



UNILAB Coils User Manual

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Introduction

UNILAB Coils User Manual

Software for the design and rating of finned heat exchangers

aligned with version 8.0

MAIN FEATURES

COILS is a tool for the design and rating of finned pack heat exchangers in the following calculation modalities:

- **Heating** and **Cooling** of the air without any change of phase of the liquid, gas or refrigerant in the tubes
- **Condensing** and **Direct Expansion** of refrigerants with change of phase
- **Steam**
- **Pump evaporators with R717**

Compressors and axial fans

In the Professional edition, **COILS** has an extensible archives of usable axial fans and compressors in the **Condensing** and **Direct Expansion** calculation options. In this way it's very easy to carry out the design of remote condensers and unit coolers.

Geometries

COILS has an extensible archive with more than 50 geometries, the most used in the air conditioning and refrigeration industry.

It's possible to insert a new geometry with the following characteristics:

- **Staggered** and **aligned** tube
- **Spiroidal** or **integral** fins
- Tubes with different types of corrugation
- Fins with different types of corrugation

Moreover, changing the correction factors of the geometry it's possible to obtain calculation results adherent to the experimental data gained from a laboratory of measures.

UNILAB is the only software house in Europe able to help an heat exchangers manufacturer in the obtaining of the Eurovent certification for water coils with the aid of our software (HECOILS norm EN 1216 - see the [Eurovent](#) website for more information). The adjustment of the correction factors has allowed a maximum deviation of the values calculates from the experimental data of 5% for the thermal power and of 10% for the pressure drop air side and tubes side, for the same geometry in different configurations and multiple conditions.

Calculation modalities

- In the **Verify** modality the user can rate the power and the pressure drops knowing all the geometrical parameters of the exchanger and the working conditions changing one or more input variables at the same time (for example: geometry, inlet air temperature and humidity, fluid, fin thickness, fin type, tube type, fluid temperatures etc.)
- In the **Design** modality it is possible to insert the working conditions and the power required without knowing all the geometrical parameters, obtaining a list of exchangers compatible with the initial conditions imposed

SYSTEM REQUIREMENTS

Suggested System Requirements

- Operating System Microsoft® Windows® 7 with Service Pack 1, 8.1 or 10, 32 or 64 bits
- Intel® Core 2 or AMD Athlon®; 1.5 GHz or faster processor
- 4 GB or more of RAM
- 2 GB or more of available hard-disk space for 32-bit operative system; 4 GB or more of available hard-disk space for 64-bit operative system
- Screen resolution **1366x768** pixel recommended with 24-bit color, small characters and 512 MB or more of dedicated VRAM
- Internet connection and registration are necessary for required software activation, validation of subscriptions.

Getting Started

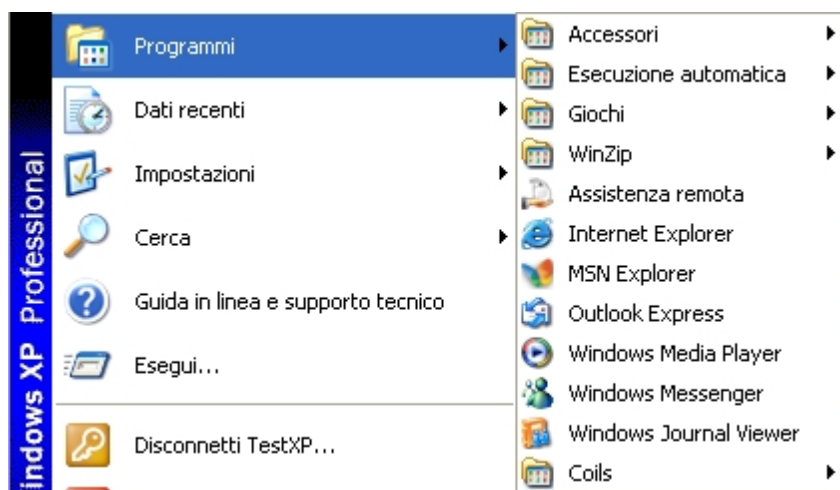
Program Opening

Program Opening

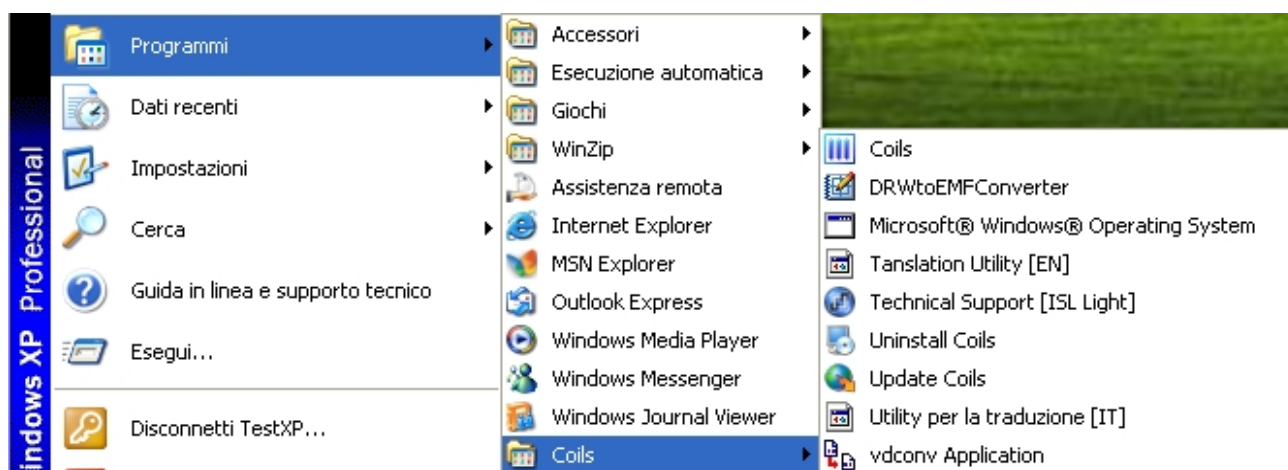
To open the program



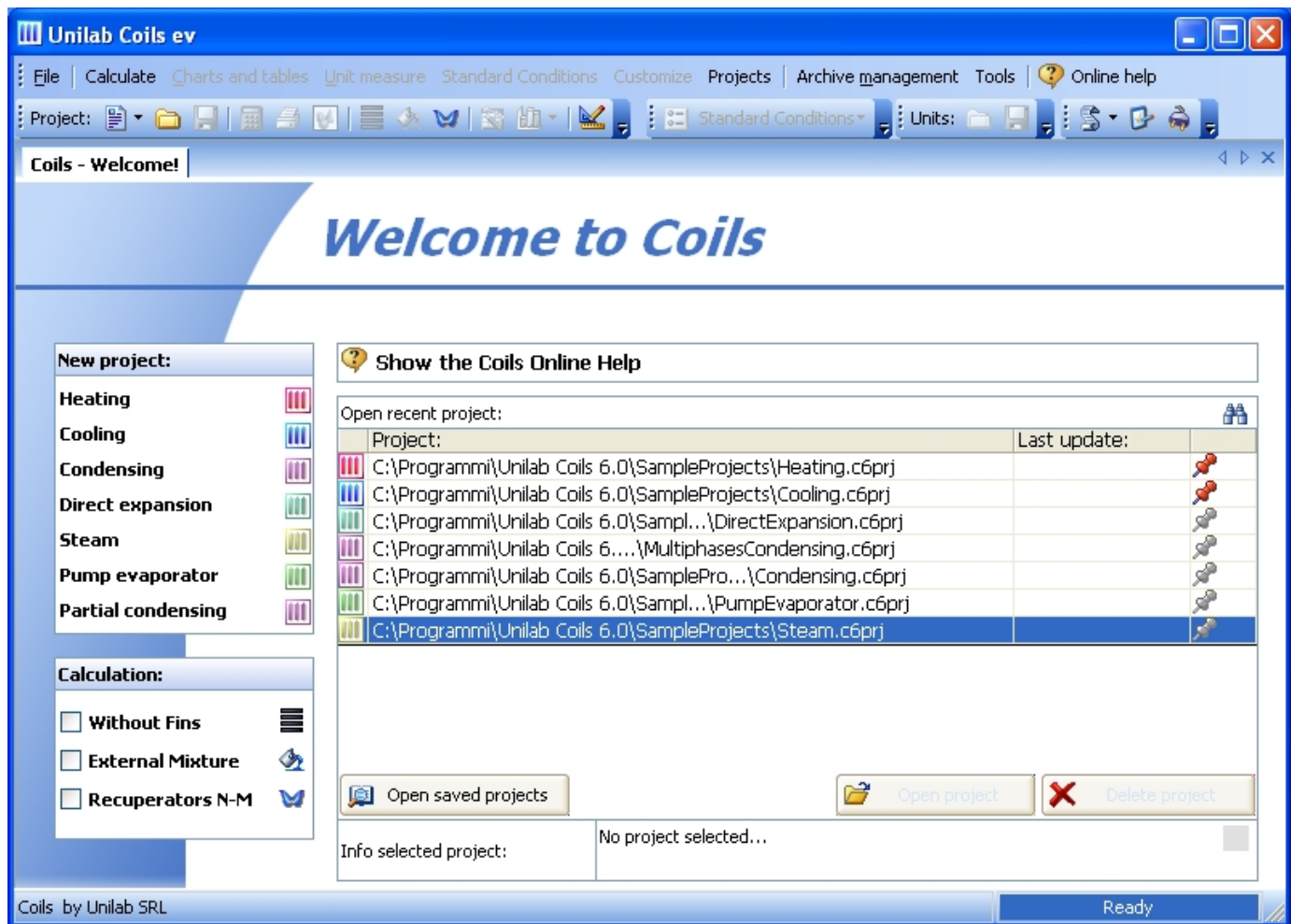
- Click on start button
- Then click on the “Program” voice of the menu



- Then click on “Unilab Coils” voice of the menu



Here is the first screen of the program



Under the New Project , We have the possible calculation modes the battery.



- Under the “Open recent project:”, We can see the projects We have recently opened plus projects examples that We will see in detail in the next section.
-

Project Examples

Project Examples

In this section We will see the different calculation modalities in already prepared examples.

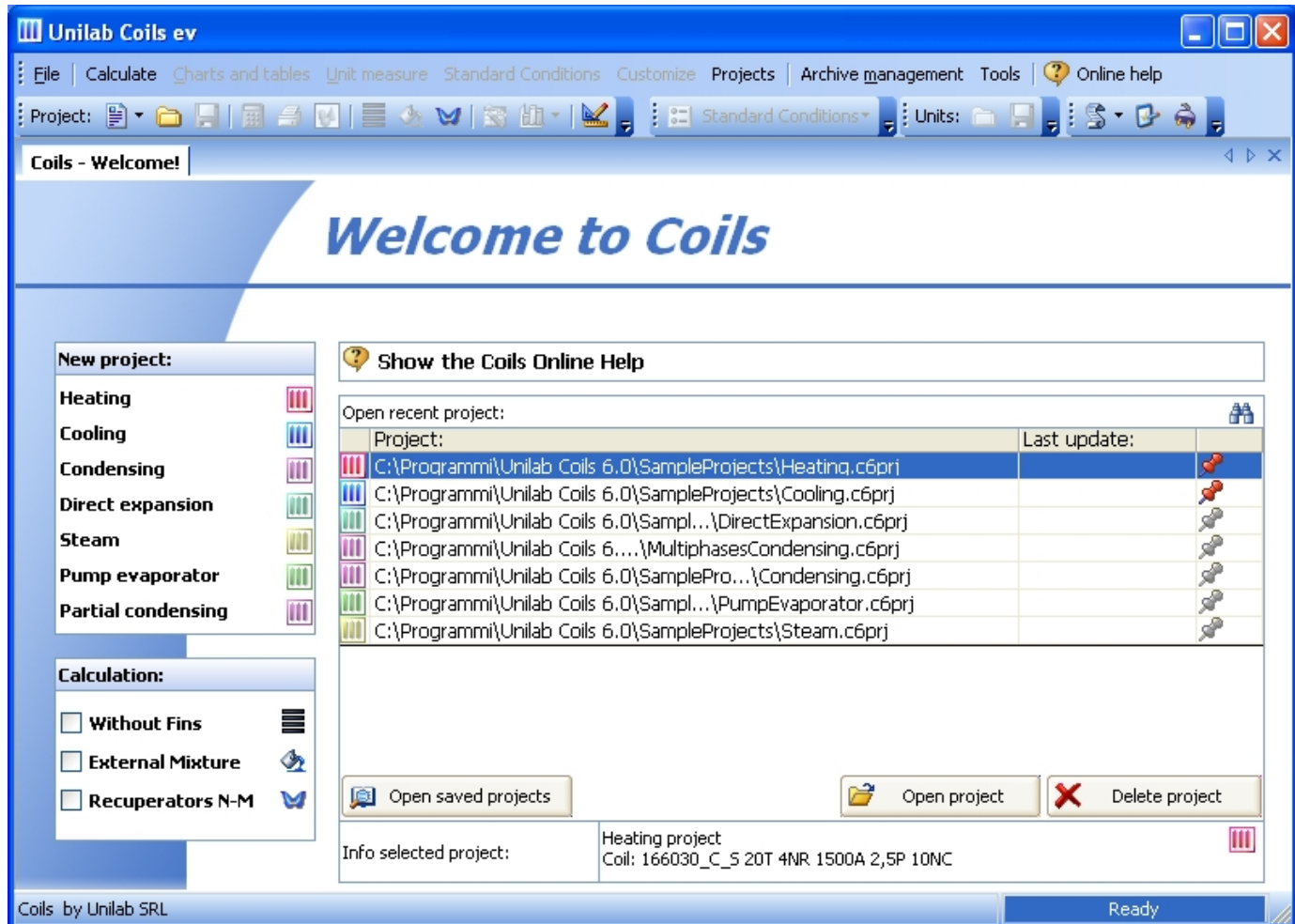
Heating example



Heating example

To open an example of Heating calculation modality:

- Click on “Heating.c6prj” file under the “Open recent project” area



the name of the file is highlighted in blue

C:\Programmi\Unilab Coils 6.0\SampleProjects\Heating.c6prj

under the selected project area we can see the file's data

Info selected project: Heating project
Coil: 166030_C_S 20T 4NR 1500A 2,5P 10NC

- Double click on the

C:\Programmi\Unilab Coils 6.0\SampleProjects\Heating.c6prj file

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | ? Online help

Project: Standard Conditions Units:

Coils 8.0 - Welcome! C:\Prog...\Heating.c6prj

Heating
Calculation Mode
Verify
Design
Geometry
166030_C_S
 Geometry Details
 Search Geometry

AIR SIDE		Obt.
Capacity	kW	195,37
Airflow	m³/h	16200
Face Velocity	m/s	2,5
Inlet Temperature DB	°C	20
Inlet Relative Humidity	%	50
Outlet Temperature DB	°C	55,7
Outlet Relative Humidity	%	7,2
Fouling factor	(m² K)/W	0
Pressure Drop	Pa	45

TUBE SIDE	
Fluid	WATER (PL)
Pressure	bar A 1
Inlet Temperature	°C 80
Outlet Temperature	°C 70
Pressure Drop	kPa 80,61
Fouling factor	(m² K)/W 0
Fluid Velocity	m/s 2,64

Tube
Fin
Manifolds
Air Side Details
Output

Calculate **Print**

N° tubes for row	20	Finned Length	mm (2) 1500
Rows	4	Circuits	10
Fin Pitch	mm (2) 2,50	Baffles n°	0
Nr of Skipped Tubes	0		

Where we can see four main areas.

- Calculation type and relative Geometry, Tube data, Fin data, Manifolds Data, and Air Side details
- Air Side data with relative parameters.



- “Capacity” measured in W or in can be measured in erg/s for example



- “AirFlow” measured in m^3/h but can also be set in



- “Face Velocity” measured in m/s but can also be changed in

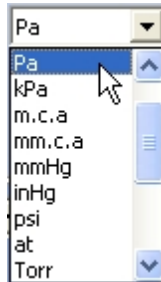
- “Inlet Temperature DB” measured in C but can be changed into



- “Outlet Temperature DB” measured in C but can be changed into

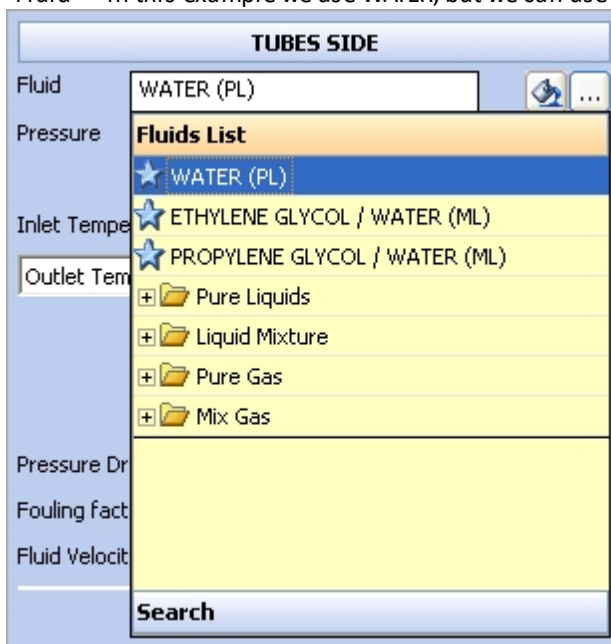


- “Pressure Drop” measured in Pa or in



- Tubes Side data

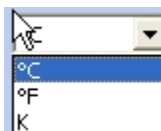
- “Fluid” - in this example we use WATER, but we can use a wide range of fluids

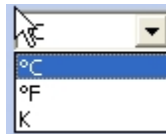


- “Pressure” measured in bar A or in



- “Inlet Temperature” measured in C or in





- “Outlet Temperature” measured in C or in



- “Pressure Drop” measured in kPa or in



- “Fluid Velocity” measured in m/s or in

- Coil Data



- “N tubes for row” or it can be expressed in

- Rows



- “Fin Pitch” measured in mm or in

- “Nr of skipped Tubes” which is the number of not alimeted circuits



- “Finned Length” measured in mm or in

- “Circuits” which indicates the number of circuits

- “Baffles n°” which indicates the number of the baffles.

As we stated in the introduction our program is able to perform two types of calculation “Verify” and “Design”.

Since in this example we have all the working conditions, we work in Verify mode, in which the user can rate the power and the pressure drop knowing all the geometrical parameters of the exchanger and the working conditions, changing one or more input variables at the same time (for example: geometry, inlet air temperature and humidity, fluid, fin thickness, fin type, tube type, fluid temperatures etc.)

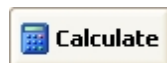
In Calculation area we can see that we are working in the “Verify modality”, which is selected .

Heating

Calculation Mode

☒ Verify

☐ Design



Now simply press the “Calculate” button

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | ? Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\Prog...\Heating.c6prj * ... \DirectExpansion.c6prj

Heating

Calculation Mode

☒ Verify

☐ Design

Geometry

Tube

Fin

Manifolds

Air Side Details

Output

Exchange Surface
m² 159,773

Project Description

No Warning ☒

Coil price (€) 0,00

Calculate **Print**

AIR SIDE		Obt.
Capacity	kW	195,37
Airflow	m ³ /h	16200
Face Velocity	m/s	2,5
Inlet Temperature DB	°C	20
Inlet Relative Humidity	%	50
Outlet Temperature DB	°C	55,7
Outlet Relative Humidity	%	7,1
Fouling factor	(m ² K)/W	0
Pressure Drop	Pa	45
N° tubes for row		20
Rows		4
Fin Pitch	mm (2)	2,50
Nr of Skipped Tubes		0

TUBE SIDE	
Fluid	WATER (PL)
Pressure	bar A 1
Inlet Temperature	°C 80
Outlet Temperature	°C 70
Pressure Drop	kPa 80,61
Fouling factor	(m ² K)/W 0
Fluid Velocity	m/s 2,64
Finned Length	mm (2) 1500
Circuits	10
Baffles n°	0

where the “Capacity air Side” is calculated

AIR SIDE		Obt.
Capacity	kW	195,37

in the “Output” area the exchange surface is calculated

Output

Exchange Surface

m² 159,773

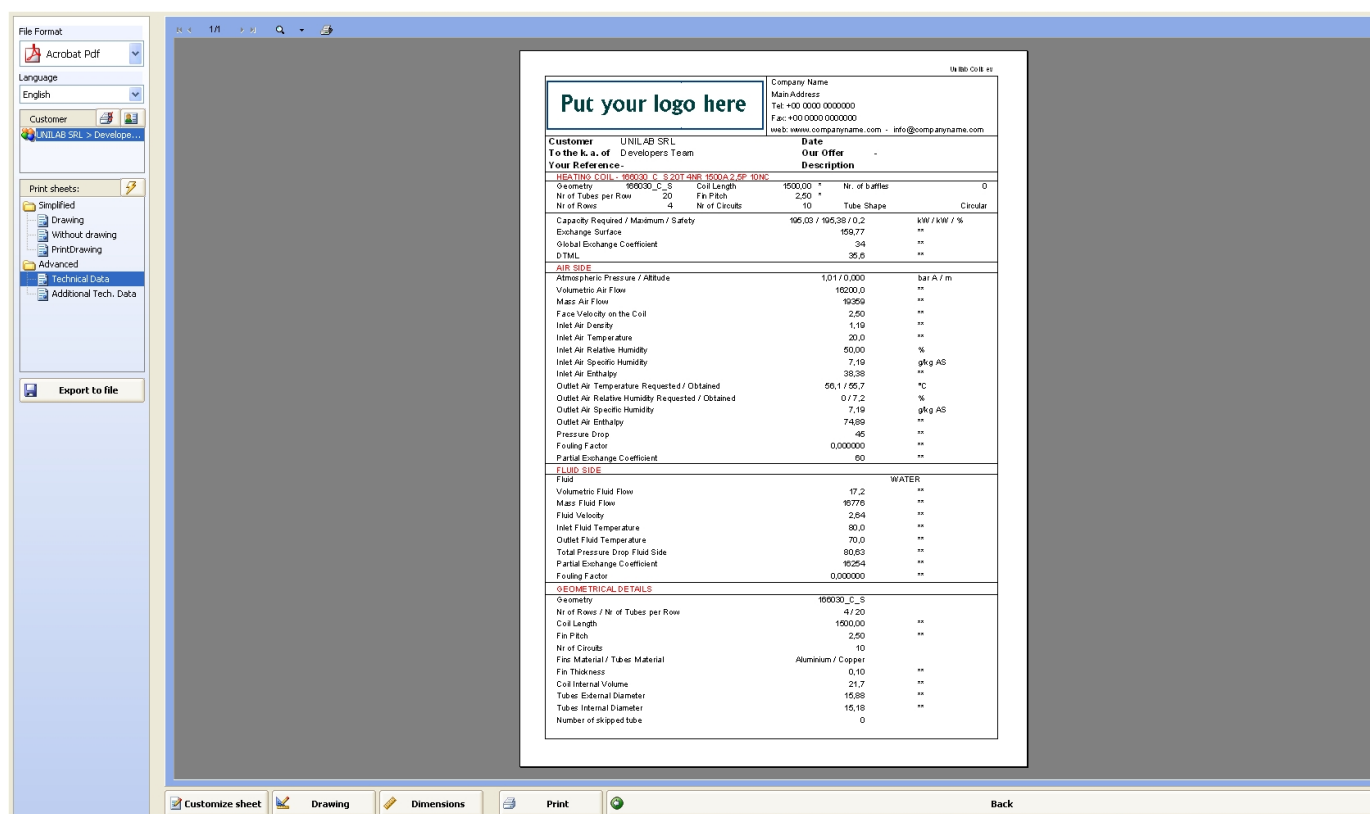
In addition the “No Warning ” message indicates that the working conditions were correct.

No Warning ☒



Print

- Now to see the output results of our calculation, press the “Print” button



The screenshot shows the UNILAB software interface with a technical data printout. The printout includes a header section for company and customer information, followed by a detailed table of technical data. The table is organized into sections: HEATING COIL, AIR SIDE, FLUID SIDE, and GEOMETRICAL DETAILS. The printout also includes a sidebar with options for file format, language, customer data, and print sheets.

