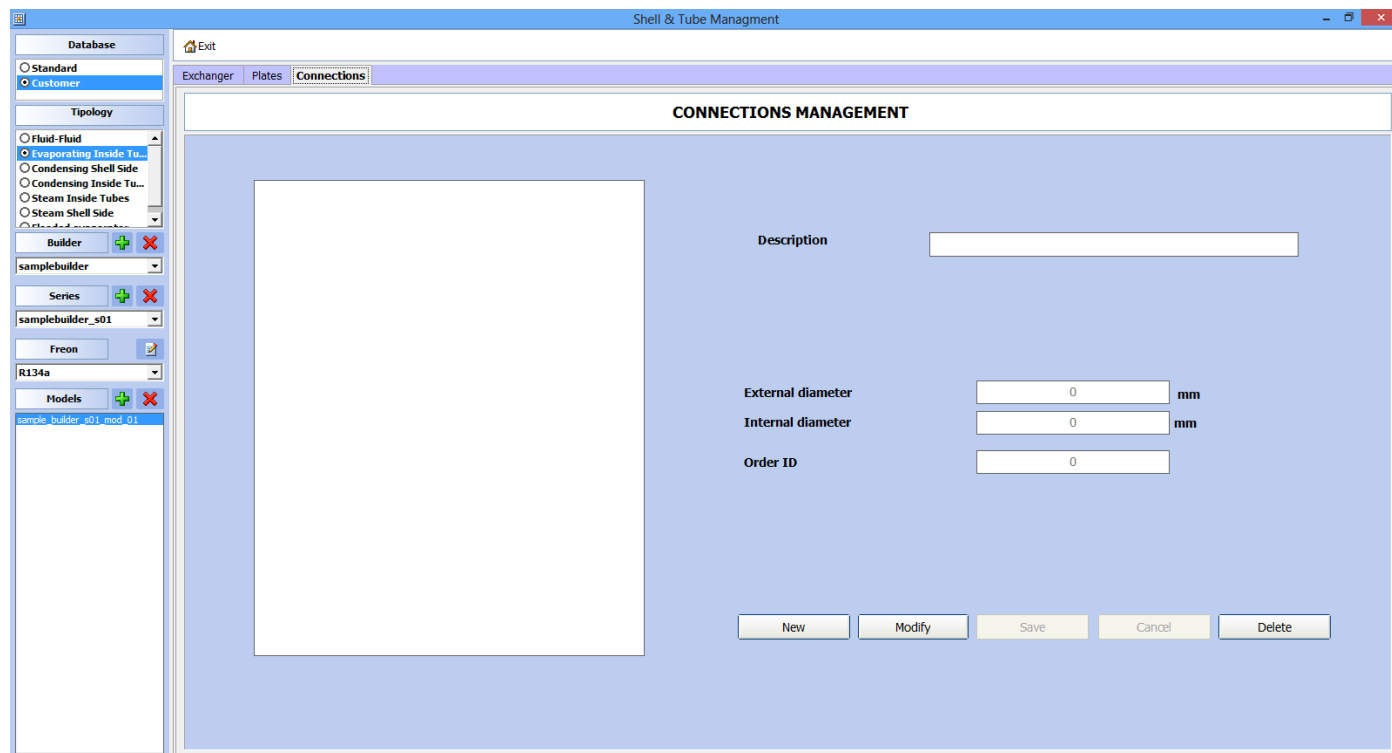
Now the data has been saved in the archive:



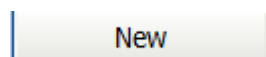
Now let's insert the connections



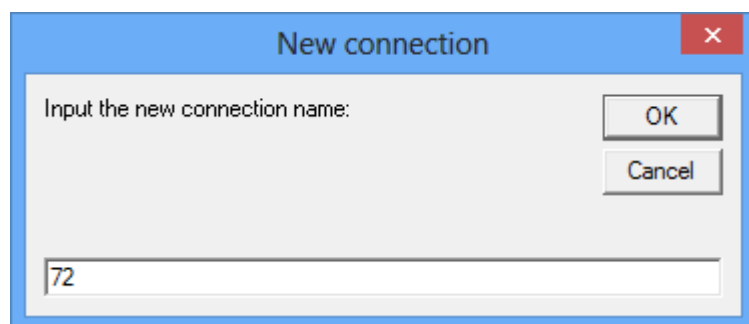
We will see the following connection data