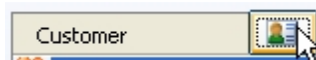
Put your logo here		Company Name	
Customer		Date	
To the k. a. of		Our Offer	
Your Reference		Description	
HEATING COIL - 160030_C_5			
Geometry	160030_C_5	Coil Length	1500.00 *
Nr of Tubes per Row	20	Fin Pitch	2.50 *
Nr of Rows	4	Nr of Circuits	10
Capacity Required / Maximum / Safety		105.00 / 105.38 / 0.2	kW / kW / %
Exchange Surface		159.77	**
Global Exchange Coefficient		34	**
D.T.M.L.		35.5	**
AIR SIDE			
Atmospheric Pressure / Altitude		1.013 / 0.000	bar A / m
Volumetric Air Flow		1600.00	**
Mass Air Flow		19259	**
Face Velocity on the Coil		2.50	**
Inlet Air Density		1.19	**
Inlet Air Temperature		20.0	**
Inlet Air Relative Humidity		50.00	%
Inlet Air Specific Humidity		7.19	g/kg AS
Inlet Air Enthalpy		39.36	**
Outlet Air Temperature Requested / Obtained		55.1 / 55.7	°C
Outlet Air Relative Humidity Requested / Obtained		0 / 7.2	%
Outlet Air Specific Humidity		7.19	g/kg AS
Outlet Air Enthalpy		74.59	**
Pressure Drop		45	**
Fouling Factor		0.000000	**
Partial Exchange Coefficient		60	**
FLUID SIDE			
Fluid		WATER	
Volumetric Fluid Flow		17.2	**
Mass Fluid Flow		8776	**
Fluid Velocity		2.54	**
Inlet Fluid Temperature		80.0	**
Outlet Fluid Temperature		70.0	**
Total Pressure Drop Fluid Side		80.63	**
Partial Exchange Coefficient		8054	**
Fouling Factor		0.000000	**
GEOMETRICAL DETAILS			
Geometry		160030_C_5	
Nr of Rows / Nr of Tubes per Row		4 / 20	
Coil Length		1500.00	
Fin Pitch		2.50	
Nr of Circuits		10	
Fin Material / Tubes Material		Aluminium / Copper	
Fin Thickness		0.10	
Coil Internal Volume		21.7	
Tubes External Diameter		15.99	
Tubes Internal Diameter		15.18	
Number of skipped tube		0	

Where we have:

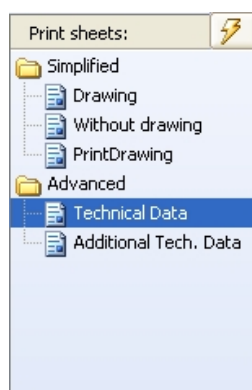
- “File Format” where by clicking on its menu, we can choose between Pdf-format or Word-format



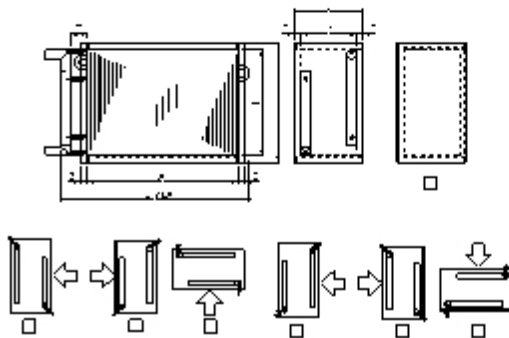
- “Customer” where we can add the customer data, that will show the printouts by clicking the “customer” button



- “Print Sheets:” which allows us to see detailed printout pages.



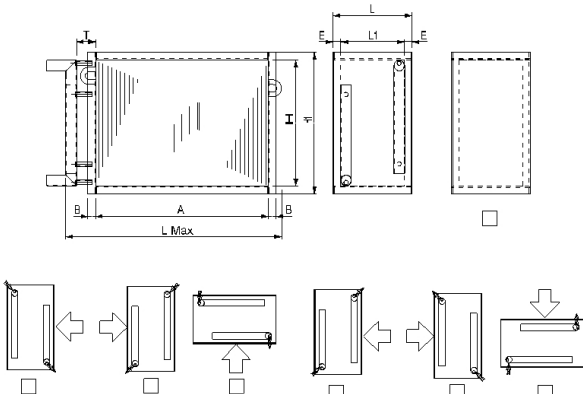
For example, if we choose the Simplified Drawing , will obtain

<div style="border: 2px solid blue; padding: 10px; font-size: 1.2em; font-weight: bold;">Put your logo here</div>	<div style="font-size: 0.8em;"> <p>Company Name _____</p> <p>Main Address _____</p> <p>Tel: +00 0000 00 000000</p> <p>Fax: +00 0000 00 000000</p> <p>web: www.companyname.com - info@companyname.com</p> </div>																											
<p>Customer To the k. a. of Your Reference</p>	<p>Date Our Offer Description</p>																											
<p>HEATING COIL - 166030_C_S 20T 4NR 1500A 2,5P 10NC</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Geometry 166030_C_S</td> <td style="width: 33%;">Coil Length 1500 mm</td> <td style="width: 33%;">Nr. of baffles 0</td> </tr> <tr> <td>Nr of Tubes per Row 20</td> <td>Fin Pitch 2,50 mm</td> <td></td> </tr> <tr> <td>Nr of Rows 4</td> <td>Nr of Circuits 10</td> <td></td> </tr> </table>		Geometry 166030_C_S	Coil Length 1500 mm	Nr. of baffles 0	Nr of Tubes per Row 20	Fin Pitch 2,50 mm		Nr of Rows 4	Nr of Circuits 10																			
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<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Capacity</td> <td style="width: 20%;">195,37</td> <td style="width: 20%;">kW</td> </tr> <tr> <td>Exchange Surface</td> <td>159,77</td> <td>m²</td> </tr> <tr> <td>DTML</td> <td>35,6</td> <td>°C</td> </tr> <tr> <td colspan="3">Fins Material / Tubes Material Aluminium / Copper</td> </tr> </table>		Capacity	195,37	kW	Exchange Surface	159,77	m²	DTML	35,6	°C	Fins Material / Tubes Material Aluminium / Copper																	
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<p>AIR SIDE</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Atmospheric Pressure / Altitude</td> <td style="width: 20%;">1,01 / 0,00</td> <td style="width: 20%;">bar A / m</td> </tr> <tr> <td>Volumetric Air Flow</td> <td>16200,0</td> <td>m³/h</td> </tr> <tr> <td>Mass Air Flow</td> <td>19359</td> <td>kg/h</td> </tr> <tr> <td>Face Velocity on the Coil</td> <td>2,50</td> <td>m/s</td> </tr> <tr> <td>Inlet Air Temperature</td> <td>20,0</td> <td>°C</td> </tr> <tr> <td>Inlet Air Relative Humidity</td> <td>50,00</td> <td>%</td> </tr> <tr> <td>Outlet Air Temperature</td> <td>55,7</td> <td>°C</td> </tr> <tr> <td>Outlet Air Relative Humidity</td> <td>7,10</td> <td>%</td> </tr> <tr> <td>Pressure Drop</td> <td>45</td> <td>Pa</td> </tr> </table>		Atmospheric Pressure / Altitude	1,01 / 0,00	bar A / m	Volumetric Air Flow	16200,0	m³/h	Mass Air Flow	19359	kg/h	Face Velocity on the Coil	2,50	m/s	Inlet Air Temperature	20,0	°C	Inlet Air Relative Humidity	50,00	%	Outlet Air Temperature	55,7	°C	Outlet Air Relative Humidity	7,10	%	Pressure Drop	45	Pa
Atmospheric Pressure / Altitude	1,01 / 0,00	bar A / m																										
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Outlet Air Relative Humidity	7,10	%																										
Pressure Drop	45	Pa																										
<p>FLUID SIDE</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Fluid</td> <td style="width: 20%;">WATER (1 bar A)</td> <td style="width: 20%;"></td> </tr> <tr> <td>Volumetric Fluid Flow</td> <td>17,2</td> <td>m³/h</td> </tr> <tr> <td>Mass Fluid Flow</td> <td>16775</td> <td>kg/h</td> </tr> <tr> <td>Fluid Velocity</td> <td>2,64</td> <td>m/s</td> </tr> <tr> <td>Inlet Fluid Temperature</td> <td>80,0</td> <td>°C</td> </tr> <tr> <td>Outlet Fluid Temperature</td> <td>70,0</td> <td>°C</td> </tr> <tr> <td>Pressure Drop</td> <td>80,61</td> <td>kPa</td> </tr> <tr> <td>Tubes Material</td> <td>Copper</td> <td></td> </tr> </table>		Fluid	WATER (1 bar A)		Volumetric Fluid Flow	17,2	m³/h	Mass Fluid Flow	16775	kg/h	Fluid Velocity	2,64	m/s	Inlet Fluid Temperature	80,0	°C	Outlet Fluid Temperature	70,0	°C	Pressure Drop	80,61	kPa	Tubes Material	Copper				
Fluid	WATER (1 bar A)																											
Volumetric Fluid Flow	17,2	m³/h																										
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Fluid Velocity	2,64	m/s																										
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Outlet Fluid Temperature	70,0	°C																										
Pressure Drop	80,61	kPa																										
Tubes Material	Copper																											
<div style="display: flex; align-items: center;">  <table style="margin-left: 20px; font-size: 0.8em;"> <tr><td>A</td><td>1500</td><td>mm</td></tr> <tr><td>H1</td><td>0,00</td><td>mm</td></tr> <tr><td>L Max</td><td>0,00</td><td>mm</td></tr> <tr><td>H</td><td>1200</td><td>mm</td></tr> <tr><td>B</td><td>0,00</td><td>mm</td></tr> <tr><td>T</td><td>0,00</td><td>mm</td></tr> <tr><td>L1</td><td>0,00</td><td>mm</td></tr> <tr><td>E</td><td>0,00</td><td>mm</td></tr> <tr><td>L</td><td>0,00</td><td>mm</td></tr> </table> </div>		A	1500	mm	H1	0,00	mm	L Max	0,00	mm	H	1200	mm	B	0,00	mm	T	0,00	mm	L1	0,00	mm	E	0,00	mm	L	0,00	mm
A	1500	mm																										
H1	0,00	mm																										
L Max	0,00	mm																										
H	1200	mm																										
B	0,00	mm																										
T	0,00	mm																										
L1	0,00	mm																										
E	0,00	mm																										
L	0,00	mm																										

- by choosing the “Without Drawing” option:

<div style="border: 1px solid black; padding: 5px; text-align: center;"> Put your logo here </div>		Company Name Main Address Tel: +00 0000 000000 Fax: +00 0000 000000 web: www.companyname.com - info@companyname.com	
Customer To the k. a. of Your Reference		Date Our Offer Description	
HEATING COIL - 166030 C S 20T 4NR 1500A 2.5P 10NC			
Geometry	166030_C_S	Coil Length	1500 mm
Nr of Tubes per Row	20	Fin Pitch	2.50 mm
Nr of Rows	4	Nr of Circuits	10
Capacity		195,37	kW
Exchange Surface		159,77	m²
DTML		35,6	°C
Fins Material / Tubes Material		Aluminium / Copper	
AIR SIDE			
Atmospheric Pressure / Altitude		1,01 / 0,00 bar A / m	
Volumetric Air Flow		16200,0 m³/h	
Mass Air Flow		19359 kg/h	
Face Velocity on the Coil		2,50 m/s	
Inlet Air Temperature		20,0 °C	
Inlet Air Relative Humidity		50,00 %	
Outlet Air Temperature		55,7 °C	
Outlet Air Relative Humidity		7,10 %	
Pressure Drop		45 Pa	
FLUID SIDE			
Fluid		WATER (1 bar A)	
Volumetric Fluid Flow		17,2 m³/h	
Mass Fluid Flow		16775 kg/h	
Fluid Velocity		2,64 m/s	
Inlet Fluid Temperature		80,0 °C	
Outlet Fluid Temperature		70,0 °C	
Pressure Drop		80,61 kPa	
Tubes Material		Copper	

- by clicking “PrintDrawing” option:

<div style="border: 1px solid black; padding: 5px; text-align: center;"> Put your logo here </div>		Company Name Main Address Tel: +00 0000 000000 Fax: +00 0000 000000 web: www.companyname.com - info@companyname.com																																														
Customer To the k. a. of Your Reference		Date Our Offer Description																																														
UNILAB SRL Developers Team																																																
		<table border="1"> <tr><td>A</td><td>1500,00</td><td>mm</td></tr> <tr><td>H1</td><td>0,00</td><td>mm</td></tr> <tr><td>L Max</td><td>0,00</td><td>mm</td></tr> <tr><td>H</td><td>1200,00</td><td>mm</td></tr> <tr><td>B</td><td>0,00</td><td>mm</td></tr> <tr><td>T</td><td>0,00</td><td>mm</td></tr> <tr><td>L1</td><td>0,00</td><td>mm</td></tr> <tr><td>E</td><td>0,00</td><td>mm</td></tr> <tr><td>L</td><td>0,00</td><td>mm</td></tr> <tr><td></td><td>0,00</td><td>mm</td></tr> <tr><td></td><td>0,00</td><td>mm</td></tr> <tr><td></td><td>0,00</td><td>mm</td></tr> <tr><td></td><td>0,00</td><td>mm</td></tr> <tr><td></td><td>0,00</td><td>mm</td></tr> <tr><td></td><td>0,00</td><td>mm</td></tr> </table>		A	1500,00	mm	H1	0,00	mm	L Max	0,00	mm	H	1200,00	mm	B	0,00	mm	T	0,00	mm	L1	0,00	mm	E	0,00	mm	L	0,00	mm		0,00	mm		0,00	mm		0,00	mm		0,00	mm		0,00	mm		0,00	mm
A	1500,00	mm																																														
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L Max	0,00	mm																																														
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- the “Advanced Technical Data” :

Unilab Coil .eu

<div style="border: 2px solid blue; padding: 5px; display: inline-block;"> <h2 style="margin: 0;">Put your logo here</h2> </div>		Company Name Main Address Tel: +00 0000 0000000 Fax: +00 0000 0000000 web: www.companyname.com - info@companyname.com	
Customer UNILAB SRL To the k. a. of Developers Team Your Reference-		Date Our Offer - Description	
HEATING COIL - 166030_C_S 20T 4NR 1500A 2.5P 10NC			
Geometry	166030_C_S	Coil Length	1500,00 * Nr. of baffles 0
Nr of Tubes per Row	20	Fin Pitch	2,50 * Tube Shape Circular
Nr of Rows	4	Nr of Circuits	10
Capacity Required / Maximum / Safety		195,03 / 195,38 / 0,2 kW / kW / %	
Exchange Surface		159,77 **	
Global Exchange Coefficient		34 **	
DTML		35,6 **	
AIR SIDE			
Atmospheric Pressure / Altitude		1,01 / 0,000 bar A / m	
Volumetric Air Flow		16200,0 **	
Mass Air Flow		19359 **	
Face Velocity on the Coil		2,50 **	
Inlet Air Density		1,19 **	
Inlet Air Temperature		20,0 **	
Inlet Air Relative Humidity		50,00 %	
Inlet Air Specific Humidity		7,19 g/kg AS	
Inlet Air Enthalpy		38,38 **	
Outlet Air Temperature Requested / Obtained		55,1 / 55,7 °C	
Outlet Air Relative Humidity Requested / Obtained		0 / 7,2 %	
Outlet Air Specific Humidity		7,19 g/kg AS	
Outlet Air Enthalpy		74,89 **	
Pressure Drop		45 **	
Fouling Factor		0,000000 **	
Partial Exchange Coefficient		60 **	
FLUID SIDE			
Fluid		WATER	
Volumetric Fluid Flow		17,2 **	
Mass Fluid Flow		16778 **	
Fluid Velocity		2,64 **	
Inlet Fluid Temperature		80,0 **	
Outlet Fluid Temperature		70,0 **	
Total Pressure Drop Fluid Side		80,63 **	
Partial Exchange Coefficient		16254 **	
Fouling Factor		0,000000 **	
GEOMETRICAL DETAILS			
Geometry		166030_C_S	
Nr of Rows / Nr of Tubes per Row		4 / 20	
Coil Length		1500,00 **	
Fin Pitch		2,50 **	
Nr of Circuits		10	
Fins Material / Tubes Material		Aluminium / Copper	
Fin Thickness		0,10 **	
Coil Internal Volume		21,7 **	
Tubes External Diameter		15,88 **	
Tubes Internal Diameter		15,18 **	
Number of skipped tube		0	

- the “Advanced Additional Technical Data”:

Unilab Coils - ev

<div style="border: 2px solid blue; padding: 10px; display: inline-block;"> <h2 style="margin: 0;">Put your logo here</h2> </div>		Company Name Main Address Tel: +00 0000 0000000 Fax: +00 0000 0000000 web: www.companyname.com - info@companyname.com	
Customer UNILAB SRL To the k. a. of Developers Team Your Reference -		Date Our Offer - Description	
HEATING - FURTHER TECHNICAL DATA			
Geometry	166030_C_S	Coil Length	1500,00 * Nr. of baffles 0
Nr of Tubes per Row	20	Fin Pitch	2,50 *
Nr of Rows	4	Nr of Circuits	10
Model 166030_C_S 20T 4NR 1500A 2,5P 10NC Face Velocity on the Coil 2,50 ** Fluid Velocity 2,64 ** Exchange Surface 159,77 ** External/Internal Surface Ratio 26,688 Dry Fin Efficiency 0,5888 Finned Surface Efficiency 0,6023 Partial Exchange Coefficient Air Side 60 ** Partial Exchange Coefficient Fluid Side 16254 ** Global Exchange Coefficient 34 ** Coil Efficiency 0,5960 ** Fluid Inside Tubes WATER Fluid Pressure Drop 80,63 ** Total Pressure Drop Fluid Side 80,63 ** Total internal volume 21,7 By-pass Factor 4,96			
Fan		n/a	
FLUID THERMOPHYSICAL PROPERTIES			
Calculation Temperature		75,0 **	
Density		974,84 **	
Specific Heat		4193 **	
Thermal Conductivity		0,667 **	
Viscosity		0,0004 **	
Fins Material / Tubes Material		Aluminium	
Tubes Material		Copper	
Fin Thermal Conductivity		204,000 **	
Tubes Thermal Conductivity		381,000 **	

Let's see, how the Design modality operates.

File Calculate Charts and tables Unit measure Standard Conditions Customize Projects Archive management Tools ? Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\Prog...\Heating.c6prj * ... \DirectExpansion.c6prj

Heating

Calculation Mode

☐ Verify Parameters

☒ Design

Geometry

Tube

Fin

Manifolds

Air Side Details

Output

Exchange Surface

m² 159,773

Project Description

No Warning ☒

Coil price (€) 0,00

Calculate **Print**

AIR SIDE

Capacity kW **195,37**

Airflow m³/h 16200

Face Velocity m/s 2,5

Inlet Temperature DB °C 20

Inlet Relative Humidity % 50

Outlet Temperature DB °C **55,7**

Outlet Relative Humidity % **7,1**

Fouling factor (m² K)/W 0

Pressure Drop Pa 45

N° tubes for row 20

Rows 4

Fin Pitch mm (2) 2,50

Nr of Skipped Tubes 0

Obt.

TUBE SIDE

Fluid WATER (PL)

Pressure bar A 1

Inlet Temperature °C 80

Outlet Temperature °C 70

Pressure Drop kPa 80,61

Fouling factor (m² K)/W 0

Fluid Velocity m/s 2,64

Finned Length mm (2) 1500

Circuits 10

Baffles n° 0

where on “Air Side” we can see “Pressure Drop ” measured in Pa, as calculation’s result.

Pressure Drop Pa 45

in the “Tubes Side” We can see “Pressure Drop” measured in kPa, as calculation’s result.

Pressure Drop kPa 80,61

Clicking on “i” we can see an information about calculated pressure drop

Details of calculated pressure drops

Value	Press. Drop	Fluid Vel.
Unit measure	kPa	m/s
Coil	80,61	2,64
Inlet Manifold	n/a	n/a
Outlet Manifold	n/a	n/a
Total	80,61	

Exit

- We hit the “Design” button and obtain the following, where you should set the tolerances and the required capacity

- We click on “Calculate” button

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where we can see a list of all possible coils chosen by software and based on the inserted Capacity value:

Rows	Fin Pitch mm (2)	Circuits	Capacity kW	Delta (%)	Outlet Temperature °C	Air press. drop Pa	Fluid press. drop kPa	Fluid Velocity m/s
3	1,7	60	169,81	13,2	51	43	0,29	0,38
3	1,8	60	164,43	9,62	50	42	0,27	0,37
3	1,92	60	158,42	5,62	48,9	40	0,25	0,36
3	2	20	177,93	18,62	52,5	39	7,3	1,2
3	2,1	12	178,04	18,69	52,5	38	30,65	2,01
3	2,11	8	179,61	19,74	52,8	38	89,83	3,04
3	2,3	8	170,29	13,53	51,1	36	81,79	2,88
3	2,4	8	165,77	10,51	50,3	35	78,01	2,8
3	2,5	8	161,49	7,66	49,5	34	74,51	2,73
3	2,54	8	159,84	6,56	49,2	34	73,17	2,7
3	2,8	8	149,93	-0,05	47,4	32	65,38	2,53
3	3	8	143,14	-4,57	46,2	31	60,27	2,42
4	2,1	80	179,45	19,64	52,8	50	0,19	0,3
4	2,11	80	179,01	19,34	52,7	50	0,19	0,3
4	2,3	80	170,89	13,93	51,2	48	0,17	0,29
4	2,4	80		11,28	50,5	47	0,17	0,28
4	2,5	80	163,13	8,75	49,8	45	0,16	0,28
4	2,54	80	161,66	7,77	49,5	45	0,16	0,27
4	2,8	16	179,94	19,96	52,9	43	18,82	1,52

- In this table we can see some fields relative to the coils geometries

Rows	Fin Pitch mm (2)	Circuits	Capacity kW
3	2,3	8	170,29
3	1,7	60	169,81
4	2,4	80	166,91
3	2,4	8	165,77
3	1,8	60	164,43
4	2,5	80	163,13
2	1,6	8	161,96
4	2,54	80	161,66
3	2,5	8	161,49
3	2,54	8	159,84
3	1,92	60	158,42
2	1,7	8	155,59
3	2,8	8	149,93
2	1,8	8	149,71
2	1,92	8	143,23

- Delta stands for the percentage difference from the capacity we are seeking.

Delta (%)
13,53
13,2
11,28
10,51
9,62
8,75
7,97
7,77
7,66
6,56
5,62
3,73
-0,05
-0,2
-4,52

- the remaining fields are about the air and fluid side variables

Outlet Temperature	Air press. drop	Fluid press. drop	Fluid Velocity
°C	Pa	kPa	m/s
51,1	36	81,79	2,88
51	43	0,29	0,38
50,5	47	0,17	0,28
50,3	35	78,01	2,8
50	42	0,27	0,37
49,8	45	0,16	0,28
49,6	30	52,98	2,74
49,5	45	0,16	0,27
49,5	34	74,51	2,73
49,2	34	73,17	2,7
48,9	40	0,25	0,36
48,4	29	49,37	2,63
47,4	32	65,38	2,53
47,4	28	46,1	2,53
46,2	27	42,65	2,42

- The highlighted row shows chosen coil, that fits best the capacity sought.

3	2,8	8	149,93	-0,05	47,4	32	65,38	2,53
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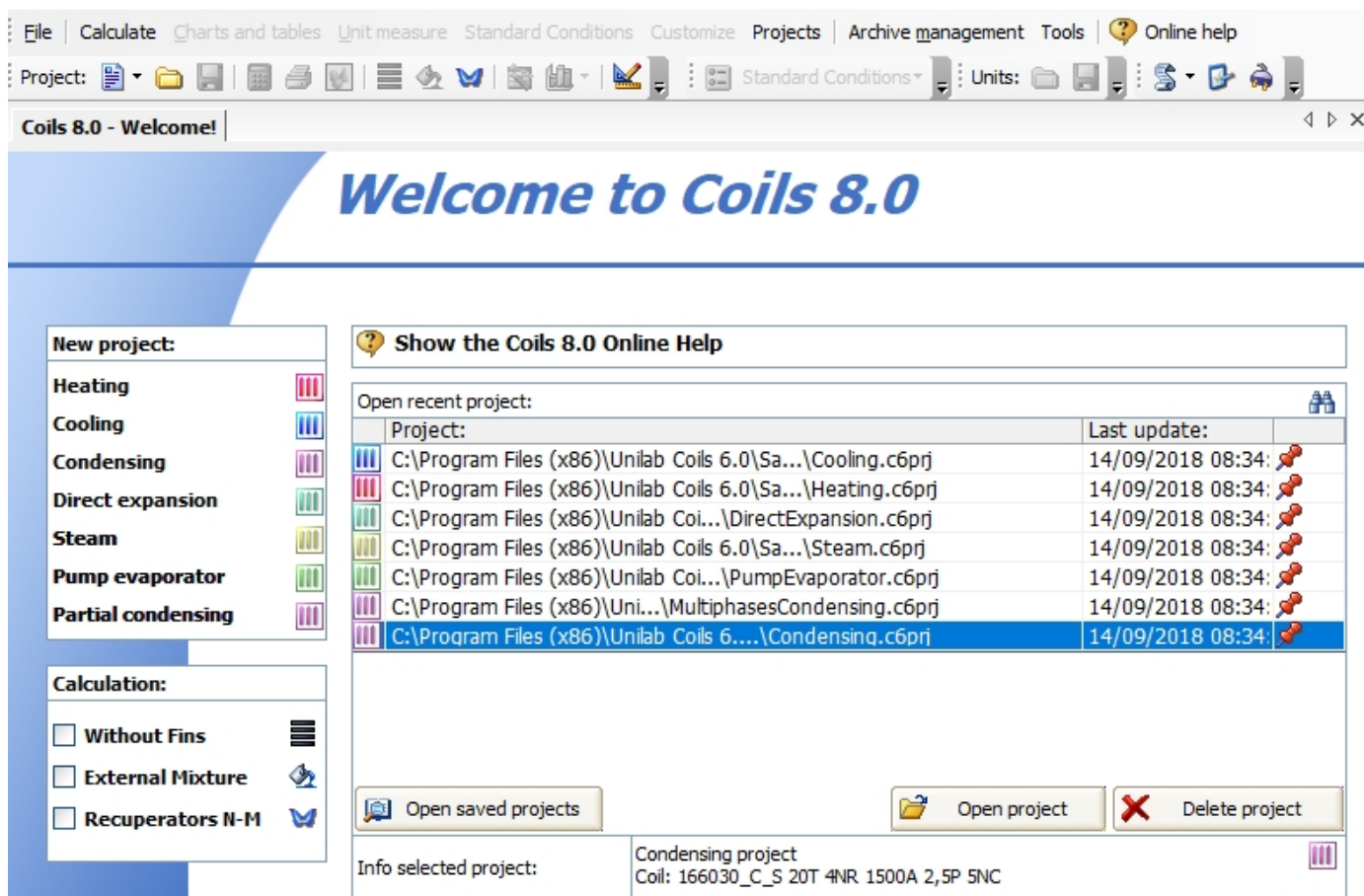
Condensing Example



Condensing Example

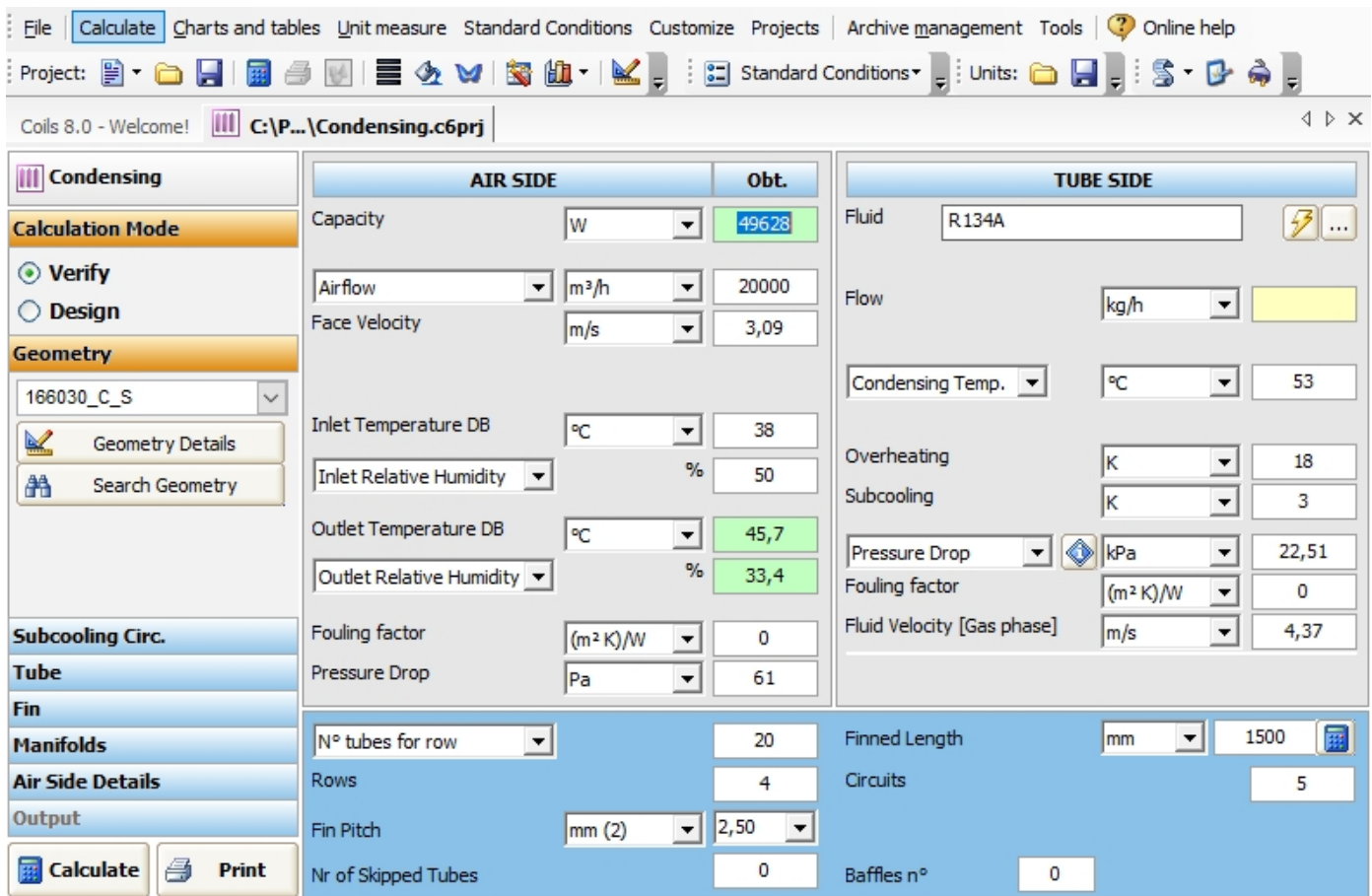
To open the Condensing calculation example

- Click on “Condensing.c6prj” file under the “Open recent project” area



The screenshot shows the UNILAB Coils 8.0 software interface. The top menu bar includes File, Calculate, Charts and tables, Unit measure, Standard Conditions, Customize, Projects, Archive management, Tools, and Online help. Below the menu bar is a toolbar with various icons for file operations and calculations. The main window displays a "Welcome to Coils 8.0" message. On the left side, there is a "New project:" section with icons for Heating, Cooling, Condensing, Direct expansion, Steam, Pump evaporator, and Partial condensing. Below this is a "Calculation:" section with checkboxes for "Without Fins", "External Mixture", and "Recuperators N-M". On the right side, there is a "Show the Coils 8.0 Online Help" button and a table titled "Open recent project:". The table lists several project files, including "C:\Program Files (x86)\Unilab Coils 6.0\Sa...\Cooling.c6prj", "C:\Program Files (x86)\Unilab Coils 6.0\Sa...\Heating.c6prj", "C:\Program Files (x86)\Unilab Coils 6.0\Sa...\DirectExpansion.c6prj", "C:\Program Files (x86)\Unilab Coils 6.0\Sa...\Steam.c6prj", "C:\Program Files (x86)\Unilab Coils 6.0\Sa...\PumpEvaporator.c6prj", "C:\Program Files (x86)\Unilab Coils 6.0\Sa...\MultiphasesCondensing.c6prj", and "C:\Program Files (x86)\Unilab Coils 6.0\Sa...\Condensing.c6prj". The "Condensing.c6prj" file is highlighted. Below the table are buttons for "Open saved projects", "Open project", and "Delete project". At the bottom, there is a section titled "Info selected project:" which shows "Condensing project" and "Coil: 166030_C_S 20T 4NR 1500A 2,5P SNC".

- Double click on the file `C:\Programmi\Unilab Coils 6.0\SamplePro...\Condensing.c6prj`



The screenshot shows the UNILAB Coils software interface. The 'Calculate' button is highlighted in the top menu. The 'Condensing' calculation mode is selected. The 'AIR SIDE' parameters are set as follows:

Parameter	Unit	Value
Capacity	W	49628
Airflow	m³/h	20000
Face Velocity	m/s	3,09
Inlet Temperature DB	°C	38
Inlet Relative Humidity	%	50
Outlet Temperature DB	°C	45,7
Outlet Relative Humidity	%	33,4
Fouling factor	(m² K)/W	0
Pressure Drop	Pa	61

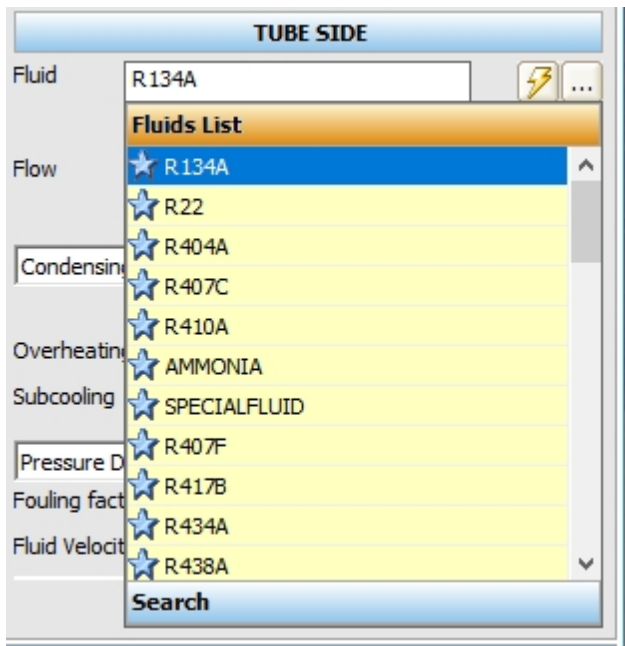
The 'TUBE SIDE' parameters are set as follows:

Parameter	Unit	Value
Fluid		R134A
Flow	kg/h	
Condensing Temp.	°C	53
Overheating	K	18
Subcooling	K	3
Pressure Drop	kPa	22,51
Fouling factor	(m² K)/W	0
Fluid Velocity [Gas phase]	m/s	4,37

The 'Geometry' section shows the following parameters:

Parameter	Value
N° tubes for row	20
Rows	4
Fin Pitch	mm (2) 2,50
Nr of Skipped Tubes	0
Finned Length	mm 1500
Circuits	5
Baffles n°	0

“Fluid” in this example is R134a, but there is a wide range of fluids



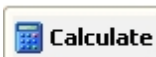
The screenshot shows the 'Fluids List' dialog box. The 'Fluid' field is set to 'R134A'. The 'Flow' field is set to 'Condensing'. The 'Overheating' field is set to '18'. The 'Subcooling' field is set to '3'. The 'Pressure Drop' field is set to '22,51'. The 'Fouling factor' field is set to '0'. The 'Fluid Velocity' field is set to '4,37'. The 'Fluids List' shows a list of fluids with a search bar at the bottom.

- “Flow”

As we stated in the introduction, our program is able to perform two types of calculation “Verify” and “Design”

Since in this example we have all the working conditions, we work in Verify mode, in which the user can rate the power and the pressure drop, knowing all the geometrical parameters of the exchanger and the working

conditions, changing one or more input variables at the same time (for example: geometry, inlet air temperature and humidity, fluid, fin thickness, fin type, tube type, fluid temperatures etc.)



- Now we simply click on “Calculate” button

Unilab Coils 8.0 ev - build 180912[E]

File | Calculate | **Charts and tables** | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | ? Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\P...\Condensing.c6prj *

Condensing		AIR SIDE		Obt.	TUBE SIDE	
Calculation Mode		Capacity	W	49629	Fluid	R134A
<input checked="" type="radio"/> Verify <input type="radio"/> Design		Airflow	m³/h	20000	Flow	kg/h 1024
Geometry		Face Velocity	m/s	3,09	Condensing Temp.	°C 53
Subcooling Circ.		Inlet Temperature DB	°C	38	Overheating	K 18
Tube		Inlet Relative Humidity	%	50	Subcooling	K 3
Fin		Outlet Temperature DB	°C	45,7	Pressure Drop	kPa 22,51
Manifolds		Outlet Relative Humidity	%	33,4	Fouling factor	(m² K)/W 0
Air Side Details		Fouling factor	(m² K)/W	0	Fluid Velocity [Gas phase]	m/s 4,37
Output		Pressure Drop	Pa	61		
Exchange Surface m² 159,773		N° tubes for row		20	Finned Length	mm 1500
Project Description Trial		Rows		4	Circuits	5
No Warning		Fin Pitch	mm (2)	2,50	Baffles n°	0
Coil price (€) 0,00		Nr of Skipped Tubes		0		
<input type="button" value="Calculate"/> <input type="button" value="Print"/>						

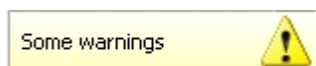
where the “Capacity air Side” is calculated

AIR SIDE		Obt.
Capacity	W	49629

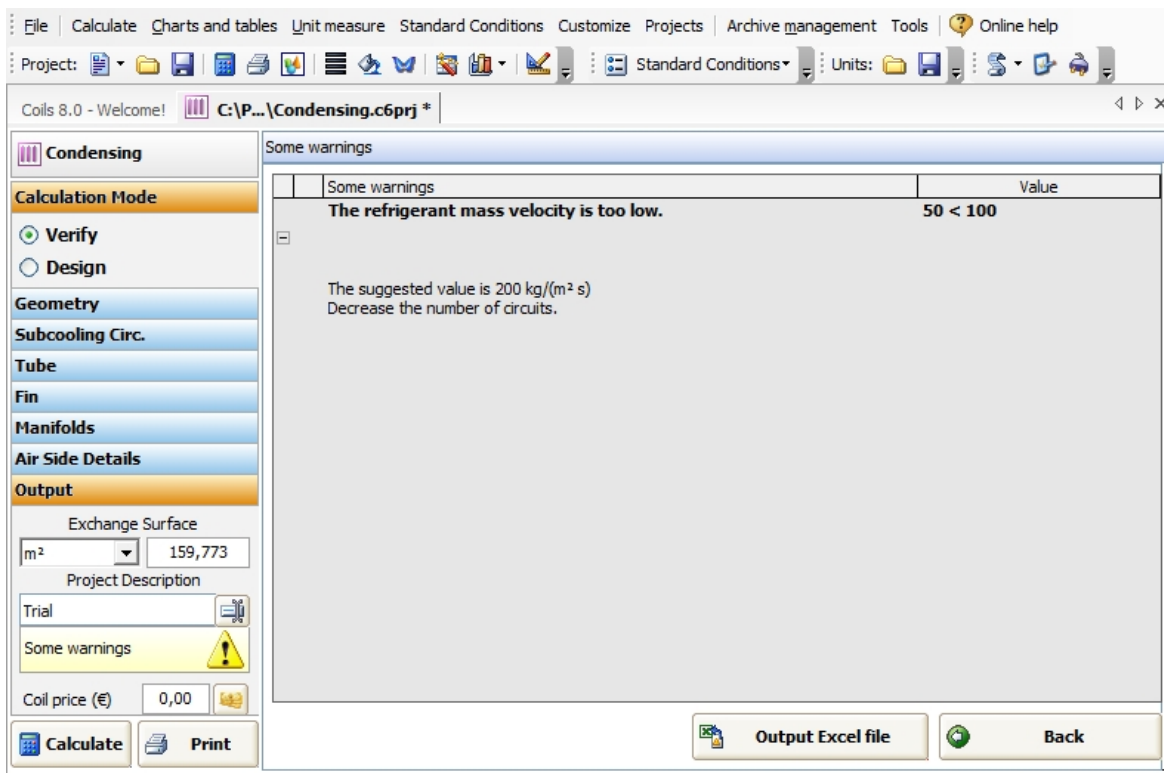
in the “Output” Area the exchange surface is calculated


Output	
Exchange Surface	m² 159,773

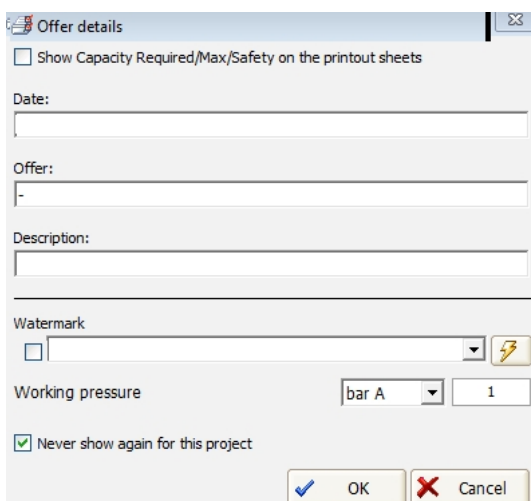
In this case, we see some warnings.



- By clicking on the warning message, in the previous version the messages were based on the fluid velocity, we have added as variable refrigerant mass velocity.



- Now to see the output results of our calculation, let's click on  button



SUBCOOLING CIRCUIT IN CONDENSING MODALITY EXAMPLE

SUBCOOLING CIRCUIT IN CONDENSING MODALITY EXAMPLE

In Coils, in the Condensing modality, it is possible to calculate the subcooling circuit. To do so, let's see this example.

Let's open the existing project in condensing modality in Coils

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\P...\Condensing.c6prj

AIR SIDE		Obt.	TUBE SIDE	
Capacity	kW	49,628	Fluid	R134A
Airflow	m³/h	20000	Flow	kg/h
Face Velocity	m/s	3,09	Condensing Temp.	°C 53
Inlet Temperature DB	°C	38	Overheating	K 18
Inlet Relative Humidity	%	50	Subcooling	K 3
Outlet Temperature DB	°C	45,7	Pressure Drop	kPa 22,51
Outlet Relative Humidity	%	33,4	Fouling factor	(m² K)/W 0
Fouling factor	(m² K)/W	0	Fluid Velocity [Gas phase]	m/s 4,37
Pressure Drop	Pa	61		
N° tubes for row	20	Finned Length	mm 1500	
Rows	4	Circuits	5	
Fin Pitch	mm (2) 2,50	Baffles n°	0	
Nr of Skipped Tubes	0			

Subcooling Circ. Tube Fin Manifolds Air Side Details Output Calculate Print

This refers to a coils without subcooling circuit. To do its calculation, we can click on the “Subcooling Circ.”

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\P...\Condensing.c6prj

AIR SIDE		Obt.	TUBE SIDE	
Capacity	kW	49,628	Fluid	R134A
Airflow	m³/h	20000	Flow	kg/h
Face Velocity	m/s	3,09	Condensing Temp.	°C 53
Inlet Temperature DB	°C	38	Overheating	K 18
Inlet Relative Humidity	%	50	Subcooling	K 0
Outlet Temperature DB	°C	45,7	Pressure Drop	kPa 22,51
Outlet Relative Humidity	%	33,4	Fouling factor	(m² K)/W 0
Fouling factor	(m² K)/W	0	Fluid Velocity [Gas phase]	m/s 4,37
Pressure Drop	Pa	61		
N° tubes for row	20	Finned Length	mm 1500	
Rows	4	Circuits	5	
Fin Pitch	mm (2) 2,50	Baffles n°	0	
Nr of Skipped Tubes	0			

Subcooling Circ. N° tubes for row 0 Rows 0 Circuits 0 Tube Fin Manifolds Air Side Details Output Calculate Print

Then we can insert the data relative to the subcooling part, which are: “N° tubes for row”, “Rows” and the “Circuits”, which are the input values, as we can see in the following screen.

Geometry

Subcooling Circ.

☒ Subcooling Circ.

N° tubes for row 10

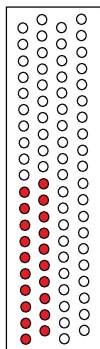
Rows 2

Circuits 2

In that example, configuration of the coil could be the following:

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Where the subcooling circuit is composed by the red coloured tubes.
Then we click on “calculate” to obtain the capacity of the subcooling circuit.

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | ? Online help

Project: [Standard Conditions] Units: [Standard Conditions]

Coils 8.0 - Welcome! C:\P...\Condensing.c6prj *

Condensing		AIR SIDE		Obt.	TUBE SIDE	
Calculation Mode		Capacity		kW	21,7	
<input checked="" type="radio"/> Verify		Airflow		m³/h	20000	
<input type="radio"/> Design		Face Velocity		m/s	3,09	
Geometry		Inlet Temperature DB		°C	38	
Subcooling Circ.		Inlet Relative Humidity		%	50	
<input checked="" type="checkbox"/> Subcooling Circ.		Outlet Temperature DB		°C	44,7	
N° tubes for row		Outlet Relative Humidity		%	35,1	
Rows		Fouling factor		(m² K)/W	0	
Circuits		Pressure Drop		Pa	61	
Circ. Capacity kW		N° tubes for row			20	
2,58		Rows			4	
Tube		Fin Pitch		mm (2)	2,50	
Fin		Nr of Skipped Tubes			0	
Manifolds		Finned Length		mm	1500	
Air Side Details		Circuits			5	
Output		Baffles n°			0	
<input checked="" type="button"/> Calculate						
<input type="button"/> Print						

Fluid: R134A

Flow: kg/h 448

Condensing Temp.: °C 53

Overheating: K 18

Subcooling: K 14,6

Pressure Drop: kPa 4,63

Fouling factor: (m² K)/W 0

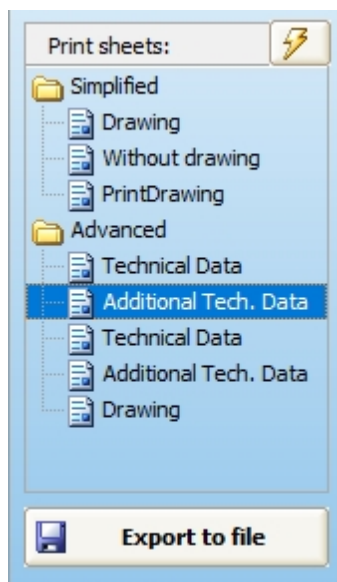
Fluid Velocity [Gas phase]: m/s 1,91

We can see our results in

Circ. Capacity kW **2,58**

Then we can go to print to see the printout templates.

To see the data relative to the subcooling part please refer to the Advanced Print Sheets, then to the first Technical Data and Additional Tech. Data.



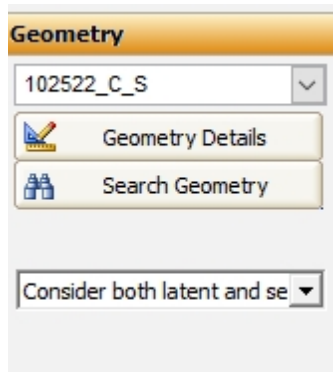
REFRIGERANT SIDE		
Fluid		R134A
Mass Fluid Flow	448	kg/h
Fluid Velocity (Gaseous Phase)	1,91	m/s
Fluid Velocity (Liquid Phase)	0,13	m/s
Mass velocity	137	kg/(m ² s)
SubCooling	3,0	K
Desuperheating	18,0	K
Condensing Temperature	53,0	°C
Fluid Pressure Drop	2,60916	kPa
Manifold Pressure Drop	0	kPa
Total Pressure Drop Fluid Side	2,60916	kPa
Partial Exchange Coefficient	1513	W/(m ² K)
Fouling Factor	0,000000	(m ² K)/W

Geometry Section

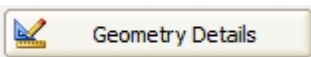
Geometries Details

Geometry Details

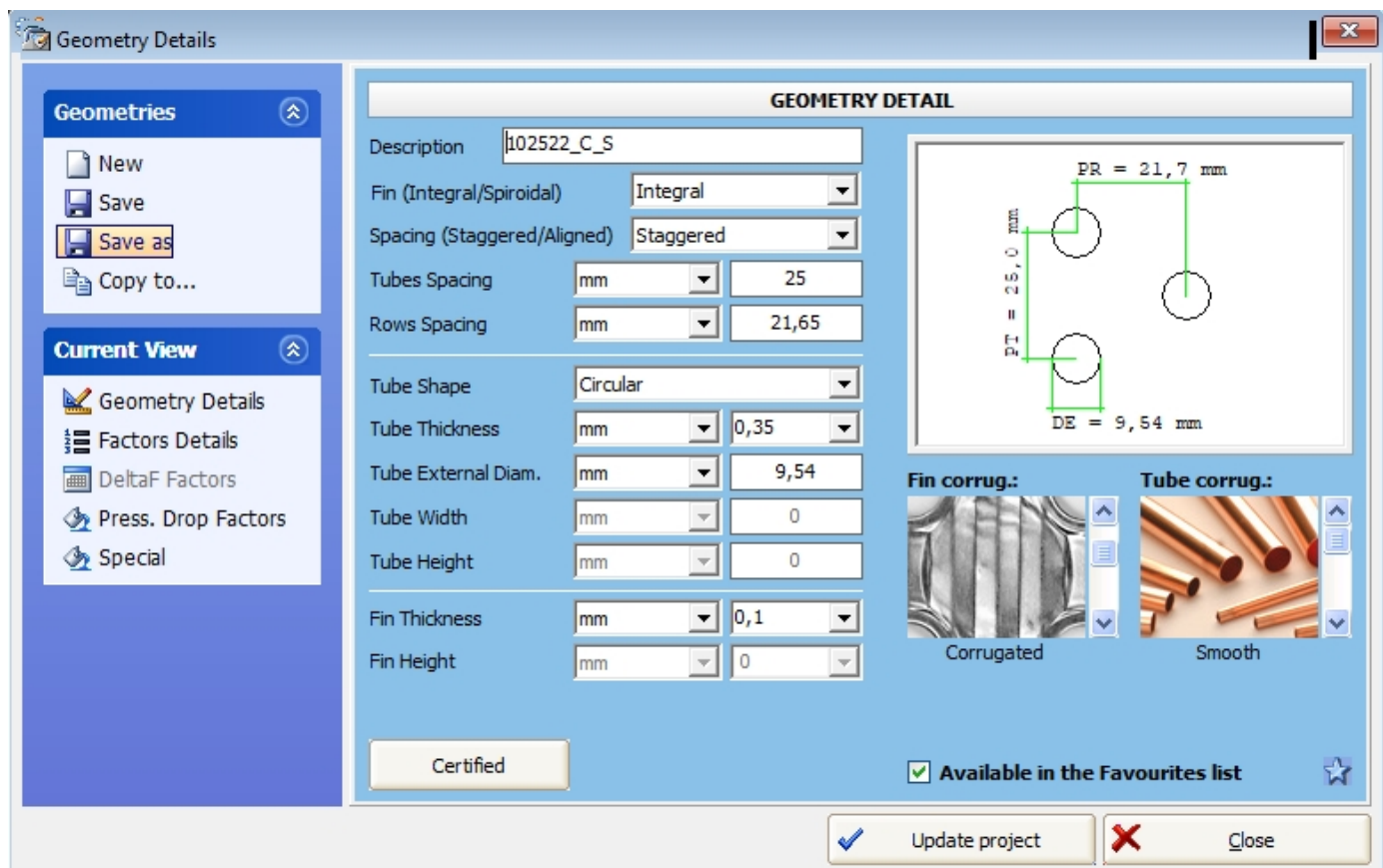
In the Geometry section of the left part of the mask



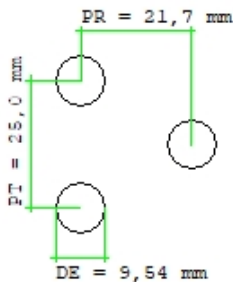
push the button



to see the details of the selected geometry (in this example the 102522_C_S):



Where we can see the Geometry Drawing



Where

- "DE" stands for "External Diameter" of the coil
- "PT" stands for "Rows Spacing" of the coil
- "PR" stands for "Tubes Spacing" of the coil

we can also see Fin corrugation type in images:

- “Smooth” Fin corrugation

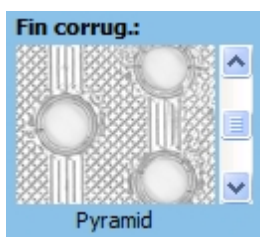


by scrolling down with the arrows, we can see the other corrugation types:

- “Corrugated” Fin corrugation



- “Pyramid” Fin corrugation



- “Windowed” Fin corrugation



- “Louvered” Fin corrugation



We can also see Tube corrugation type in images:

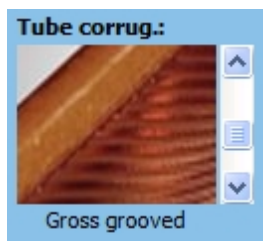
- “Smooth” Tube Corrugation



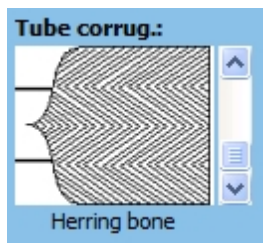
- “Microfin” Tube Corrugation



- “Gross Grooved” Tube Corrugation



- “Herring Bone” Tube Corrugation



We can also see the Description and other geometry details:

Description	102522_C_S	
Fin (Integral/Spiroidal)	Integral	
Spacing (Staggered/Aligned)	Staggered	
Tubes Spacing	mm	25
Rows Spacing	mm	21,65
Tube Shape	Circular	
Tube Thickness	mm	0,35
Tube External Diam.	mm	9,54
Tube Width	mm	0
Tube Height	mm	0
Fin Thickness	mm	0,1
Fin Height	mm	0

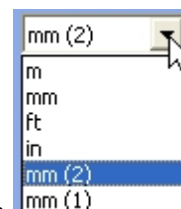
where

- "Description" is a string that identifies a geometry
 - the first two digits "10" stand the tube external diameter rounded
 - the third and fourth digits "25" stand for the Tubes Spacing
 - the fifth and the sixth digits "22" stand for the Rows Spacing rounded
 - the last two characters stand for the initial of Fin and Tube corrugation Type

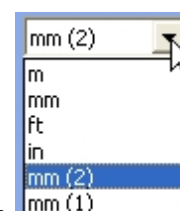
- "Fin" can be Integral or Spiroidal Fin (Integral/Spiroidal) Integral

- "Spacing" can be Staggered or Aligned Spacing (Staggered/Aligned) Staggered

- "Tube Spacing" Tubes Spacing mm 25 can be entered in mm (2) or even when We have entered a measure in one unit measure We can always transform it just by clicking on the unit We desire.