Let's click on "New":



Let's insert the name of the connection:



The new value will be added in the archive:

Description

72

External diameter

0

mm

Internal diameter

0

mm

Order ID

0

We click on "Modify" to insert the data:

 Modify

Let us insert the following

Description

72

External diameter

72

mm

Internal diameter

65

mm

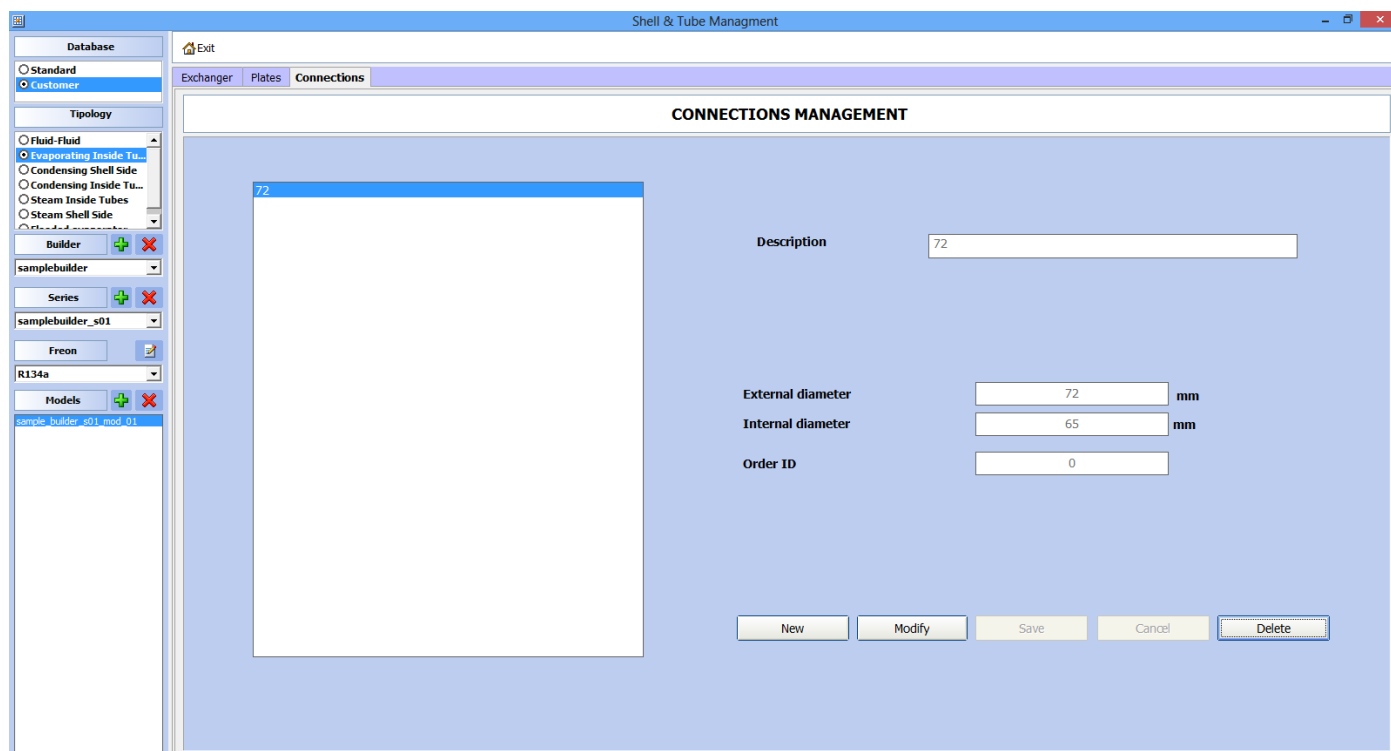
Order ID

0

Let's click on Save:

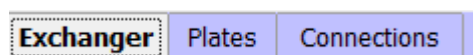
 Save

At this point the connection is inserted in the archive:

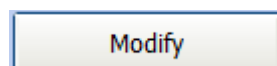


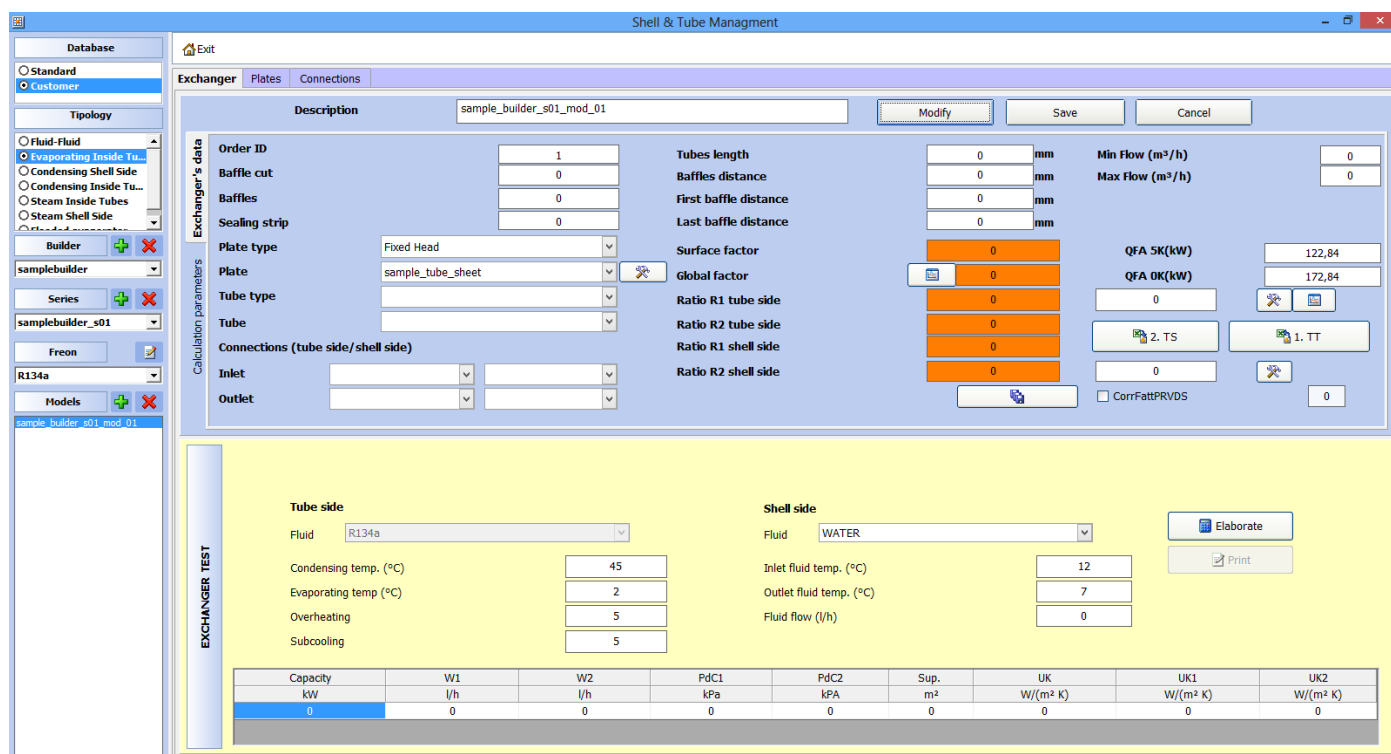
NB: repeat for all models of nozzles required.

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:

Order ID	1	Tubes length	1980 mm	Min Flow (m³/h)	0
Baffle cut	25,4	Baffles distance	94 mm	Max Flow (m³/h)	0
Baffles	21	First baffle distance	172 mm		
Sealing strip	0	Last baffle distance	175 mm		

We insert the type of the plate:

Tipo piastra	"U" Head
Piastra tubiera	sample_tube_sheet


The one of the tube:

Tube type	Smooth
Tube	TUBE 3/8

And the connections:

Bocchelli (lato tubi/lato mantello)			
Ingresso	72	72	
Uscita	72	72	

We insert the factors:

Surface factor	<input type="text" value="1"/>
Global factor	 <input type="text" value="1"/>
Ratio R1 tube side	<input type="text" value="1"/>
Ratio R2 tube side	<input type="text" value="1"/>
Ratio R1 shell side	<input type="text" value="1"/>
Ratio R2 shell side	<input type="text" value="1"/>

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:

Min Flow (m ³ /h)	<input type="text" value="0"/>
Max Flow (m ³ /h)	<input type="text" value="0"/>

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.