- "Fin Spacing" Rows Spacing mm 21,65 can be entered in mm (2).

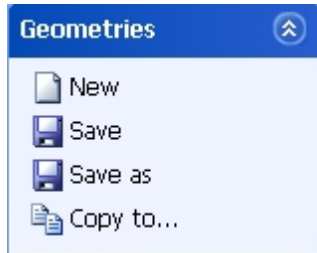


The other factors that we can set or see in Geometry Detail are:

- Tube Shape Tube Shape Circular which can be Rectangular
Circular
Rectangular
Rounded Rectangular
- Tubes Thickness Tube Thickness mm 0,35

- Tube External Diameter if the tubes are circular
- Tube Width and Tube Height if the tubes are rectangular
- Fin Thickness
- Fin Height

There is another area we can see:



This allows us to copy the geometry in other calculation modality, if we need it, after hitting the “Copy to...” button.

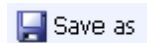
We have a place where we can select possible Coil operation mode to copy the geometry to.



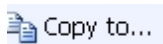
permits to add a new geometry.



permits only saving by default



permits to give a file name while saving the geometry



permits to copy a geometry from one treatment to the other

**** For further information about the geometries factors and theirs possible values, please see section “Geometry management” ****

New Geometry

New Geometry

Let's do an example of inserting a new geometry for DX-Coil

With :

External diameter	0.7 mm
Tube spacing	19.05 mm
Rows Spacing	16.5

- At following screen let's click on the “New” button

Geometry Details

Geometries

- New
- Save
- Save as
- Copy to...

Current View

- Geometry Details
- Factors Details
- DeltaF Factors
- Press. Drop Factors

GEOMETRY DETAIL

Description: 102512_S_S

Fin (Integral/Spiroidal): Integral

Spacing (Staggered/Aligned): Staggered

Tubes Spacing: mm (2) 25

Rows Spacing: mm (2) 12,5

Tube Shape: Circular

Tube Thickness: mm (2) 0,35

Tube External Diam.: mm (2) 9,54

Tube Width: mm (2) 0

Tube Height: mm (2) 0

Fin Thickness: mm (2) 0,1

Fin Height: mm (2) 0

Diagram: PR = 12,5 mm (2), PT = 25 mm (2), DE = 9,54 mm (2)

Fin corrug.: Smooth

Tube corrug.: Smooth

Certified

☒ Available in the Favourites list

☒ Update project ☐ Close

In the next screen we have two types of Coils, spiroidal and integral. We choose the integral one

Geometry Details

Geometries

- New
- Save
- Save as
- Copy to...

Current View

- Geometry Details
- Factors Details
- DeltaF Factors
- Press. Drop Factors
- Special

GEOMETRY DETAIL

Description: 102522_C_S

Fin (Integral/Spiroidal): Integral

Spacing (Staggered/Aligned): Staggered

Tubes Spacing: mm 25

Rows Spacing: mm 21,65

Tube Shape: Circular

Tube Thickness: mm 0,35

Tube External Diam.: mm 9,54

Tube Width: mm 0

Tube Height: mm 0

Fin Thickness: mm 0,1

Fin Height: mm 0

Diagram: PR = 21,7 mm, PT = 25,0 mm, DE = 9,54 mm

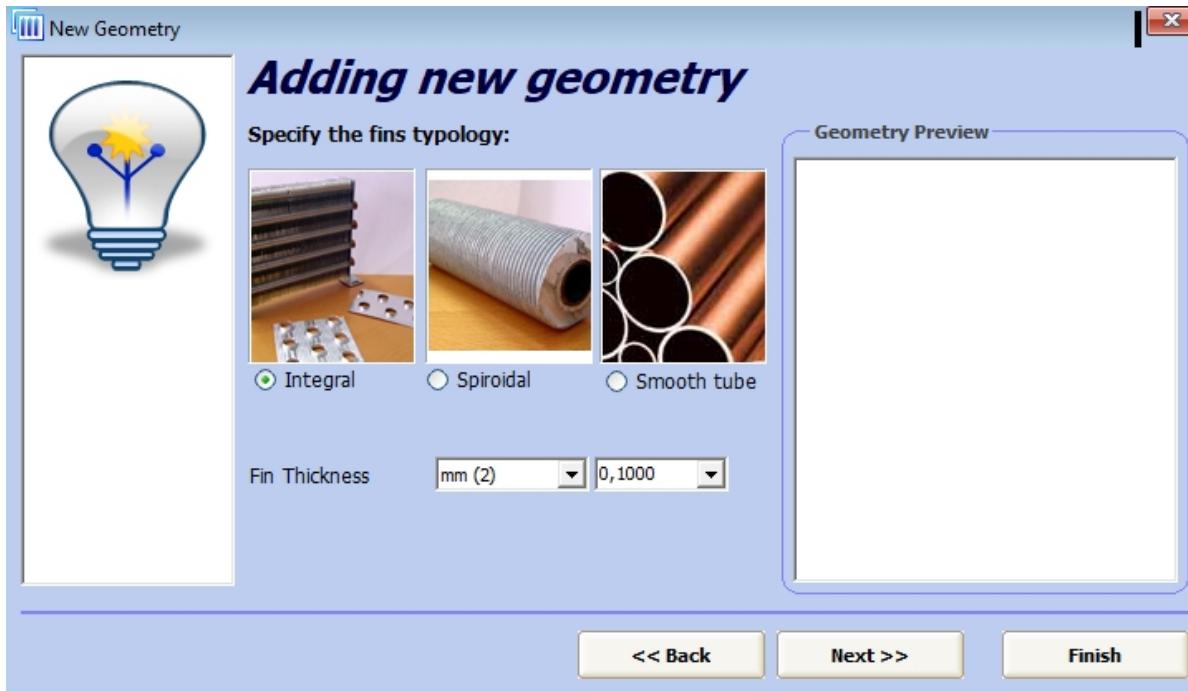
Fin corrug.: Corrugated

Tube corrug.: Smooth

Certified

☒ Available in the Favourites list

☒ Update project ☐ Close



Adding new geometry

Specify the fins typology:

☒ Integral
 ☐ Spiroidal
 ☐ Smooth tube

Fin Thickness: mm (2) 0,1000

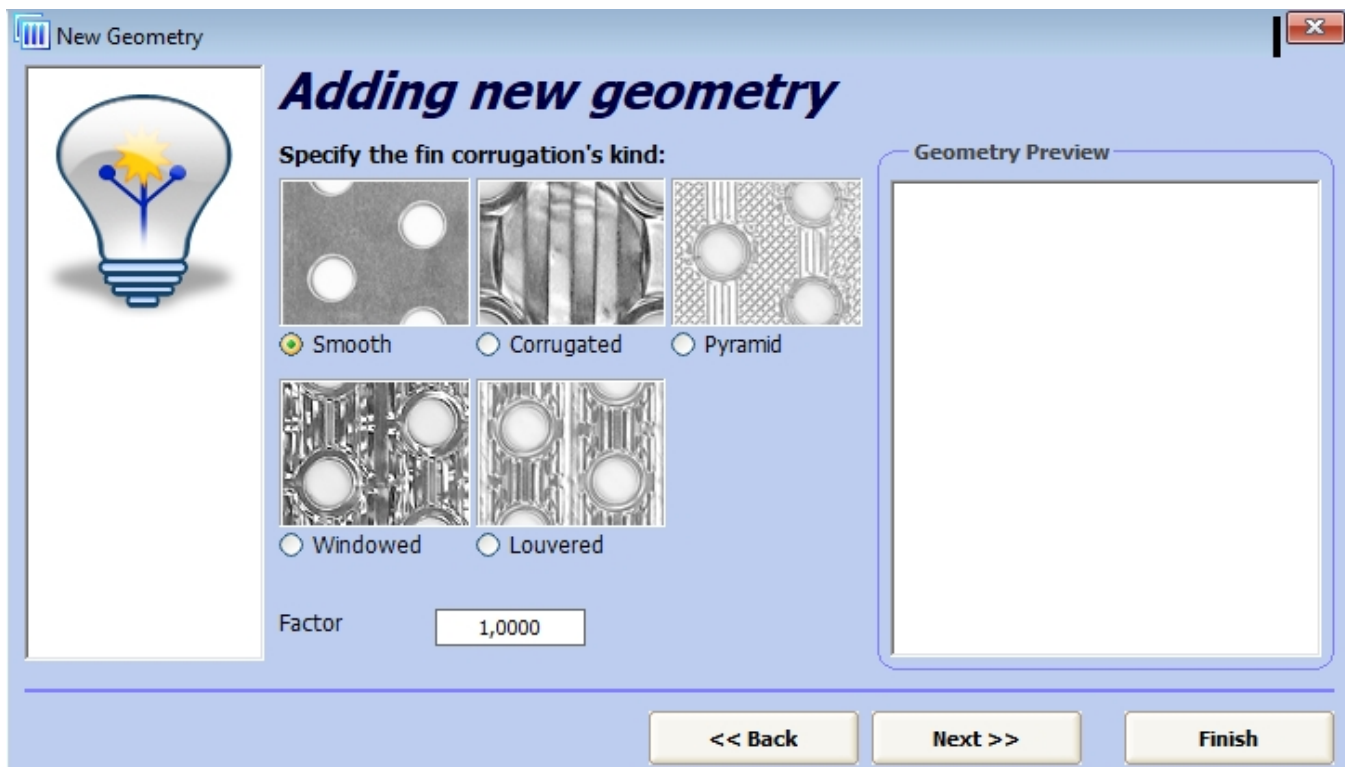
Geometry Preview

<< Back Next >> Finish

- Let's insert Fin Thickness at 0.1000

- Let's click on the "Next" button

Next >>



Adding new geometry

Specify the fin corrugation's kind:

☒ Smooth
 ☐ Corrugated
 ☐ Pyramid

☐ Windowed
 ☐ Louvered

Factor: 1,0000

Geometry Preview

<< Back Next >> Finish

- Let's choose the fin corrugation as "Smooth" and click on the "Next" button




New Geometry

Adding new geometry

Specify the tube alignment kind:

☒ Staggered
 ☐ Aligned

Specify these geometry data:

Tubes Spacing: mm (2) 0 
 Rows Spacing: mm (2) 0 
 Tube Shape: Circular
 Tube Thickness: mm (2) 0,2500
 Tube Ext. Diameter: mm (2) 0 
 Tube Width: mm (2) 0
 Tube Height: mm (2) 0

Geometry Preview

<< Back Next >> Finish

- Let's leave the tube alignment "Staggered" and click on the "Next" button after enter 7 mm as external diameter, 19,05 mm as tube thickness, 16,5 mm as rows spacing,

New Geometry

Adding new geometry

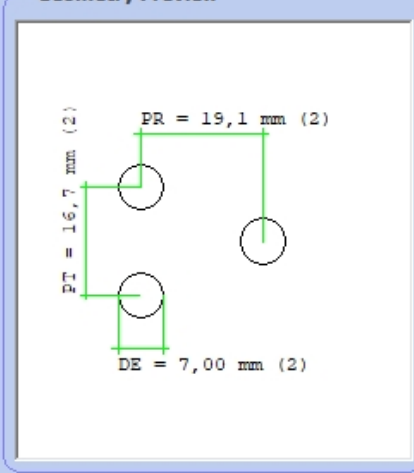
Specify the tube alignment kind:

☒ Staggered
 ☐ Aligned

Specify these geometry data:

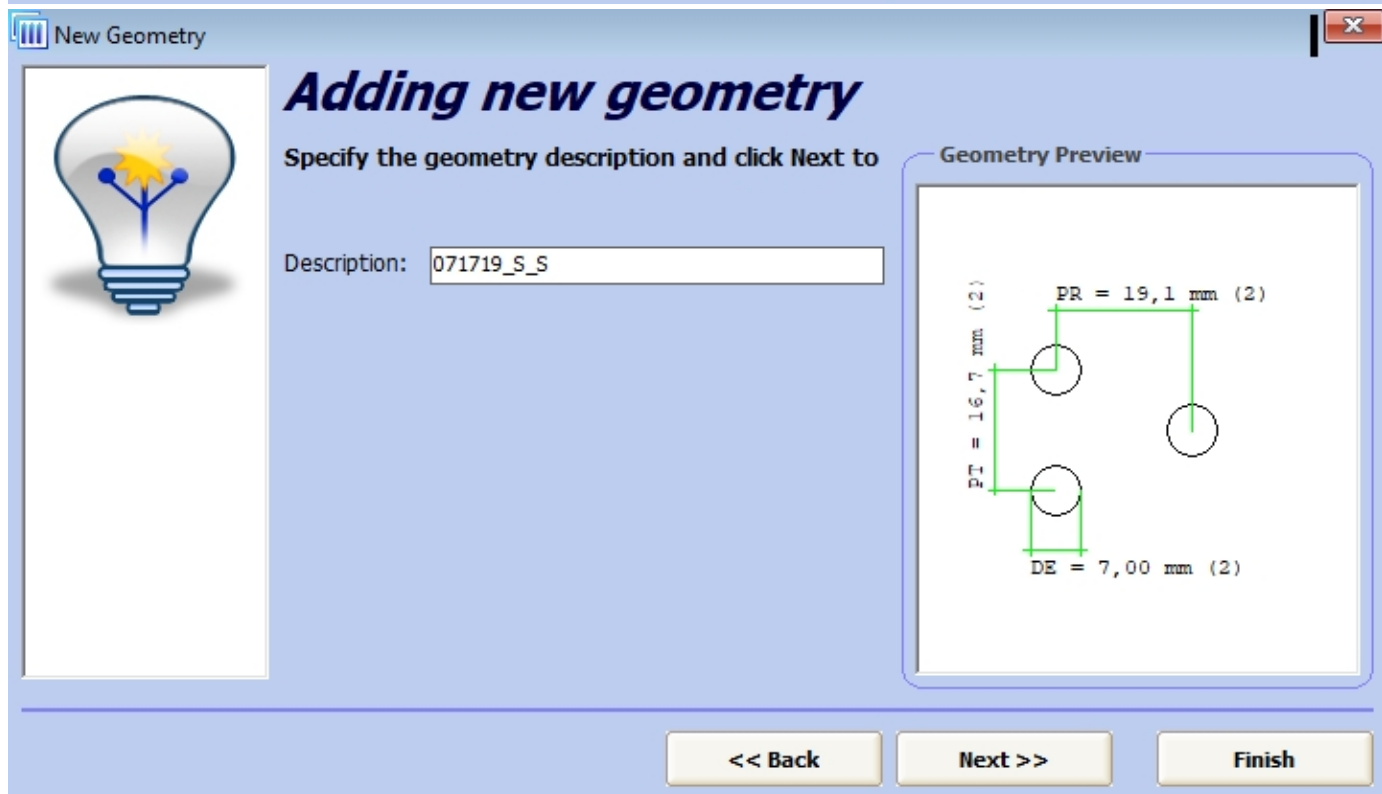
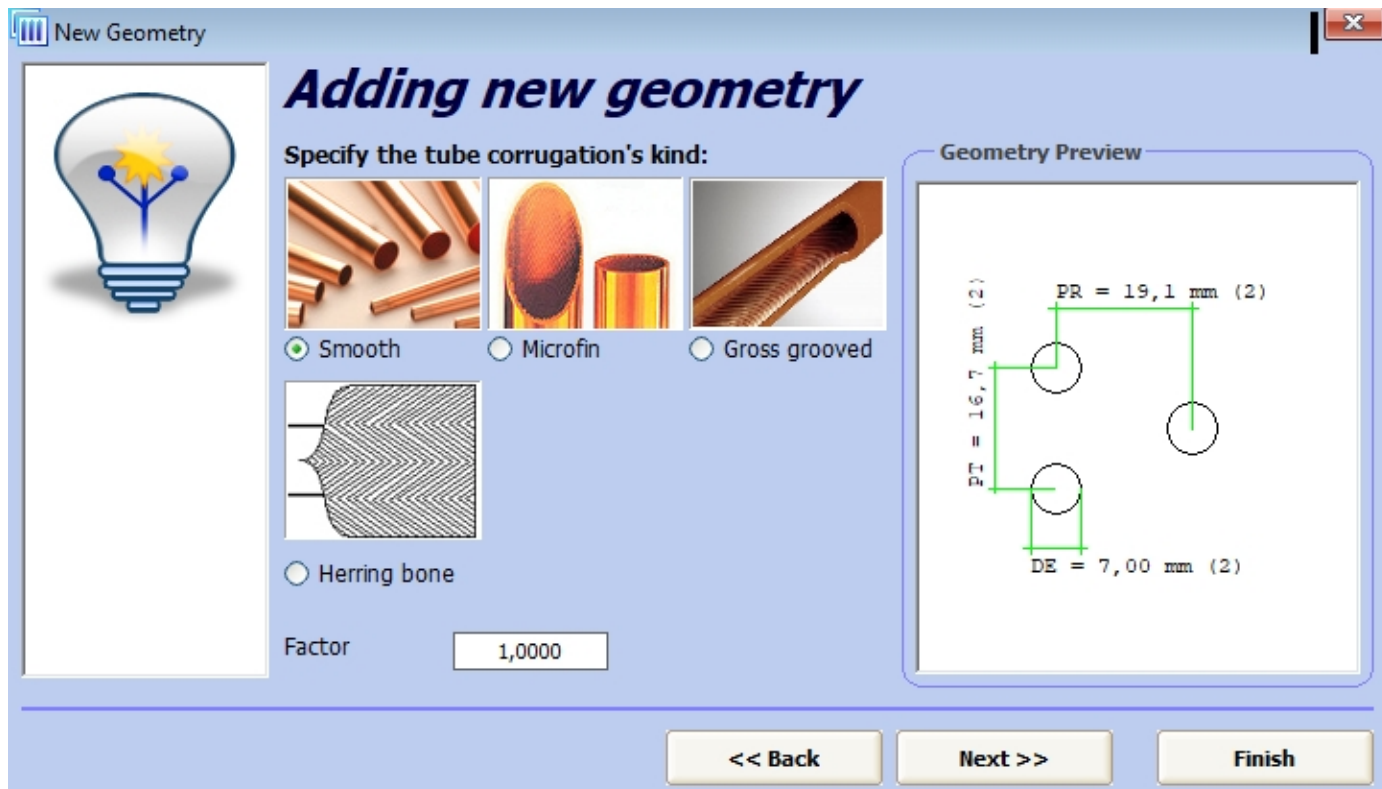
Tubes Spacing: mm (2) 16,7
 Rows Spacing: mm (2) 19,05
 Tube Shape: Circular
 Tube Thickness: mm (2) 0,2700
 Tube Ext. Diameter: mm (2) 7
 Tube Width: mm (2) 0
 Tube Height: mm (2) 0

Geometry Preview



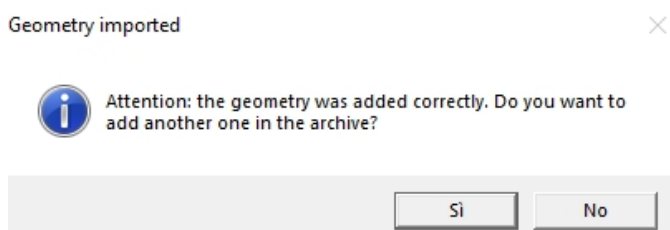
<< Back Next >> Finish

- After clicking on the "Next button", we specify the tube corrugation type at "Smooth" and then click to the "next" button again



Here we can see the description name given as explained in the previous paragraph.

- Clicking "Next" button again yields the following message



- In this case, we do not want to add another geometry, so we reply “No”

Warning



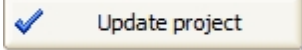
Do you want to use the new geometry in the specified project?

Si

No



Update project

- Then we choose “Yes”, click on  and geometry will be used in this project

As we can see, we have added a new Geometry. Now we can proceed with a Calculation.

- We then hit the calculate button and get the result

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! ... \DirectExpansion.c6prj *

Direct Expansion

Calculation Mode

☒ Verify
☐ Design

Geometry

Tube

Fin


Manifolds


Air Side Details

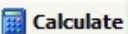
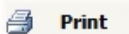
Output

Exchange Surface
m² 43,24522

Project Description
[Text Box]


No Warning 

Coil price (€) 0,00 

AIR SIDE		Total	Sensible
Capacity	W	69892	42597
Airflow	m ³ /h	10000	
Face Velocity	m/s	3,78	
Inlet Temperature DB	°C	30	
Inlet Relative Humidity	%	50	
Outlet Temperature DB	°C	17,1	
Outlet Relative Humidity	%	81,3	
Fouling factor	(m ² K)/W	0	
Pressure Drop	Pa	171	
N° tubes for row	40		
Rows	4		
Fin Pitch	mm (2) 2,50		
Nr of Skipped Tubes	0		

TUBE SIDE

Fluid R410A 


Flow kg/h 1437

Evaporating Temp. °C 2

Quality 0,2


Inlet press. of the valve kPa 0

Overheating K 0

Pressure Drop  kPa 128,78

Fouling factor (m² K)/W 0

Fluid Velocity [Gas phase] m/s 18,67

Finned Length mm 1100 

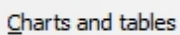
Circuits 20

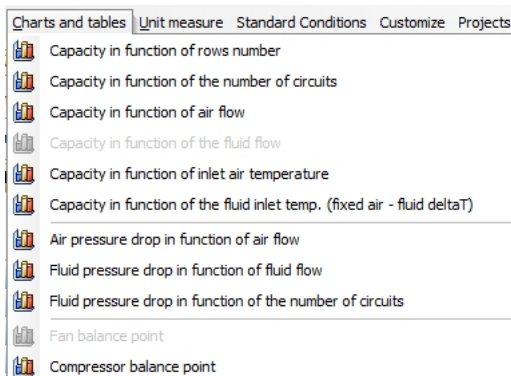
Baffles n° 0

CHARTS AND TABLES

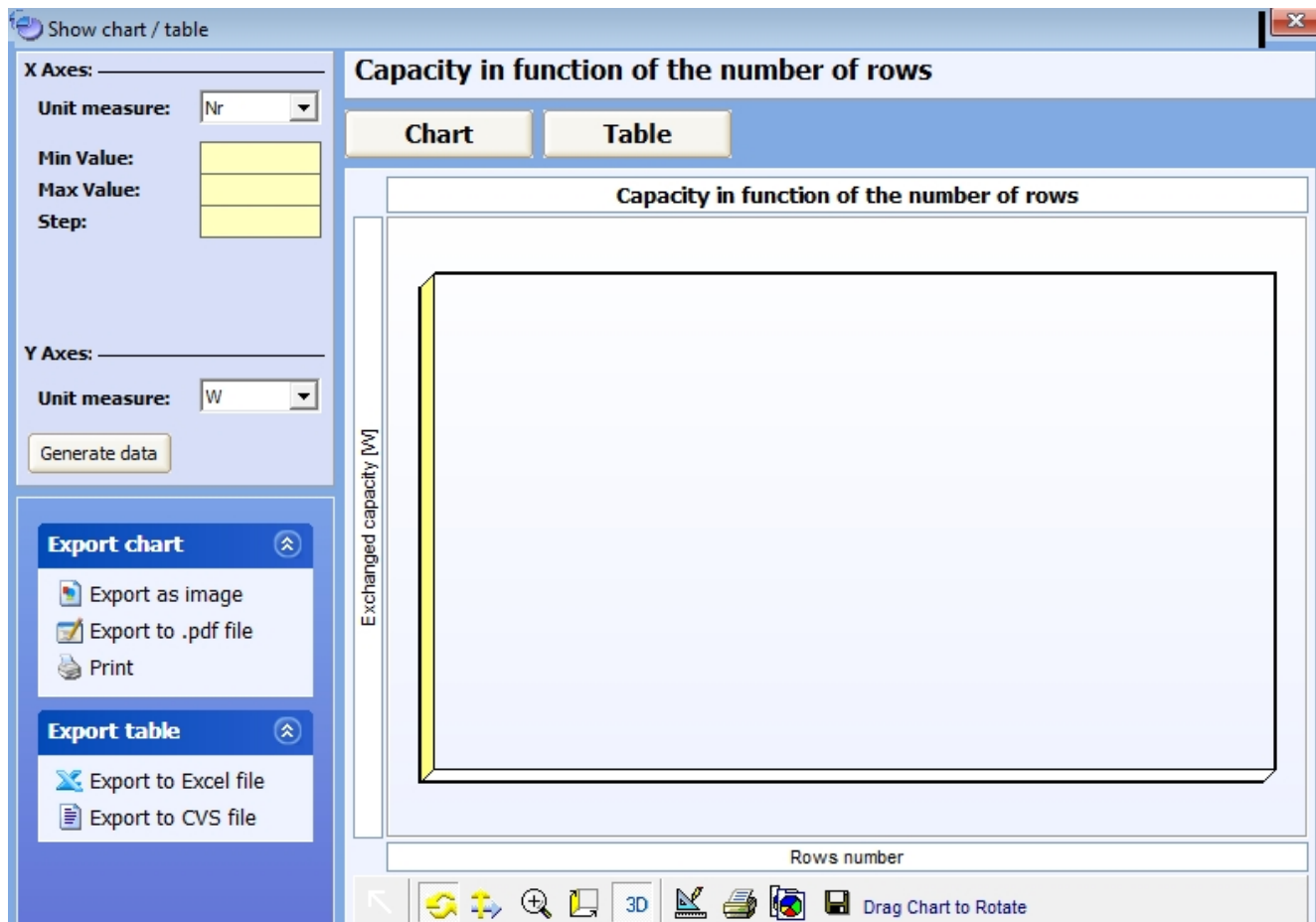
CHARTS AND TABLES

In this part, we will describe the part regarding charts and tables with examples.

- Let's Click on "Charts and Tables" menu  on the menu bar
- Let's click on "Capacity in function of rows number"



- A chart page opens



- On the x axis, we can set the number of Rows. In this example, we put the Min value 1, Max Value 10 and Step: 1

X Axes:

Unit measure: Nr

Min Value: 1

Max Value: 10

Step: 1

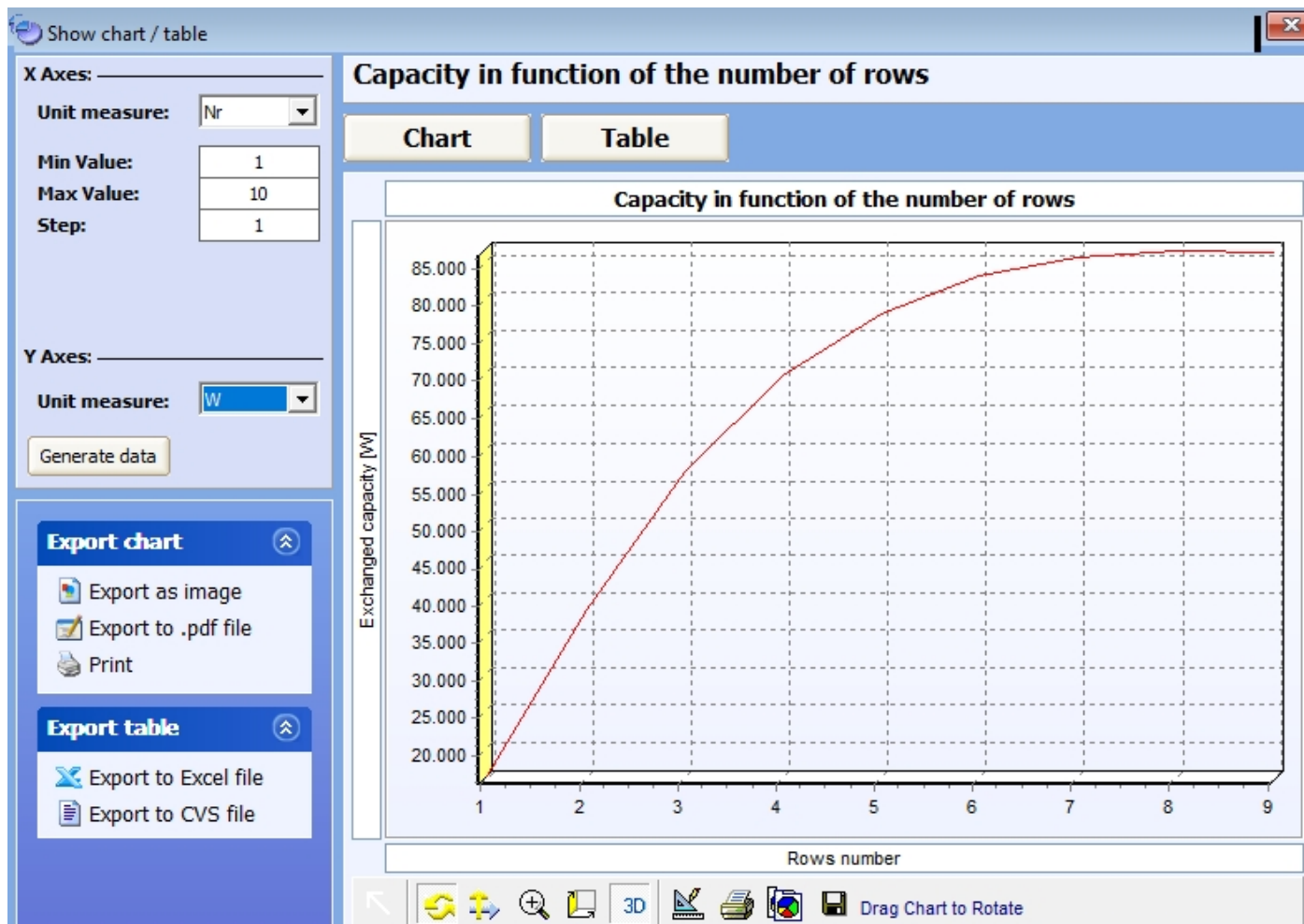
Y Axes:

Unit measure: W






Generate data


- Then we hit the “Generate data” button

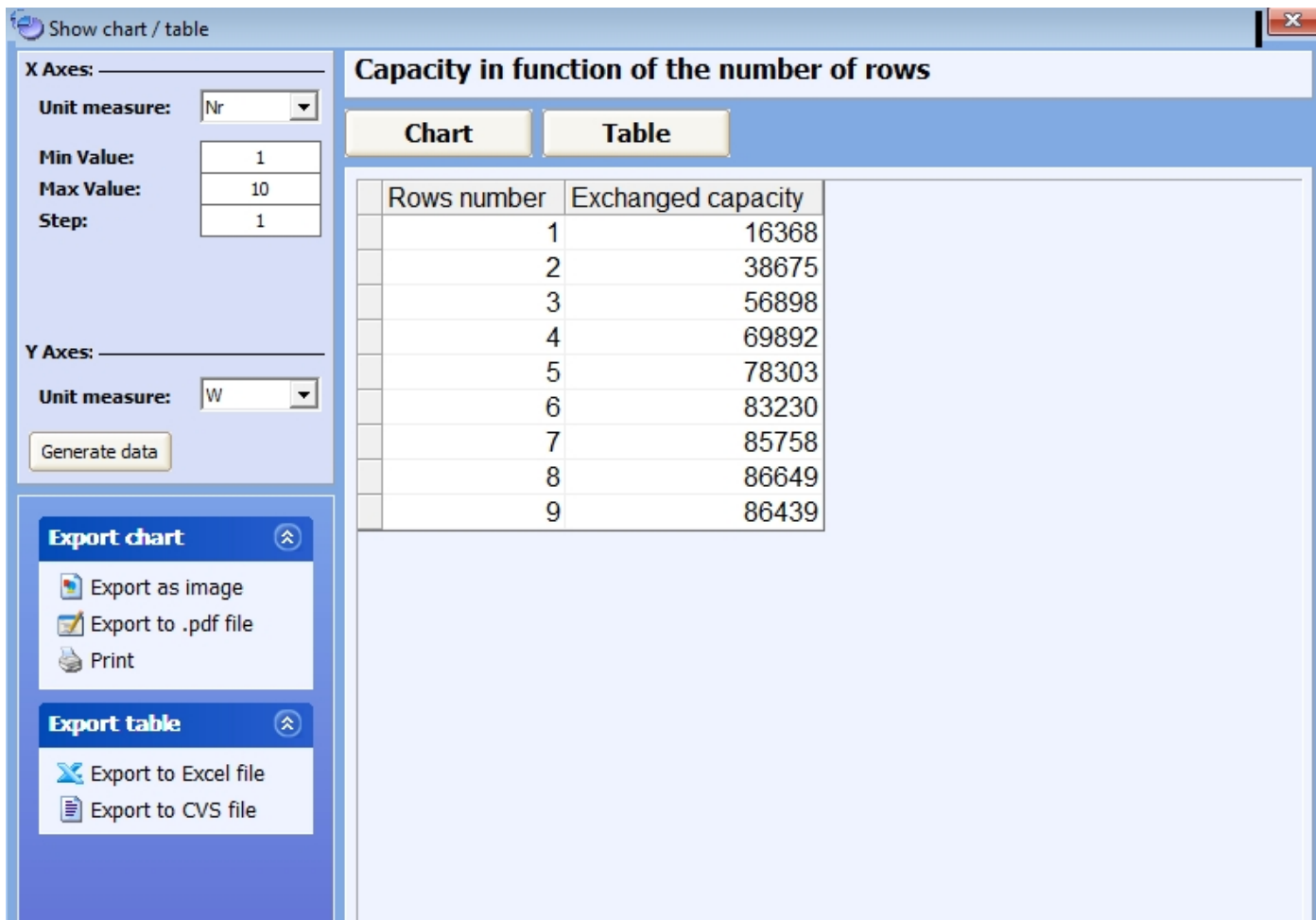
Generate data



- From the above image we see, that it's possible to:

- Export and Save the chart as Image  Export as image
- Export to .pdf file  Export to .pdf file
- Print the chart  Print
- Export the table to file excel  Export to Excel file or to cvs file  Export to CVS file

- Let's click on the "Table" button 



- To view another graph. Click on "Charts and Tables".




















We can follow the same procedures as above to get the other Graphs. The graphs balance point will be examined in a separate section.

CALCULATE MENU

MENU "CALCULATE"

Let's examine the Calculate Menu.

- Let's click on the "Calculate" Menu

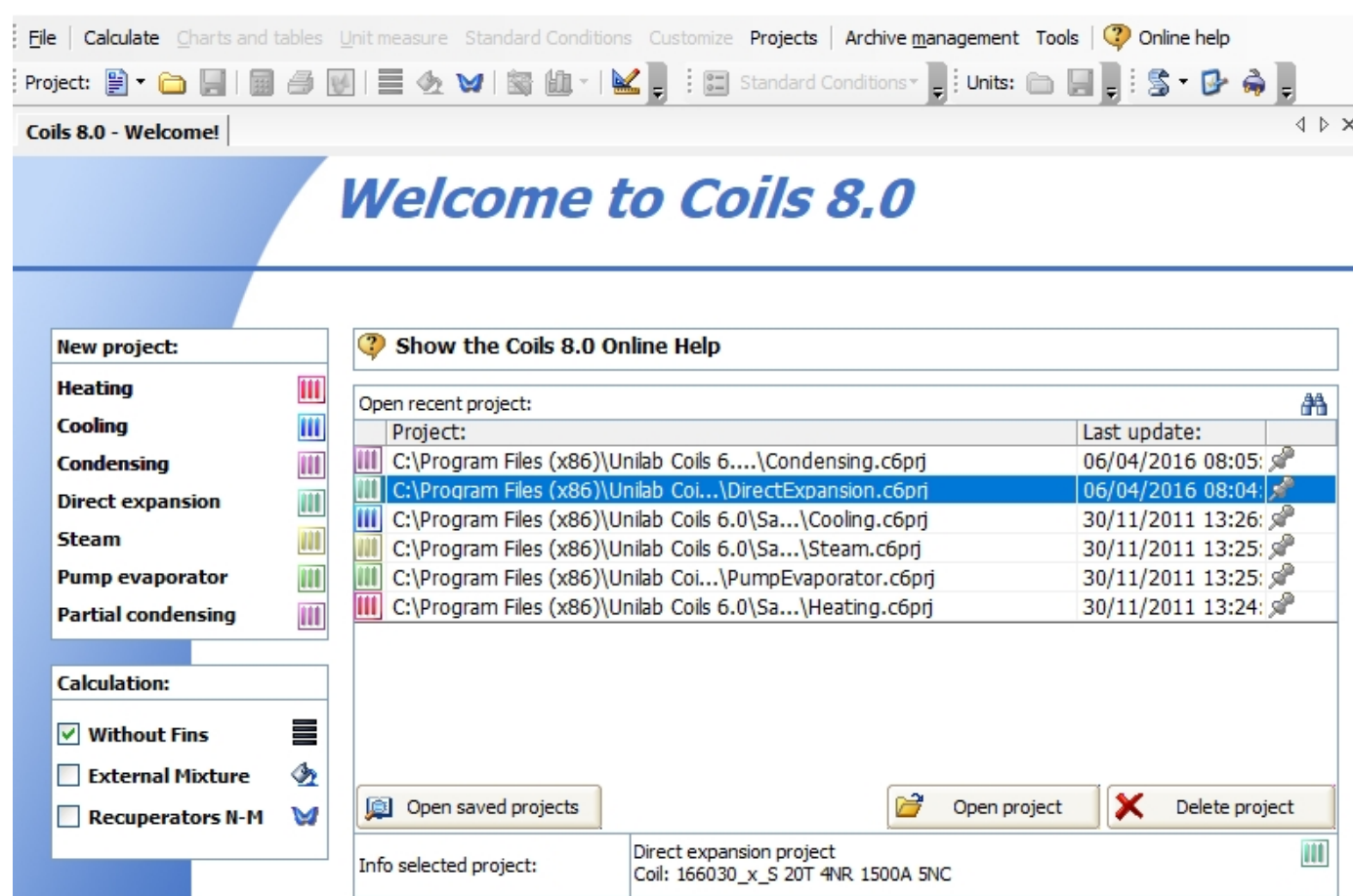
Calculate	Charts and tables	Unit measure	Stand
	Without Fins		F10
	External Mixture		F11
	Calculate	Ctrl+Invio	
	Details		F2
	Psychrometric chart		F3
	Pressure vs. Enthalpy plot:		F4
	Functional point on the PH diagram		F5
	Distributor selection		F6
	Line Pressure Drops		F7
	Recuperators - bFly		F12
	Catalogues Generator		
	Refr. Cycle Project		
	Add Coil to Heat Series		
	Reset Coil Heat Series		
	Heat Exchanger Series Calculation		
	Coil Price Calculation		F9
	Snapshot		
	Revert		
	Modify the Design Profile		F8

Without Fins

Without Fins

We have added (only in the Enterprise Edition) a possibility to calculate coils without fins, available in all the calculation modalities. The applications of this typology of coils are a lot, both on low and high temperatures (recuperator gas-gas both mono and multi crossing, painting rooms, coils for fluids with considerable filth, or with transportation of dust and strips of paper, fabric, etc.). With this system you can simulate the shell and tubes with non circular plate, but rather rectangular or quadrangular.

when we click on the without fins option, we start the calculation of such fins.



We can open new project by clicking on the left part like Heating, Cooling, Condensing, Direct expansion, Steam, Pump Evaporator and Partial condensing.

Let's open an example of heating calculation.

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | Online help

Project: ... Standard Conditions Units: ...

Coils 8.0 - Welcome! ... \DirectExpansion.c6prj

Direct Expansion

Calculation Mode

☒ Verify
☐ Design

Geometry

166030_x_S

Geometry Details
Search Geometry
Modified factors
Consider both latent and sensible

Tube

Manifolds

Air Side Details

Output

Calculate Print

AIR SIDE		Total	Sensible
Capacity	W	16012	
Airflow	m³/h	10000	
Face Velocity	m/s	1,54	
Inlet Temperature DB	°C	32	
Inlet Relative Humidity	%	50	
Outlet Temperature DB	°C	29,2	
Outlet Relative Humidity	%	55,7	
Fouling factor	(m² K)/W	0	
Pressure Drop	Pa	11	

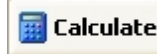
TUBE SIDE	
Fluid	R 1234ZE
Flow	kg/h
Evaporating Temp.	°C
Quality	0,22
Inlet press. of the valve	kPa
Overheating	K
Pressure Drop	kPa
Fouling factor	(m² K)/W
Fluid Velocity [Gas phase]	m/s

N° tubes for row: 20 Tubes length: mm 1500

Rows: 4 Circuits: 5

Nr of Skipped Tubes: 0 Baffles n°: 0

We can see, that in the bottom part of the calculation form we do not mention the fin, because the tube is smooth or bare



After the input of data, we can click on the “Calculate” button

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | Online help

Project: ... Standard Conditions Units: ...

Coils 8.0 - Welcome! ... \DirectExpansion.c6prj *

Direct Expansion

Calculation Mode

☒ Verify
☐ Design

Geometry

Tube

Manifolds

Air Side Details

Output

Exchange Surface: m² 5,986614

Project Description

Trial

No Warning

Coil price (€): 0,00

Calculate Print

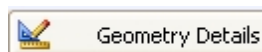
AIR SIDE		Total	Sensible
Capacity	W	15990	9360
Airflow	m³/h	10000	
Face Velocity	m/s	1,54	
Inlet Temperature DB	°C	32	
Inlet Relative Humidity	%	50	
Outlet Temperature DB	°C	29,1	
Outlet Relative Humidity	%	55,5	
Fouling factor	(m² K)/W	0	
Pressure Drop	Pa	5	

TUBE SIDE	
Fluid	R 1234ZE
Flow	kg/h
Evaporating Temp.	°C
Quality	0,22
Inlet press. of the valve	kPa
Overheating	K
Pressure Drop	kPa
Fouling factor	(m² K)/W
Fluid Velocity [Gas phase]	m/s

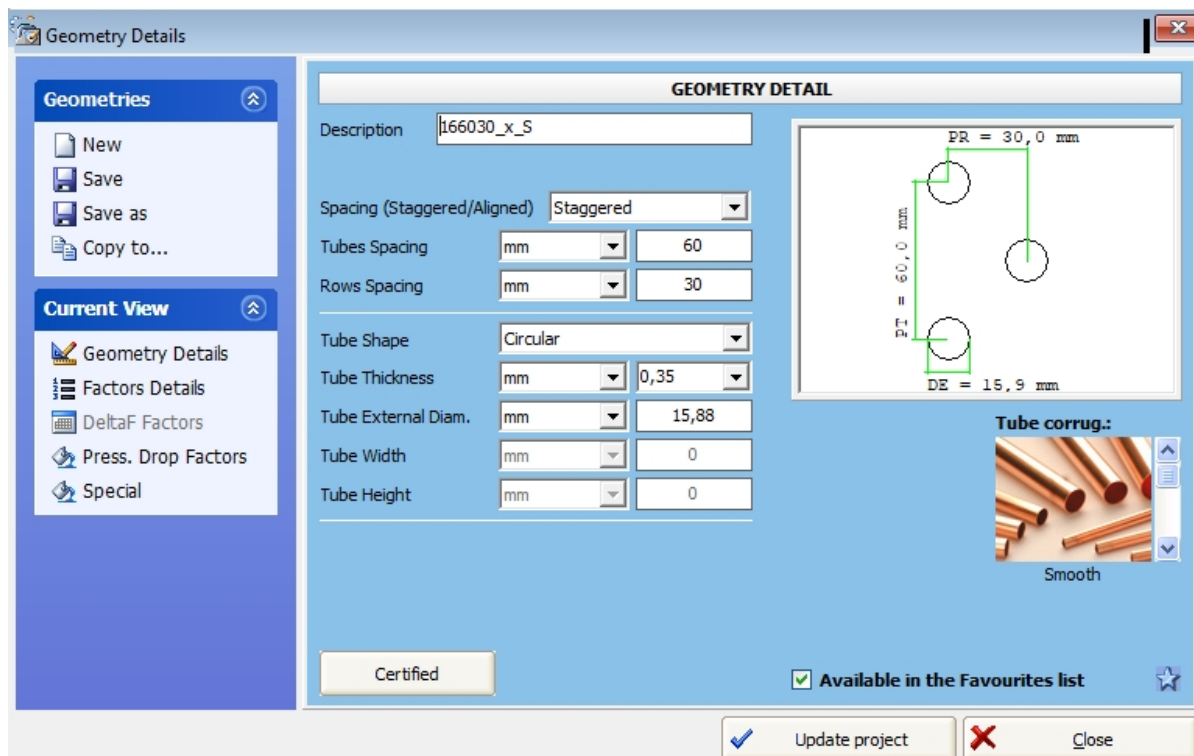
N° tubes for row: 20 Tubes length: mm 1500

Rows: 4 Circuits: 5

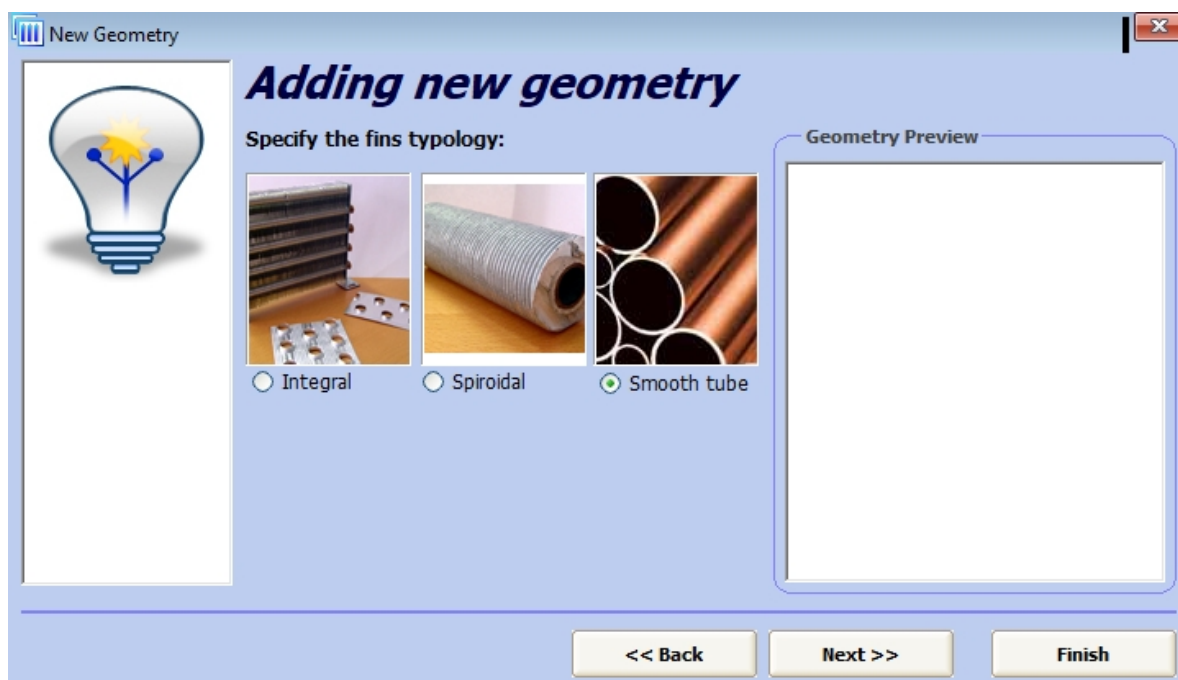
Nr of Skipped Tubes: 0 Baffles n°: 0



If we click on the geometry details



We click on “New” 



We can see the smooth tube.

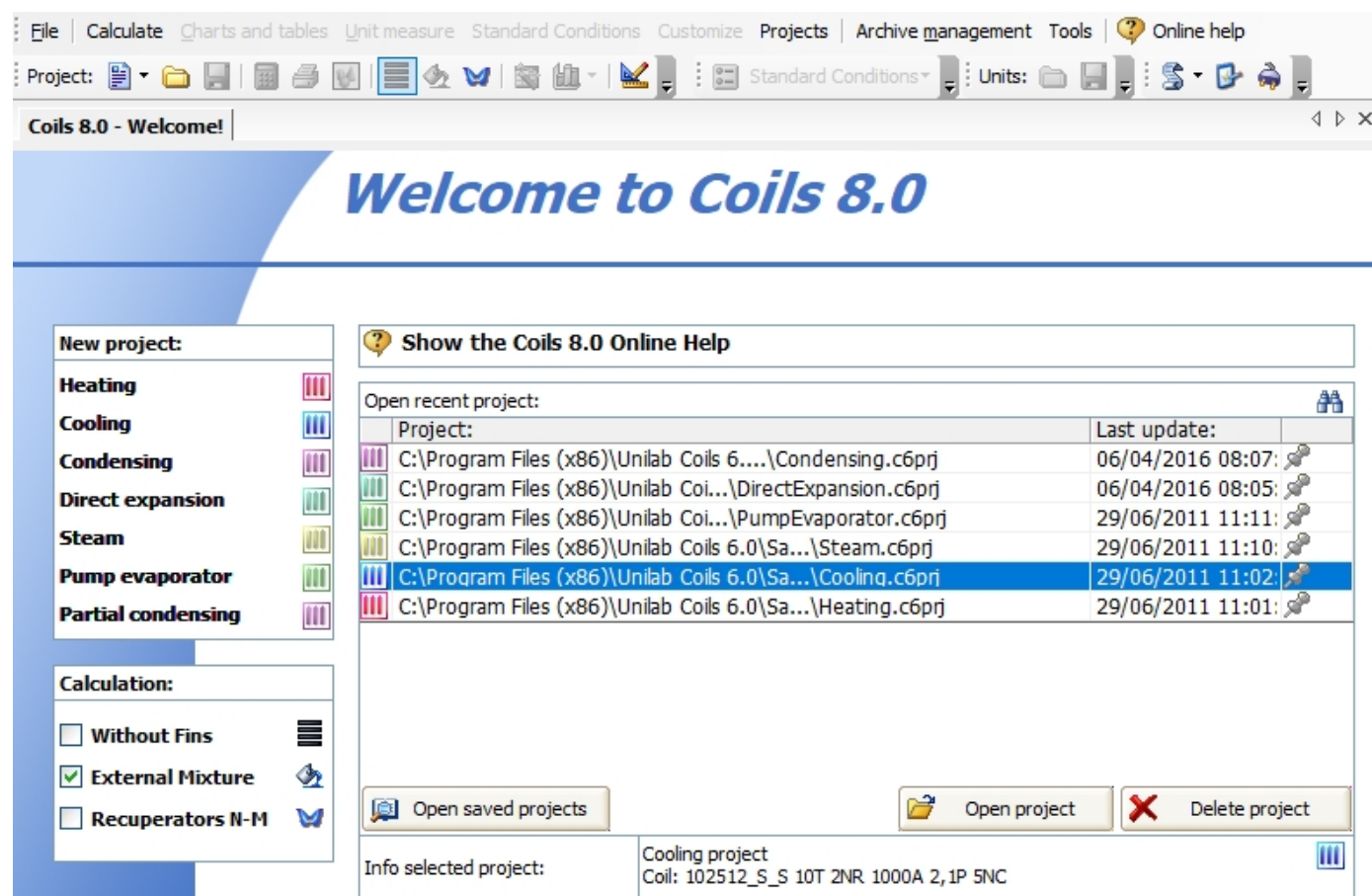
External Mixture

External Mixture

We have added (only in Enterprise edition) in all the modalities the possibility of choosing on the external tubes side whichever fluid either in gaseous phase or in liquid phase, both pure and mixture. The only actual limitation is, that in this case the calculation is performed only without the condensation of some condensing fluid, so only

the calculation of the sensible capacity will be given. Also in this case, the applications are many, if we were to think only at the possibility to analyzing the combustion gas, or the coils immersed in water tubs, or inside shell and tubes, etc...

From the main form of Coils, if we click on external mixture



We obtain

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | ? Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\Prog...\Cooling.c6prj

Cooling

Calculation Mode

☒ Verify
☐ Design

Geometry

102512_S_S

Geometry Details
Search Geometry

MIXTURE SIDE

Capacity: W 42771

Fluid: CARBON DIOXIDE (PG)

Pressure: bar A 1

Flow: m³/h 20000

Inlet Temperature: °C 50

Outlet Temperature: °C 44,8

Pressure Drop: kPa 0

Fouling factor: (m² K)/W 0

Fluid Velocity: m/s 0

TUBE SIDE

Fluid: WATER (PL)

Pressure: bar A 1

Inlet Temperature: °C 7

Outlet Temperature: °C 12

Pressure Drop: kPa 382,91

Fouling factor: (m² K)/W 0

Fluid Velocity: m/s 6,65

Tube

Fin

Manifolds

Output

Calculate Print

N° tubes for row: 10

Rows: 2


Fin Pitch: mm (2) 2,10

Nr of Skipped Tubes: 0

Finned Length: mm 1000

Circuits: 5

Baffles n°: 0

Where we can see that on the mixture side we can choose our fluid by clicking on the  , next to the “Fluid” field:



CARBON DIOXIDE (PG)

Fluids List

- ★ WATER (PL)
- ★ ETHYLENE GLYCOL / WATER (ML)
- ★ PROPYLENE GLYCOL / WATER (ML)
- + Pure Liquids
- + Liquid Mixture
- + Pure Gas
- AIR (PG)
- OXYGEN (O2) (PG)
- NITROGEN (N2) (PG)
- HYDROGEN (H2) (PG)


Search



The fluids list, where we can click on the Search voice and get

CARBON DIOXIDE (PG)
 


Fluids List


Search




For example, let's search the fluid "AIR" . we input "AIR" in the search box

Search




We click on the search button 

We have found our fluid

Fluids List

Search



DRY AIR (PL)
 DRY AIR (PG)

To select the fluid we click on "DRY AIR (PG)"

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\Prog...\Cooling.c6prj

Cooling

Calculation Mode

Verify

Design

Geometry

102512_S_S

Geometry Details

Search Geometry

MIXTURE SIDE

Capacity W 42771

Fluid DRY AIR (PG)

Pressure bar A 1

Flow m³/h 20000

Inlet Temperature °C 50

Outlet Temperature °C 44,8

Pressure Drop kPa 0

Fouling factor (m² K)/W 0

Fluid Velocity m/s 0

TUBE SIDE

Fluid WATER (PL)

Pressure bar A 1

Inlet Temperature °C 7

Outlet Temperature °C 12

Pressure Drop kPa 382,91

Fouling factor (m² K)/W 0

Fluid Velocity m/s 6,65

Tube

Fin

Manifolds

Output

Calculate Print

N° tubes for row 10

Rows 2

Fin Pitch mm (2) 2,10

Nr of Skipped Tubes 0

Finned Length mm 1000

Circuits 5

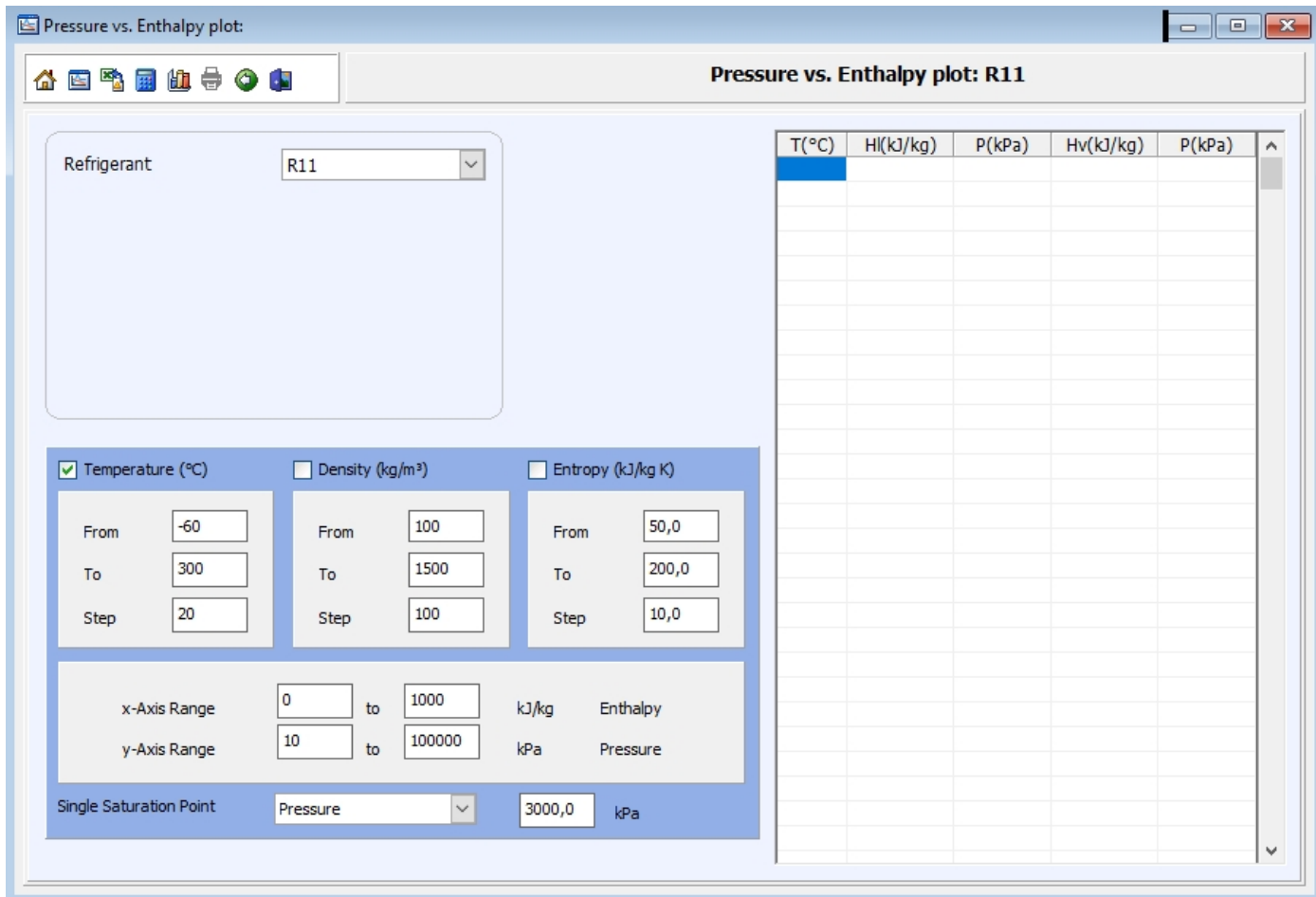
Baffles n° 0

Then we can perform our calculation and proceed to the printouts.

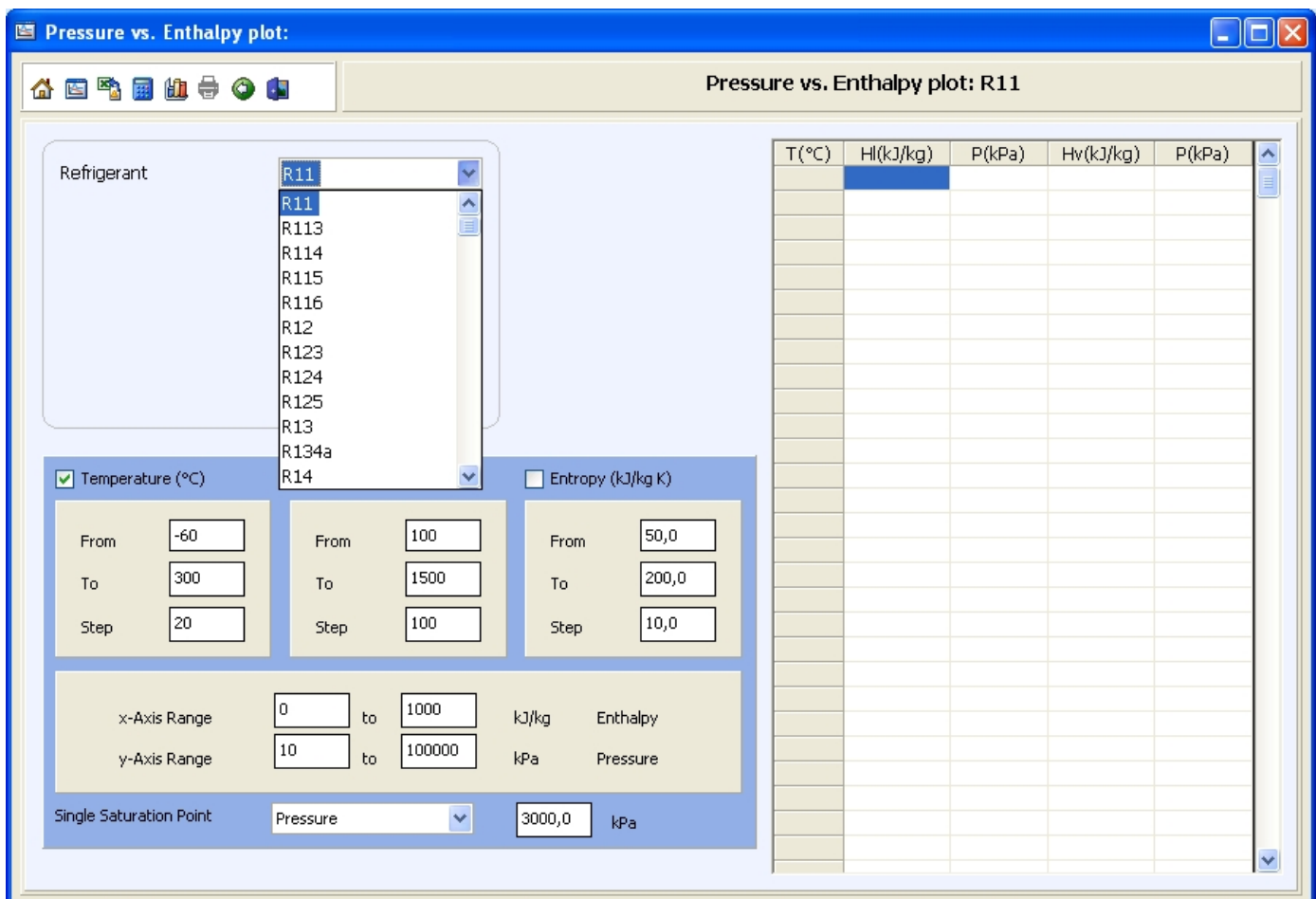
Pressure vs. Enthalpy plot

Pressure vs. Enthalpy plot

When we click the “Pressure vs. Enthalpy” voice  Pressure vs. Enthalpy plot: F4 we get




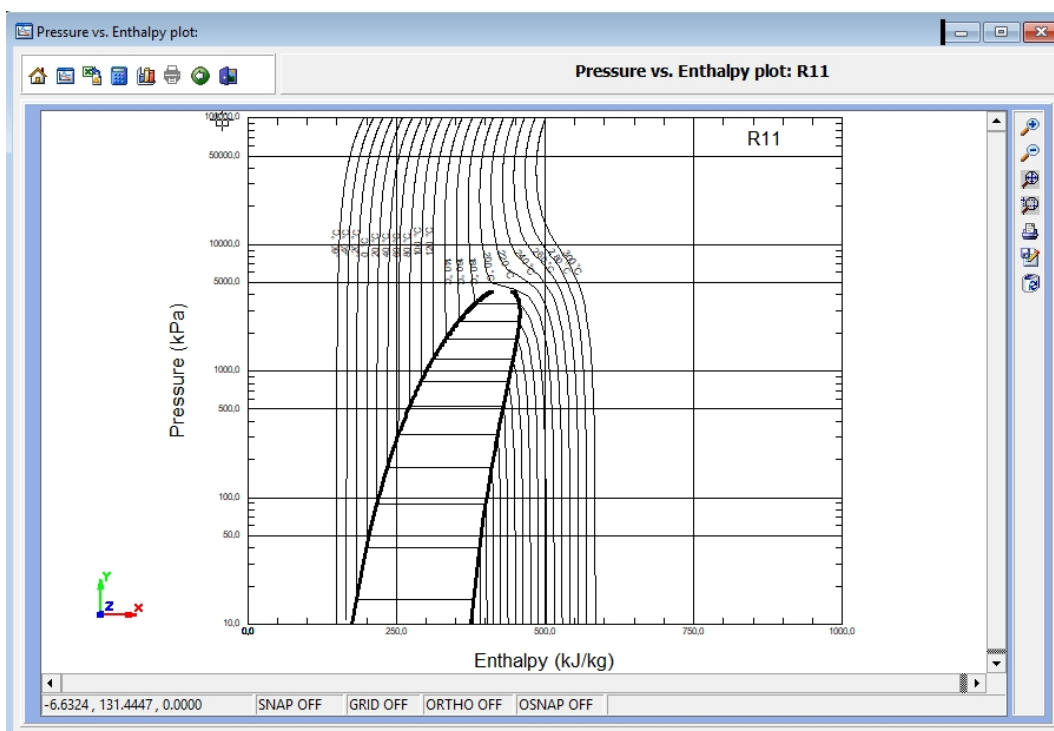
We can choose the refrigerant of which we want to build the chart





We can set and modify the chart data

<input checked="" type="checkbox"/> Temperature (°C)	<input type="checkbox"/> Density (kg/m³)	<input type="checkbox"/> Entropy (kJ/kg K)
From: -60	From: 100	From: 50,0
To: 300	To: 1500	To: 200,0
Step: 20	Step: 100	Step: 10,0
x-Axis Range: 0 to 1000 kJ/kg Enthalpy y-Axis Range: 10 to 100000 kPa Pressure		
Single Saturation Point: Pressure 3000,0 kPa		

To start the chart we click on the  button



By clicking  button, we can export the graph into an excel file

By clicking  button, we can calculate a single saturation point

By clicking on the , we can do the cycle

Pressure vs. Enthalpy plot:

Pressure vs. Enthalpy plot: R11

Refrigerant: R11

Point	H(kJ/kg)	P(kPa)	T(°C)
3000,0	171,92	371,078	171,92

Evaporator

Temperature(°C): 2,00
Superheating (K): 5,00
Pressure Drop(kPa): 0,00

Condenser

Temperature(°C): 45,00
Subcooling (K): 5,00
Pressure Drop(kPa): 0,00

Compressor

Isoentropic Efficiency: 0,80
Suction line pressure drop (kPa): 0,00
Discharge line pressure drop(kPa): 0,00

Print
Chart
Calculation

We click on the calculation button

Pressure vs. Enthalpy plot:

Pressure vs. Enthalpy plot: R11

Refrigerant: R11

Point	H(kJ/kg)	P(kPa)	T(°C)
1	393,7	43,8	7,0
2s	421,2	203,5	58,1
2	428,0	203,5	68,9
3	412,8	203,5	45,0
4'	239,6	203,5	45,0
4	235,1	203,5	40,0
5	235,1	43,8	2,0
6s	390,8	43,8	2,0
6	393,7	43,8	7,0
1	393,7	43,8	7,0

Evaporator

Temperature(°C): 2,00
Superheating (K): 5,00
Pressure Drop(kPa): 0,00

Condenser

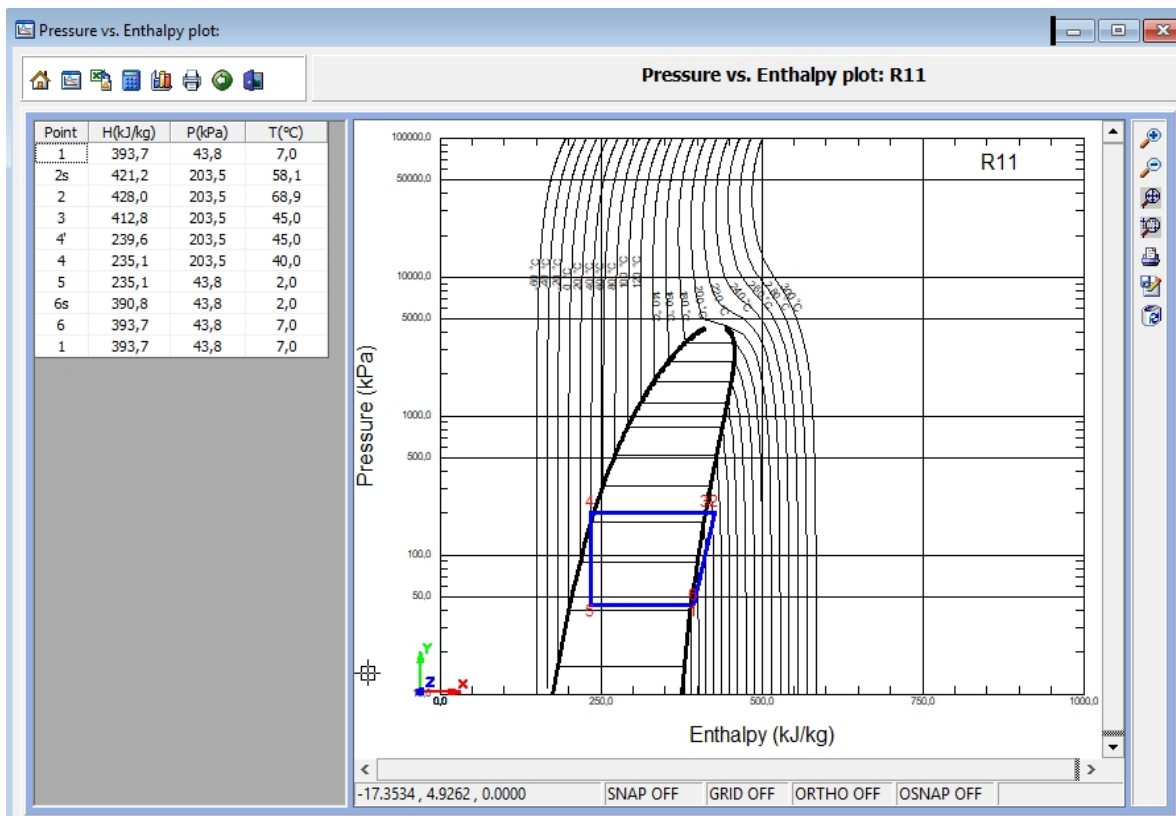
Temperature(°C): 45,00
Subcooling (K): 5,00
Pressure Drop(kPa): 0,00

Compressor

Isoentropic Efficiency: 0,80
Suction line pressure drop (kPa): 0,00
Discharge line pressure drop(kPa): 0,00

Print
Chart
Calculation

Now we click on the "Chart" button



Functional point on the PH diagram

Functional point on the PH diagram

When we click on this voice



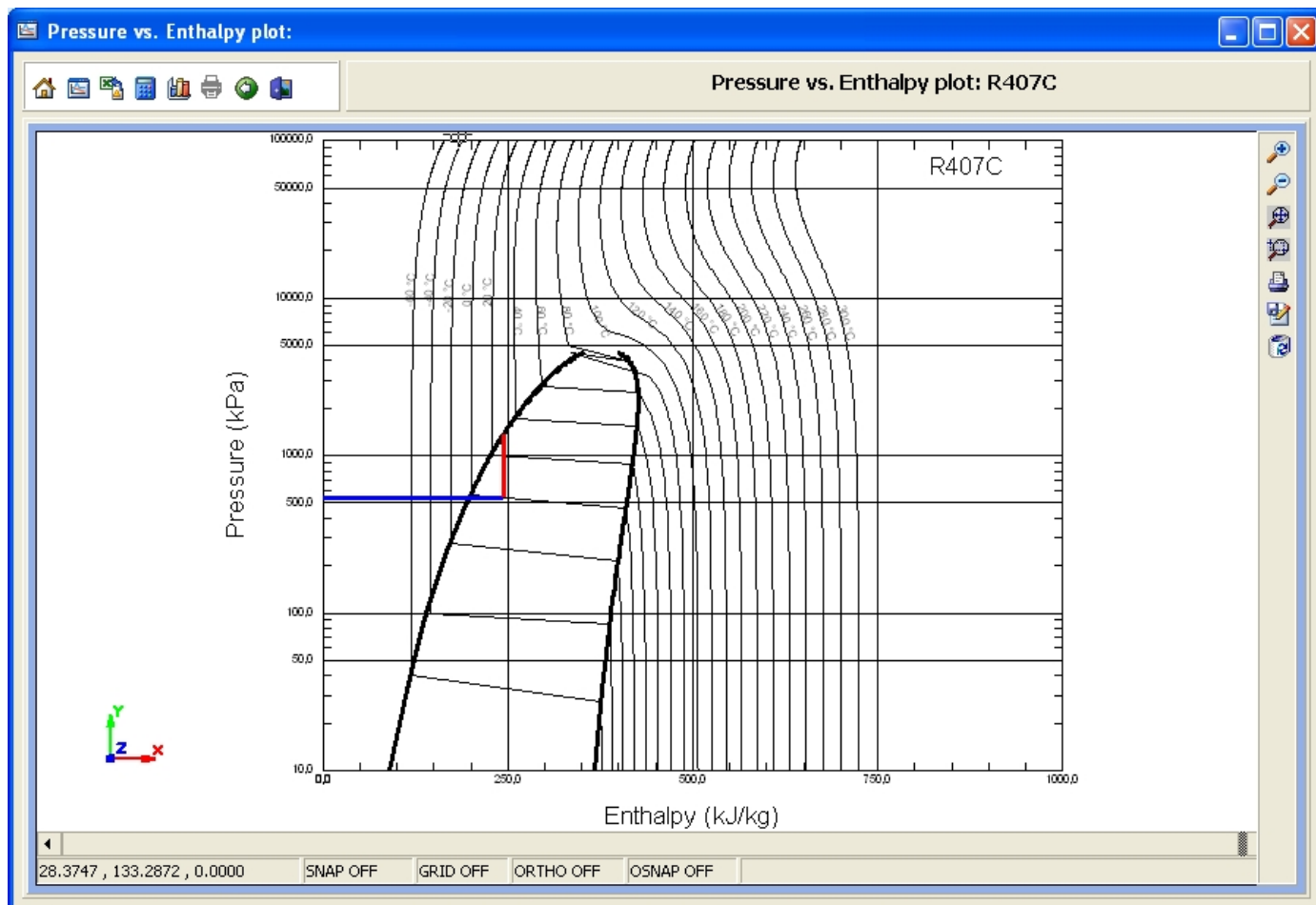
Functional point on the PH diagram

F5

of the Calculate menu

Calculate

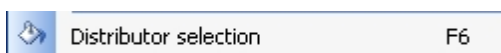
we get




Distributor selection

Distributor selection

When we click on the “Distributor selection” voice menu **Calculate** we get



of the Calculate


Distributor selection

Unit measure system

Max nr of distributors

Quantity	Tipology	Model	Nr of holes	Hole	System

Model
No model selected

Quote	Value
ODM	
L (mm)	
L1 (mm)	
øD (mm)	
Weight (kg)	

Calculate

Ok

Cancel

We click on the calculate button and get this. Please check a refrigerant type before, since the choice of distributors depends on this.

Distributor selection

Unit measure system

All

Max nr of distributors

4

Quantity	Typology	Model	Nr of holes	Hole	System
1x	TE 2	069G1002	5	1/4"	Imperial
1x	TE 2	069G1006	5	6 mm	Metric
1x	TE 2	069G1010	5	1/4"	Imperial
1x	TE 2	069G1014	5	6 mm	Metric
1x	TE 2	069G1029	5	1/4"	Imperial
1x	TE 5	069G2003	5	1/4"	Imperial
1x	TE 5	069G2004	5	6 mm	Metric
1x	TE 5	069G2010	5	1/4"	Imperial
1x	TE 5	069G2014	5	6 mm	Metric
1x	TE 12	069G3002	5	1/4"	Imperial
1x	TE 5	069G3002	5	1/4"	Imperial
1x	TE 12	069G3006	5	6 mm	Metric
1x	TE 5	069G3006	5	6 mm	Metric

Calculate

Ok

Cancel

Model

069G1006, TE 2 - 5 holes

Quote	Value
ODM	1/2"
L (mm)	71
L1 (mm)	
øD (mm)	33
Weight (kg)	0,1

Line Pressure Drops

Line Pressure Drop

when we click on this voice Line Pressure Drops F7 of the Calculate menu we get

Line Pressure Drops

Input Data		Output Data	
Refrigerant	R407C	Mass Fluid Flow (kg/s)	0,00000000
Suction Lines		Internal Diameter (m)	0,0048
Cooling capacity (kW)	0,01	Velocity inside tube (m/s)	0,00
Condensing Temperature (°C)	40,00	Density (kg/m³)	0,00
Saturated Suction Temperature (°C)	2,00	Viscosity (kg/(m s))	0,00000000
Line Length (m)	5,00	Reynolds number	0,0
Tube material	Copper	Friction factor (*)	0,00000000
Nominal Diameter (*) 6 (mm) Thick. 0,6		Pressure Drop (Pa) (**)	0,0
		Pressure Drop Dt (K)	0,0000
(*) EN 12735-1 Outside recommended dimensions		(*) Colebrook-White equation (***) Darcy_Weisbach equation	
		<input type="button" value="Calculate"/> <input type="button" value="Exit"/>	

Where we can calculate the pressure drop for a specific refrigerant along the suction, discharge and liquid lines.

Line Pressure Drops

Input Data		Output Data	
Refrigerant	R407C	Mass Fluid Flow (kg/s)	0,00000000
Suction Lines		Internal Diameter (m)	0,0048
Discharge Lines		Velocity inside tube (m/s)	0,00
Liquid Lines		Density (kg/m³)	0,00
Condensing Temperature (°C)	40,00	Viscosity (kg/(m s))	0,00000000
Saturated Suction Temperature (°C)	2,00	Reynolds number	0,0
Line Length (m)	5,00	Friction factor (*)	0,00000000
Tube material	Copper	Pressure Drop (Pa) (**)	0,0
Nominal Diameter (*) 6 (mm) Thick. 0,6		Pressure Drop Dt (K)	0,0000
(*) EN 12735-1 Outside recommended dimensions		(*) Colebrook-White equation (***) Darcy_Weisbach equation	
		<input type="button" value="Calculate"/> <input type="button" value="Exit"/>	

Recuperators – bFly

Recuperators – bFly

The Enterprise edition of Coils contains an application for the heat balance of heat plant of Energy recovery based on heat exchange coils linked together by an hydraulic circuit. In the most common case, usually we have only one coil air side as supply and one coil air side as return. At the moment, our software is the only one that allows the analysis, at the same time, with more coils on supply and return side. We have implemented the

possibility of dividing in more, than one plant, homogeneous zones from the energy side. The actual limits of the software are:

Maximum number of simultaneous plants = 10

Maximum number of coils supply side = 50 for each plant

Maximum number of coils return side = 50 for each plant.

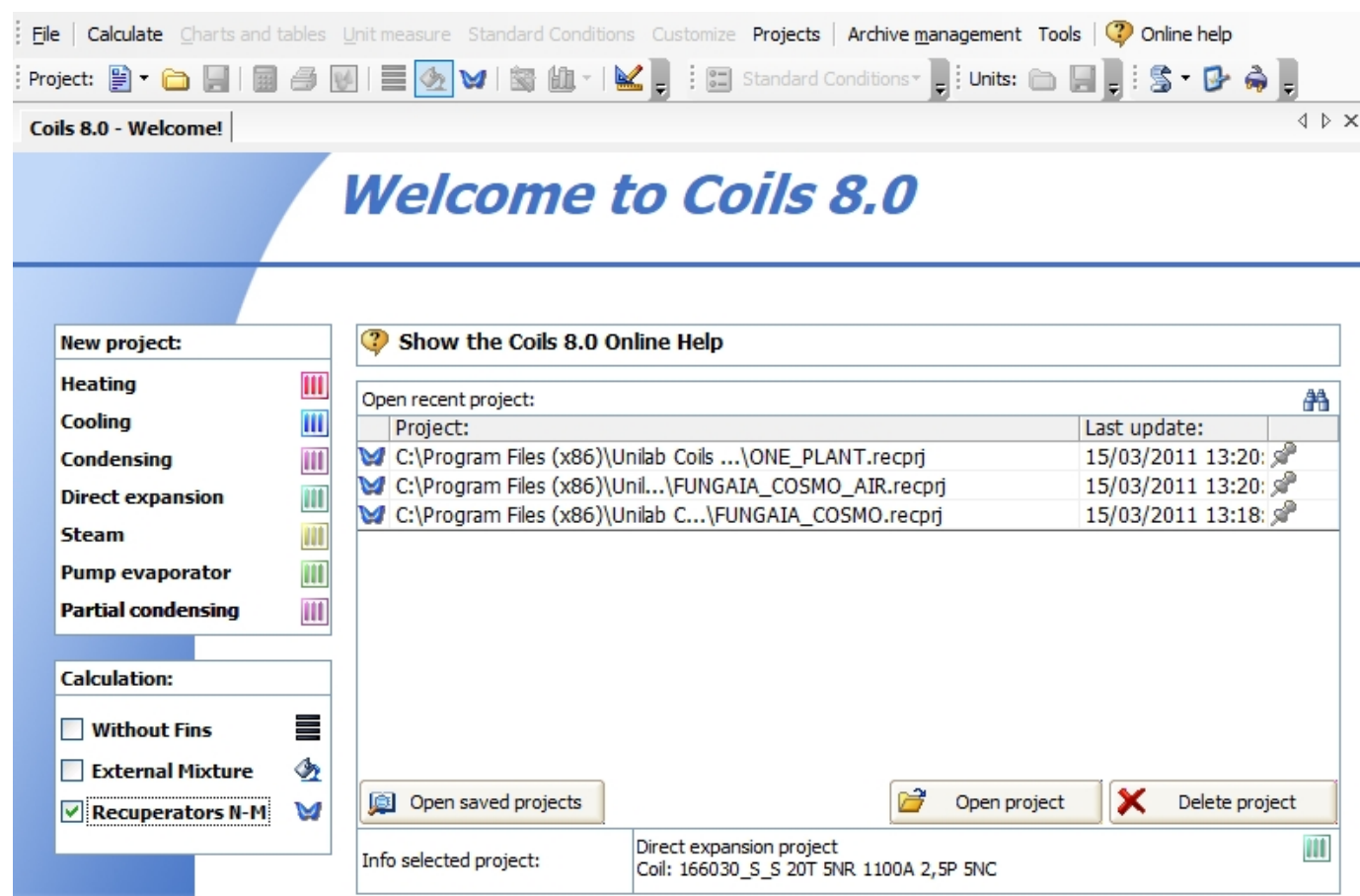
For each plant we can choose in an independent way the fluids both supply and return and naturally also the fluid hydraulic circuit side.

Calculation Recuperators M – N

Calculation Recuperators N – M

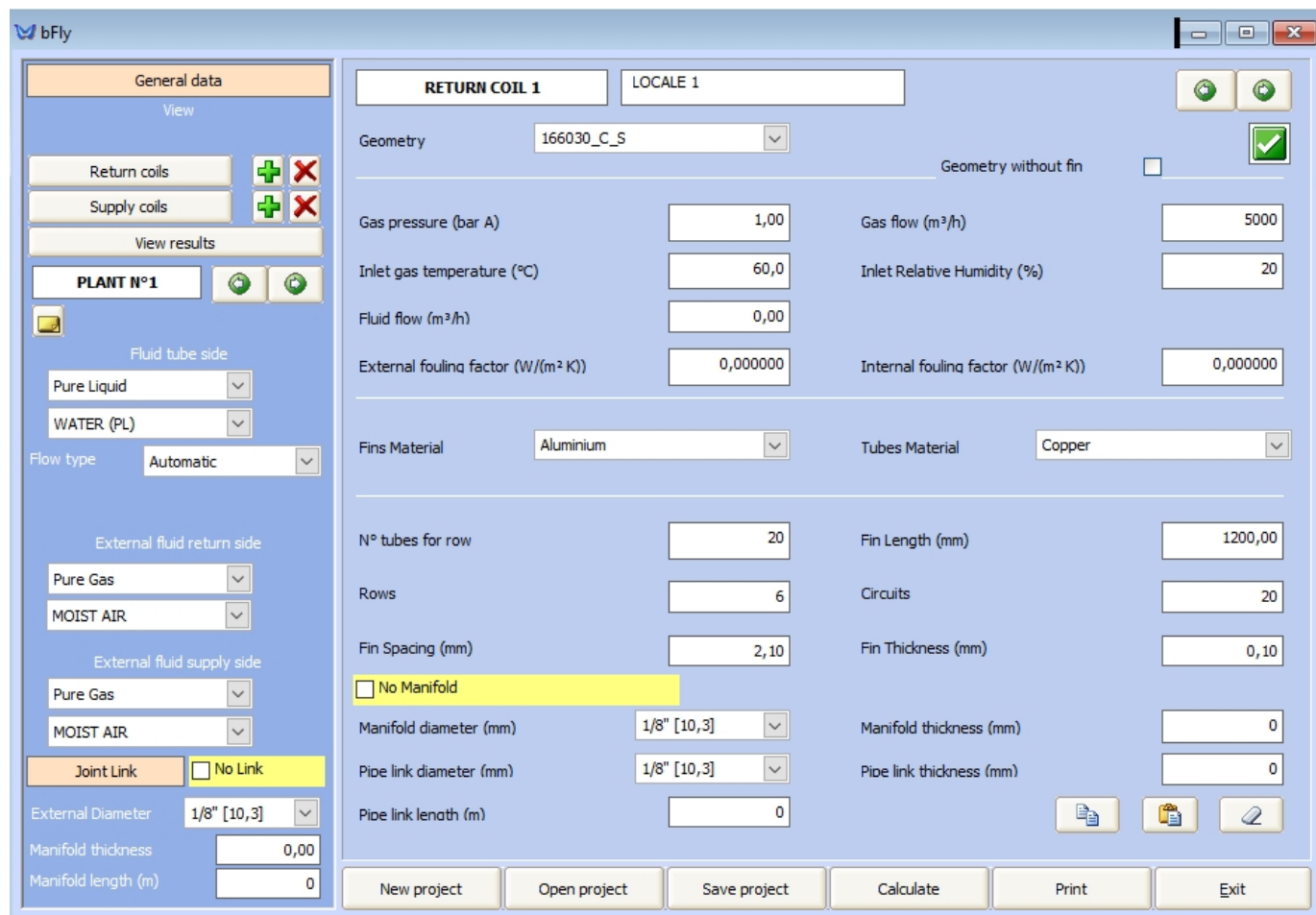
Let's see an example of a project of Recuperator N- M as loaded in the software.

Click on the Recuperator N-M voice of the menu Calculation as in the following screen



Now, as you can see, we have three examples of project already filled with data, but, just for example, let's open one that refers to recuperators N-M of a mushroom bed

C:\Program Files (x86)\Unilab C...\FUNGAI_A_COSMO.recprj 15/03/2011 13:18:



The screenshot shows the 'bFly' software interface for configuring a heat exchanger coil. The main window is titled 'RETURN COIL 1' and 'LOCALE 1'. It contains several input fields and buttons for project management and calculation.

General data:

- Return coils: + (add), - (remove)
- Supply coils: + (add), - (remove)
- View results: [button]
- PLANT N°1: [button]
- Fluid tube side: Pure Liquid (dropdown), WATER (PL) (dropdown)
- Flow type: Automatic (dropdown)
- External fluid return side: Pure Gas (dropdown), MOIST AIR (dropdown)
- External fluid supply side: Pure Gas (dropdown), MOIST AIR (dropdown)
- Joint Link: [button], No Link (checkbox)
- External Diameter: 1/8" [10,3] (dropdown)
- Manifold thickness: 0,00
- Manifold length (m): 0

Geometry:

- Geometry: 166030_C_S (dropdown)
- Geometry without fin: [checkbox]
- Gas pressure (bar A): 1,00
- Gas flow (m³/h): 5000
- Inlet gas temperature (°C): 60,0
- Inlet Relative Humidity (%): 20
- Fluid flow (m³/h): 0,00
- External fouling factor (W/(m² K)): 0,000000
- Internal fouling factor (W/(m² K)): 0,000000
- Fins Material: Aluminium (dropdown)
- Tubes Material: Copper (dropdown)
- N° tubes for row: 20
- Fin Length (mm): 1200,00
- Rows: 6
- Circuits: 20
- Fin Spacing (mm): 2,10
- Fin Thickness (mm): 0,10
- No Manifold: [checkbox]
- Manifold diameter (mm): 1/8" [10,3] (dropdown)
- Manifold thickness (mm): 0
- Pipe link diameter (mm): 1/8" [10,3] (dropdown)
- Pipe link thickness (mm): 0
- Pipe link length (m): 0

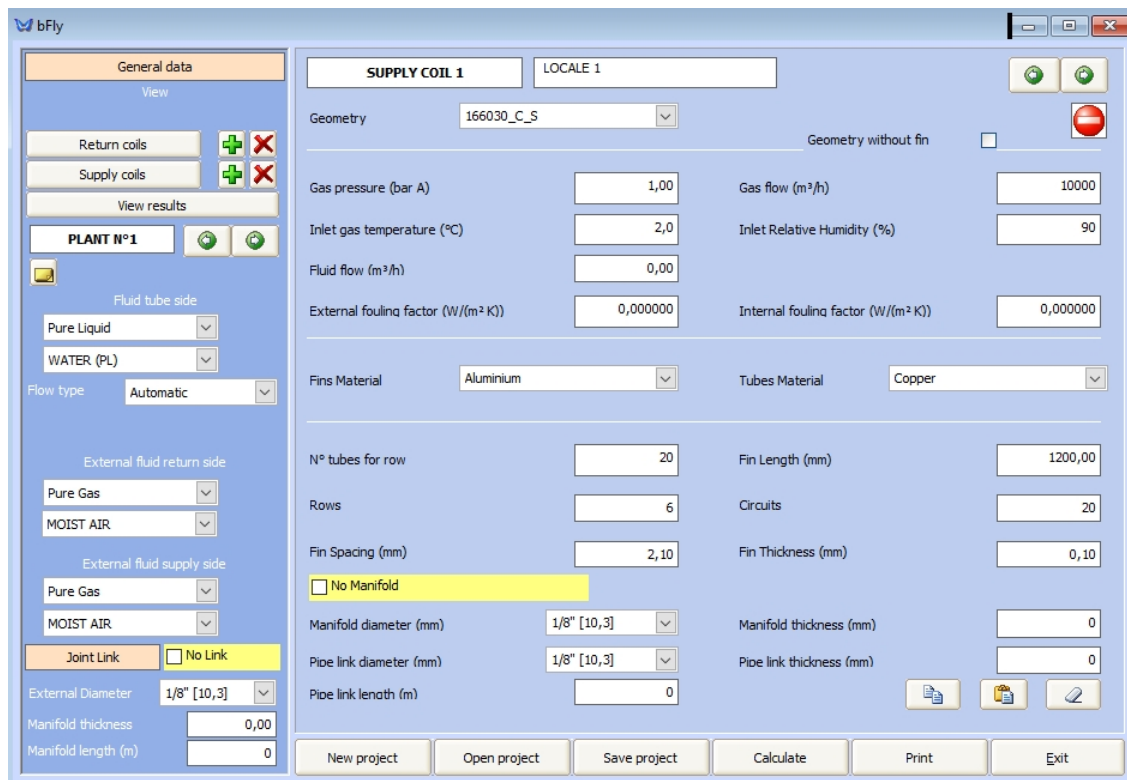
Buttons: New project, Open project, Save project, Calculate, Print, Exit

You get the above input data for the current project.

We can see the input data given for the Return Coil 1.

This are the input data which in this case are filled, but in case of new project, you can insert them on your own. In the "Geometry" combo **Geometry** 166030_C_S you can choose the geometry. The "Gas pressure" in bar, the inlet gas temperature, the "Gas Flow". You can then choose the Fin and Tubes material. Afterwards, you can insert the physical data of the coil.

On the main menu, on the left side, by clicking on the "Supply Coils" button **Supply coils** you see the following



General data

View

Return coils ☐ ☐

Supply coils ☐ ☐

View results

PLANT N°1

Fluid tube side

Pure Liquid

WATER (PL)

Flow type Automatic

External fluid return side

Pure Gas

MOIST AIR

External fluid supply side

Pure Gas

MOIST AIR

Joint Link ☐ No Link

External Diameter 1/8" [10,3]

Manifold thickness 0,00

Manifold length (m) 0

SUPPLY COIL 1 LOCALE 1

Geometry 166030_C_S

Geometry without fin ☐

Gas pressure (bar A) 1,00

Gas flow (m³/h) 10000

Inlet gas temperature (°C) 2,0

Inlet Relative Humidity (%) 90

Fluid flow (m³/h) 0,00

External fouling factor (W/(m² K)) 0,000000

Internal fouling factor (W/(m² K)) 0,000000

Fins Material Aluminium

Tubes Material Copper

N° tubes for row 20

Fin Length (mm) 1200,00

Rows 6

Circuits 20

Fin Spacing (mm) 2,10

Fin Thickness (mm) 0,10

☐ No Manifold

Manifold diameter (mm) 1/8" [10,3]

Manifold thickness (mm) 0

Pipe link diameter (mm) 1/8" [10,3]

Pipe link thickness (mm) 0

Pipe link length (m) 0

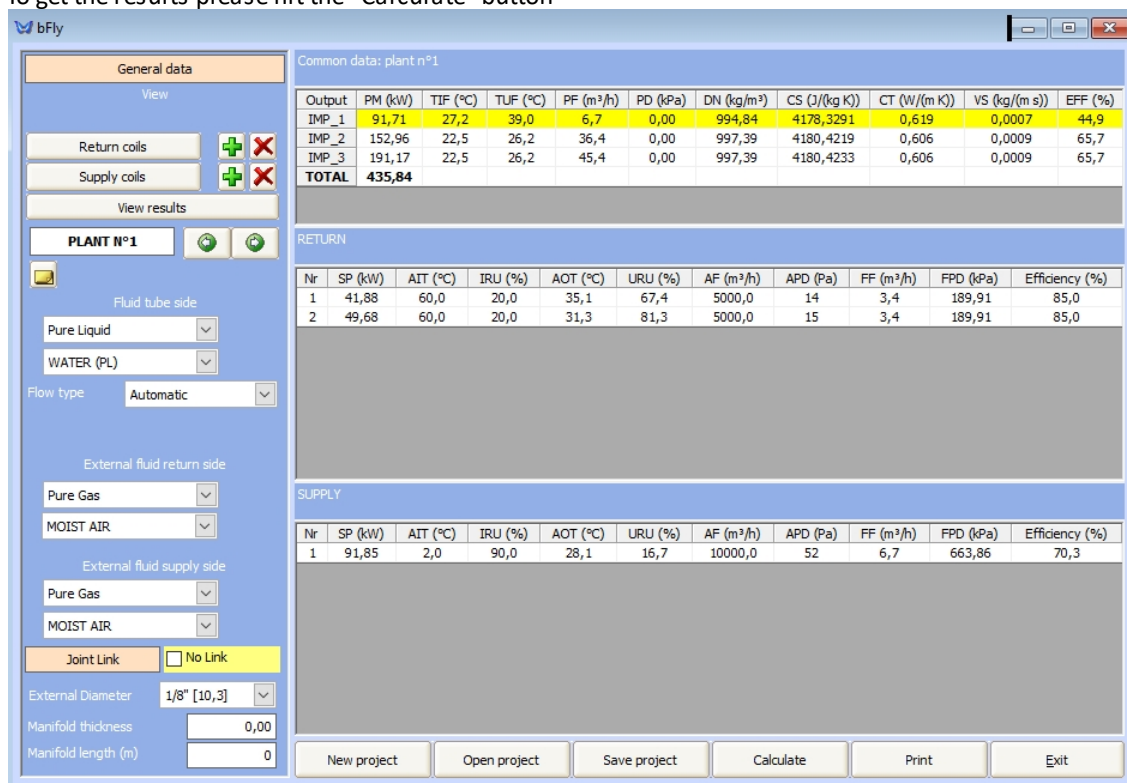
New project Open project Save project Calculate Print Exit

This is an example of the supply coil. As you can see, in the data inserted, the supply coil has lower inlet temperature, than the return.

You can choose also the Fluid tube side, the external fluid return side, the external fluid supply side, the joint link.

To get the results please hit the "Calculate" button

Calculate



General data

View

Return coils ☐ ☐

Supply coils ☐ ☐

View results

PLANT N°1

Fluid tube side

Pure Liquid

WATER (PL)

Flow type Automatic

External fluid return side

Pure Gas

MOIST AIR

External fluid supply side

Pure Gas

MOIST AIR

Joint Link ☐ No Link

External Diameter 1/8" [10,3]

Manifold thickness 0,00

Manifold length (m) 0

Common data: plant n°1

Output	PM (kW)	TIF (°C)	TUF (°C)	PF (m³/h)	PD (kPa)	DN (kg/m³)	CS (J/(kg K))	CT (W/(m K))	VS (kg/(m s))	EFF (%)
IMP_1	91,71	27,2	39,0	6,7	0,00	994,84	4178,3291	0,619	0,0007	44,9
IMP_2	152,96	22,5	26,2	36,4	0,00	997,39	4180,4219	0,606	0,0009	65,7
IMP_3	191,17	22,5	26,2	45,4	0,00	997,39	4180,4233	0,606	0,0009	65,7
TOTAL	435,84									

RETURN

Nr	SP (kW)	AIT (°C)	IRU (%)	AOT (°C)	URU (%)	AF (m³/h)	APD (Pa)	FF (m³/h)	FPD (kPa)	Efficiency (%)
1	41,88	60,0	20,0	35,1	67,4	5000,0	14	3,4	189,91	85,0
2	49,68	60,0	20,0	31,3	81,3	5000,0	15	3,4	189,91	85,0

SUPPLY

Nr	SP (kW)	AIT (°C)	IRU (%)	AOT (°C)	URU (%)	AF (m³/h)	APD (Pa)	FF (m³/h)	FPD (kPa)	Efficiency (%)
1	91,85	2,0	90,0	28,1	16,7	10000,0	52	6,7	663,86	70,3

New project Open project Save project Calculate Print Exit



Print



The "Print" button will give the following

General data



View

SCHEME - TREE


Return coils  


Supply coils  


View results

PLANT N°3  


Fluid tube side


Pure Liquid 

WATER (PL) 


Flow type Automatic 


External fluid return side

Pure Gas 


AIR (PG) 

External fluid supply side

Pure Gas 

AIR (PG) 

Joint Link

External Diameter 1/8" [10,3] 

Manifold thickness 0,00

Manifold length (m) 0

Common data: plant n°3

Output	PM (kW)	TIF (°C)	TUF (°C)	PF (m³/h)	PD (kPa)	DN (kg/m³)	CS (J/(kg K))	CT (W/(m K))	VS (kg/(m s))	EFF (%)
IMP_1	93,79	28,7	37,8	8,9	0,00	994,80	4178	0,621	0,0007	45,2
IMP_2	147,70	20,8	26,6	21,9	0,00	997,56	4181	0,605	0,0009	62,4
IMP_3	184,62	20,8	26,6	27,4	0,00	997,56	4181	0,605	0,0009	62,4
TOTAL	426,11									

RETURN

Nr	SP (kW)	AIT (°C)	AOT (°C)	AF (m³/h)	APD (Pa)	FF (m³/h)	FPD (kPa)	Efficiency (%)
1	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
2	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
3	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
4	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
5	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
6	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
7	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
8	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3
9	18,46	35,0	24,7	5000,0	17	2,7	140,01	72,3

SUPPLY

Nr	SP (kW)	AIT (°C)	AOT (°C)	AF (m³/h)	APD (Pa)	FF (m³/h)	FPD (kPa)	Efficiency (%)
1	36,93	2,0	22,6	5000,0	16	5,5	482,36	83,8
2	36,93	2,0	22,6	5000,0	16	5,5	482,36	83,8
3	36,93	2,0	22,6	5000,0	16	5,5	482,36	83,8
4	36,93	2,0	22,6	5000,0	16	5,5	482,36	83,8
5	36,93	2,0	22,6	5000,0	16	5,5	482,36	83,8

New project Open project Save project Calculate Print Exit

After hitting the printing button again, you will see the print preview with all the results of calculation and scheme three.



New project



The button "New project" allows to start a new project.

General data



View

SCHEME - TREE


Return coils  


Supply coils  


View results

PLANT N°3  


Fluid tube side


Pure Liquid 

WATER (PL) 


Flow type Automatic 


External fluid return side

Pure Gas 


AIR (PG) 

External fluid supply side

Pure Gas 

AIR (PG) 

Joint Link

External Diameter 1/8" [10,3] 

Manifold thickness 0,00

Manifold length (m) 0

Nr of Plants 1

Project description

OK Cancel

New project Open project Save project Calculate Print Exit

Catalogues Generator

Catalogues Generator

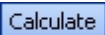


Automatic Generation of Catalogues and performance Tables

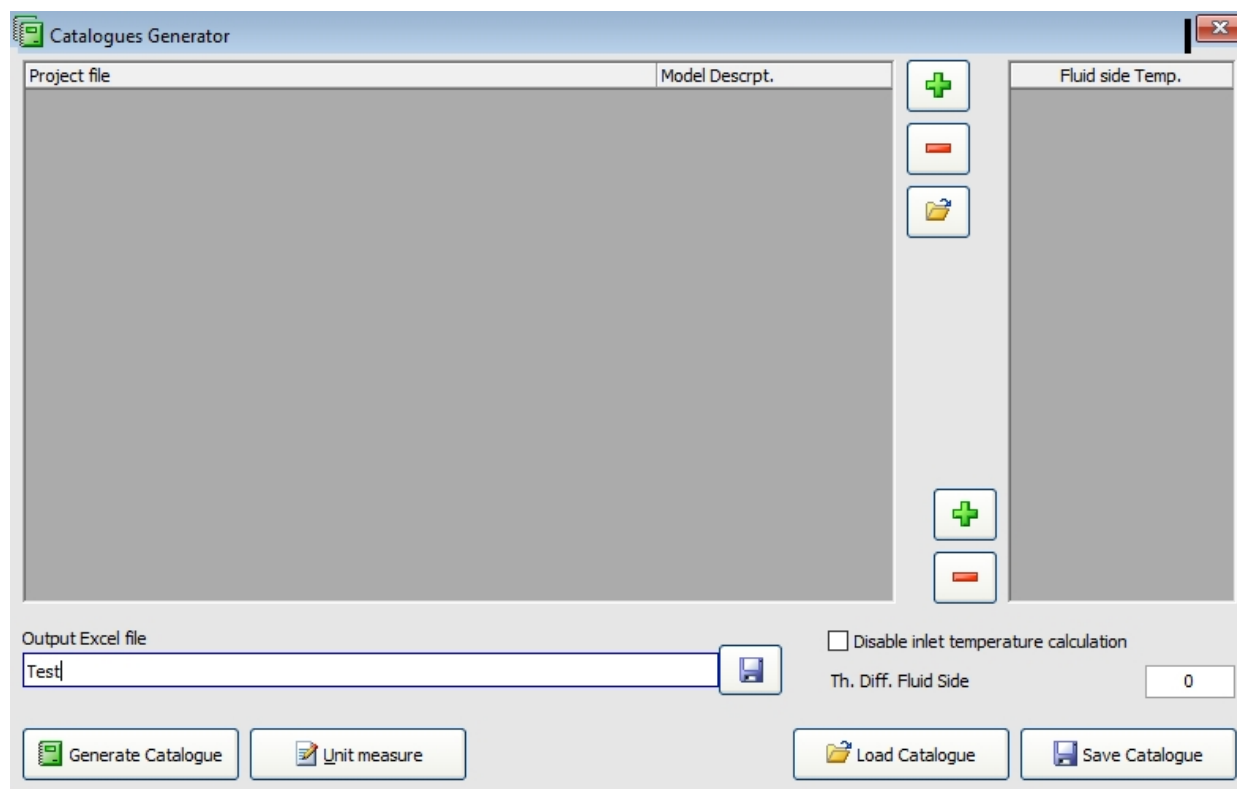
This feature allows the automatic creation of catalogues and performance tables in Excel format. This feature is particularly suitable for those, who must design a series of coils, unit coolers, air coolers, remote condensers, dry coolers, condensing units, motorevaporators, etc.. and insert a capacity table, calculated at different working conditions in the catalogue of the new series.

Advantages of this new feature:

- Within minutes you can create tables of a hundred units
- The tables are saved in Excel format already formatted, and ready for use
- Three tables are generated: yields, air side pressure drop and pressure drop fluid side
- Working conditions are fully customizable
- The units are customizable
- You can save the design of the catalogue to a file so if one day you will need to update the data, simply load the project and create new catalogue


How to use this new function

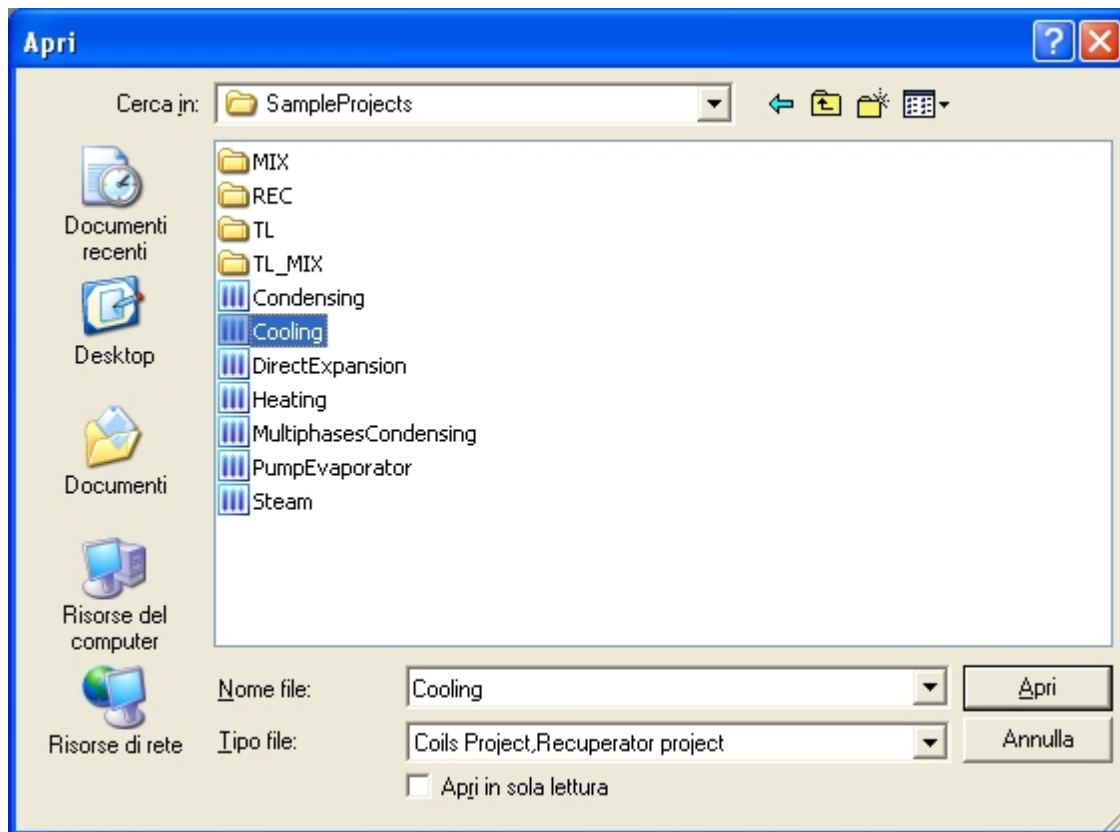
Choose the menu “Calculate”  and click on “Catalogues Generator”  Catalogues Generator . The following screen will appear:



On the top left end of the grid let's insert the project files of models we need to create the catalogue for.

For each model we have already created a Coils project. To expedite this, just follow a simple procedure at the end of this document.

Let's click on “+” green button  on the top right corner of the grid and we specify the project file to insert in the list:



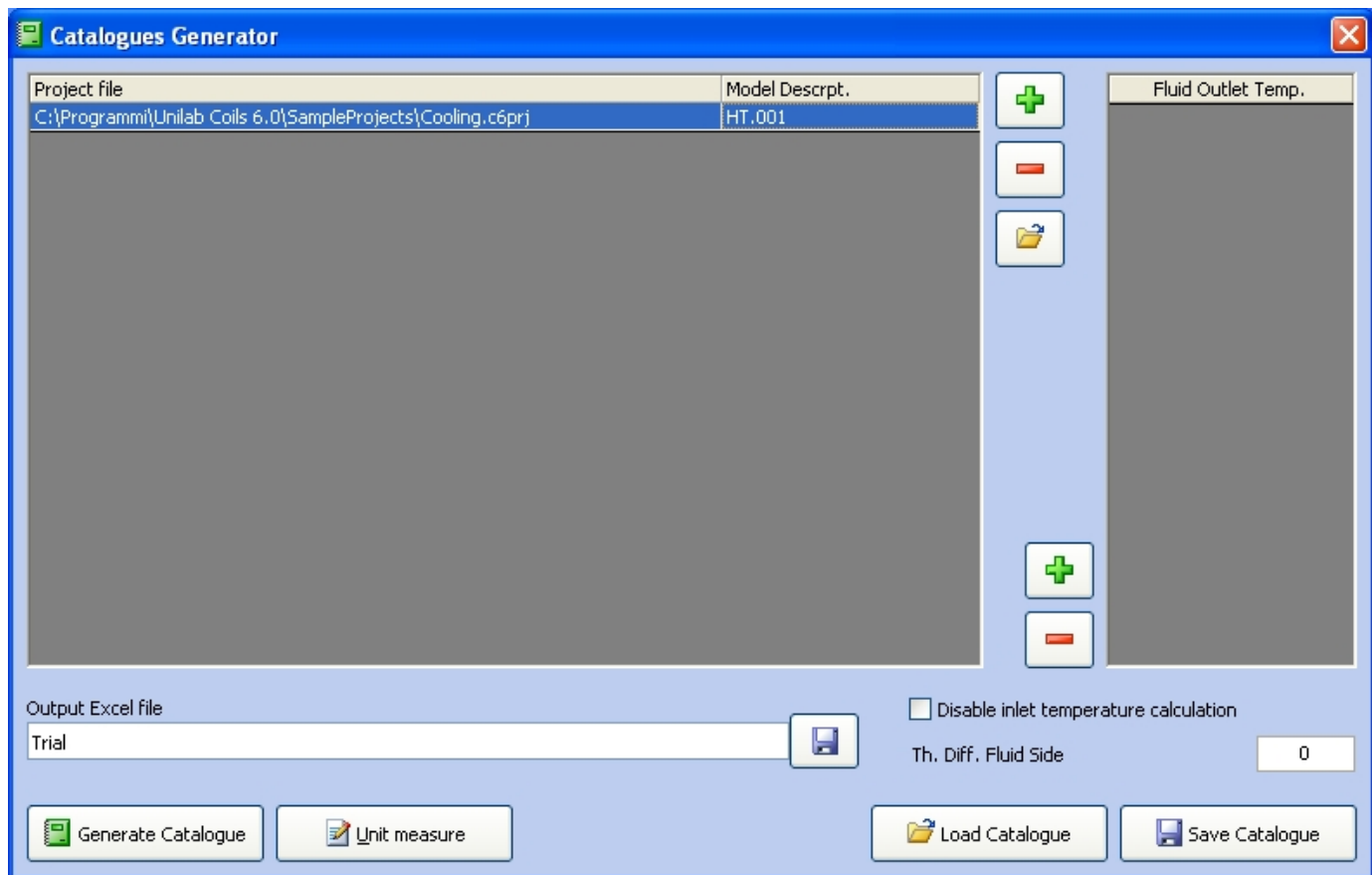
Attention: the projects need to be in the same calculation modality!

We need to specify the name of the model/size that corresponds to this project. Thus we write the name in the column “Descr. Modello”

Model Descript.
HT.001



Now We click on the green button “+” and we repeat the procedure to add the other models. In our example we have only one model.



In the grid at the top right hand side we insert the temperature fluid, which will vary will be included in the columns of the Excel sheet. These temperatures vary depending on the mode of calculation:

Heating: Inlet Fluid Temperature
 Cooling: Outlet fluid Temperature
 Condensing: Condensing Temperature (Middle Point)
 Evaporating: Evaporating Temperature (Middle Point)
 Vapour: Saturation Temperature
 Pump Evaporator: Evaporating Temperature (Middle Point)



Let's click on the green button "+" on the left hand of temperatures grid more than once we introduce these values:

Fluid Outlet Temp.
50
55
60
65
70
75
80


Just below we find the delta T: in the case of fluids without phase change, refers to the temperature difference between the input and output fluid side, in the case of fluids with phase change, refers to the difference between the temperature fluid side and the input side air. Here are some examples:

Modality	Temp. Fluid Side	Delta T	Set Value	Results
Heating	80	10	Outlet Temp.	70
Cooling	12	5	Inlet Temp.	7
Condensing	45	15	Inlet Air Temp.	30
Evaporating	5	6	Inlet Air Temp.	11
Vapour	120	100	Inlet Air Temp.	20
Pump Evaporator	5	6	Inlet Air Temp.	11

Let's set a delta T of 10 °C

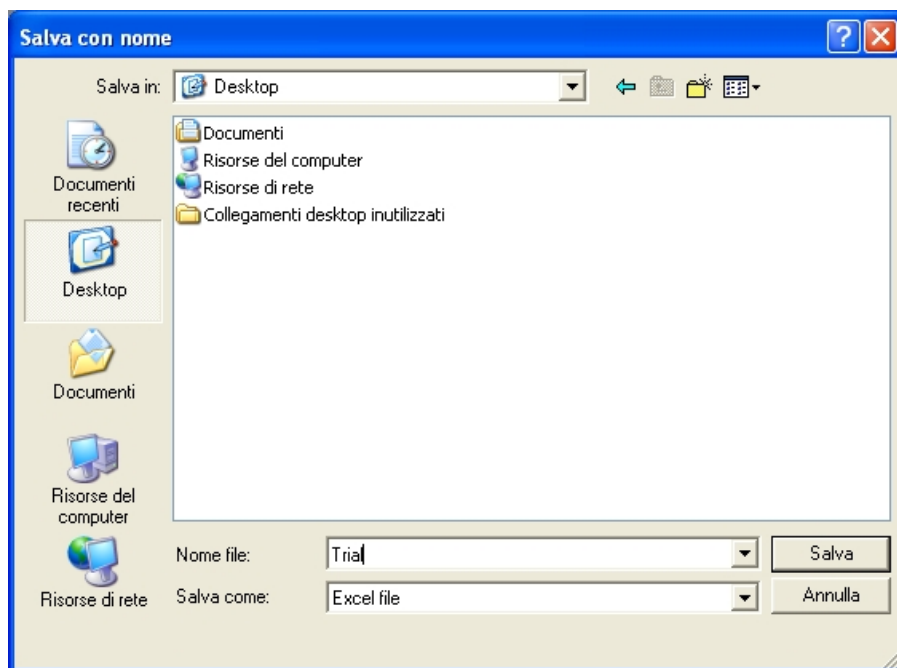
Th. Diff. Fluid Side


0

Once the temperatures are set, we specify the path on which we save the excel sheet by clicking on the button "Save"  with the disk "Output Excel file"

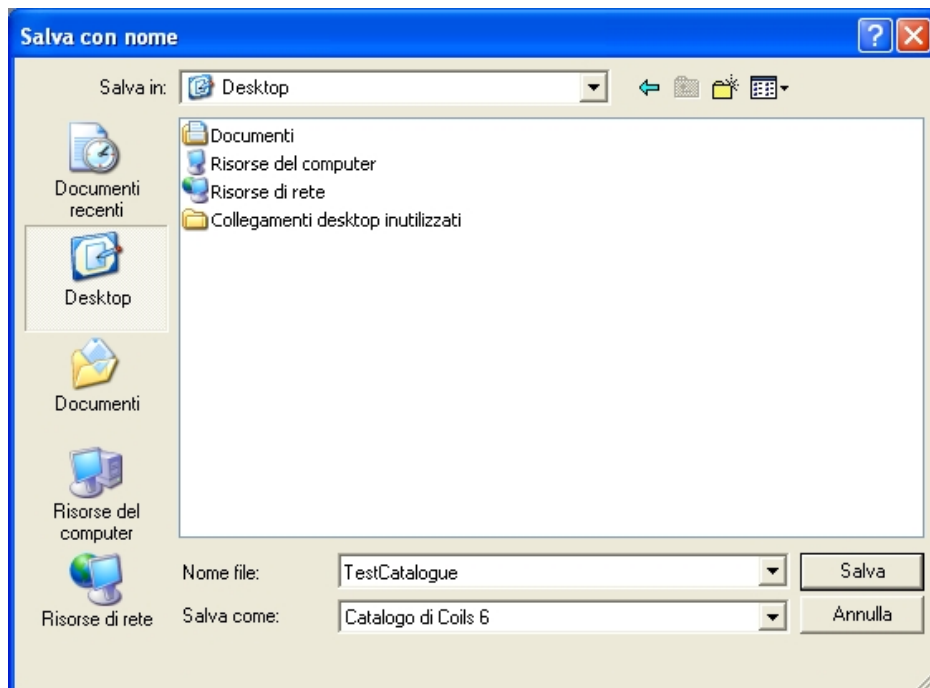
Output Excel file

Trial

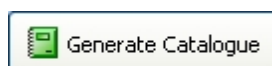


 Save Catalogue

Now that the project is ready, let's click on the "Save Catalogue" button to save work done so far:



Attention: this operations saves the information contained in this mask, not the power table, the pressure drop, etc..



Let's click on "Generate catalogue" button and let's wait on the programme to finish the data generation.

Considerations and limitations

- Projects must all be set in the same mode of calculation. You can not mix projects in direct expansion cooling or condensation.
- The working conditions of the coil must be the same for each project. For example, if we calculate a set of coils in direct expansion, overheating and subcooling must be the same for each project, otherwise the power data will not be comparable. The same goes for: fluid selected, relative humidity / wet bulb temperatures, fouling factor, factor recycling, etc..
- In the direct expansion mode is possible to vary the temperature of evaporation, but not the pressure, in addition the calculation is performed at a constant condensing temperature of 45 ° C.
- In condensing mode, the evaporating temperature is fixed: 2 ° C

How to generate a set of project files, one for each unit

1. Create a new project of 6 coils in the desired mode
2. Set the working conditions of the first unit: temperature and humidity on the air side, air flow, fluid inside the tubes, inlet temperature / outlet or evaporation / condensation, etc..
3. Set construction data of the coil of the first unit: geometry, number of rows, number of circuits, step fins, finned pack size, presence or absence of the collectors
4. Perform the calculation and display the print preview
5. Verify that the data are correct and match the performance data of the first unit
6. Make corrections if necessary
7. Save the project and specify a file name similar or equal to that of the unit
8. Change the data construction of the coil by putting those in the second unit
9. Click on "File", then "Save As"
10. Specify the file name as that of the second unit
11. Repeat the steps from 8 onwards for each unit

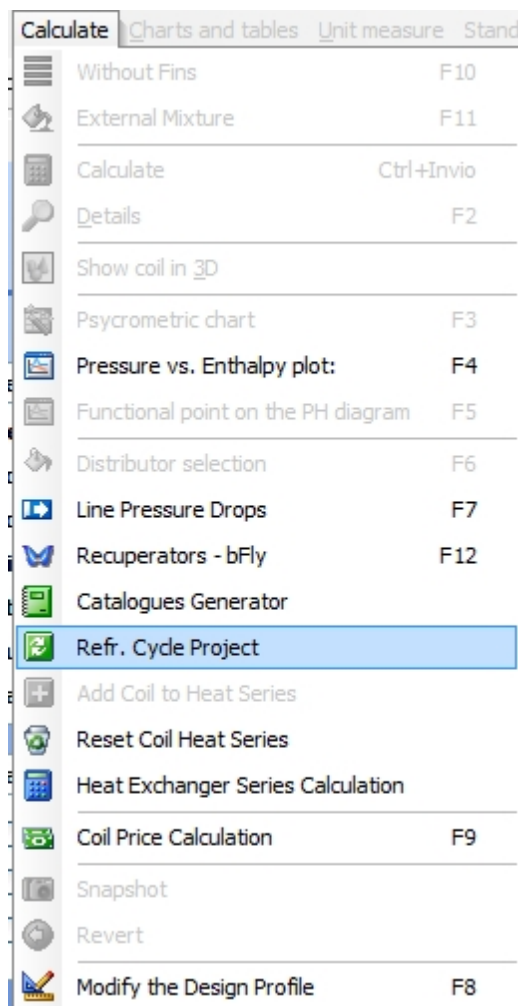
Refrigerant Cycle Project

Refrigerant Cycle Project

This option will give us the opportunity to balance a project of a unit made of a condenser coil, evaporator coil and a compressor.

Let us see an example of the same.

On the Calculate menu we click on “Refr Cycle Project”





Then we get

Refrigerant Cycle Project

Condenser

Project file

Description:

Inlet Temperature DB

°C

▼

35

Overheating


K

▼

30

COMPRESSOR

Compressor



Freon list

▼

Overheating

K

▼

5

Subcooling



K

▼

5

Evaporator

Project file

Description:

Inlet Temperature DB


°C


▼


24


Inlet Relative Humidity

50

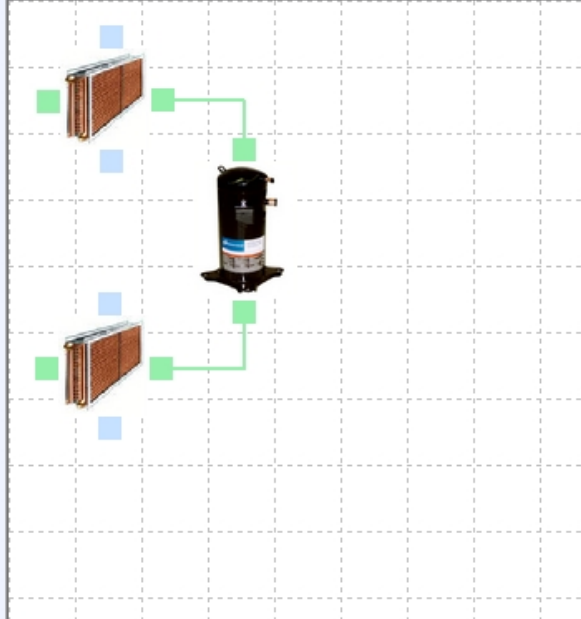
 Open project

 Save project

 Calculate Refrigerant Cycle

 Print

Project data



Designer:
Approved by:
Starting Date: Delivery date:
Model:
Series:
Notes:

Results

On the above screen we can see the parts relative to the three parts, the condenser

Condenser

Project file




Description:

Inlet Temperature DB

°C

▼

35

Overheating

K

▼

30

The compressor

COMPRESSOR

Compressor

Freon list

Overheating

Subcooling

And the evaporator

Evaporator

Project file

Description:

Inlet Temperature DB

Inlet Relative Humidity

In order to do our calculate we have to have a condenser and an evaporator coil project

Heat Exchanger Series Calculation

Heat Exchanger Series Calculation

Let's make an example of how calculation of the heat exchangers in serie works.

Let's suppose we have a system made by several heating components, where we have the output of one thermodynamic calculation becomes the input to the second element and so forth. This can be accomplished with the heat exchanger series calculation.

First we open coils and open heating calculation projects to be added to the calculation in series system.

We open one heating coils project

File Calculate Charts and tables Unit measure Standard Conditions Customize Projects Archive management Tools ? Online help

Project: Standard Conditions Units:

Coils 8.0 - Welcome! C:\Prog...\Heating.c6prj

Heating

Calculation Mode

Verify
Design

Geometry

166030_C_S

Geometry Details
Search Geometry

Tube

Fin

Manifolds

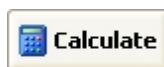
Air Side Details

Output

Calculate Print

AIR SIDE		Obt.
Capacity	kW	195,37
Airflow	m ³ /h	16200
Face Velocity	m/s	2,5
Inlet Temperature DB	°C	20
Inlet Relative Humidity	%	50
Outlet Temperature DB	°C	55,7
Outlet Relative Humidity	%	7,2
Fouling factor	(m ² K)/W	0
Pressure Drop	Pa	45
N° tubes for row		20
Rows		4
Fin Pitch	mm (2)	2,50
Nr of Skipped Tubes		0

TUBE SIDE	
Fluid	WATER (PL)
Pressure	bar A 1
Inlet Temperature	°C 80
Outlet Temperature	°C 70
Pressure Drop	kPa 80,61
Fouling factor	(m ² K)/W 0
Fluid Velocity	m/s 2,64
Finned Length	mm (2) 1500
Circuits	10
Baffles n°	0



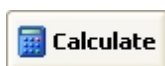
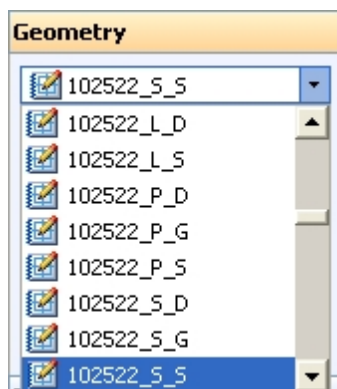
We click on the “Calculate” button

Then on the “Calculate” menu Calculate we click “Add Coil to Heat Series” button



We go back to the heating project to select another calculation to add to our catalogue

Now let's change the geometry



We click on “Calculate”

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | ? Online help

Project: Standard Conditions Units:

Coils 8.0 - Welcome! C:\Prog...\Heating.c6prj *

Heating

Calculation Mode

- Verify
- Design

Geometry




















- Tube
- Fin
- Manifolds
- Air Side Details
- Output

Exchange Surface
 m² 48,69437
 Project Description
 Some warnings
 Coil price (€) 0,00

AIR SIDE		Obt.
Capacity	kW	150,07
Airflow	m ³ /h	16200
Face Velocity	m/s	6
Inlet Temperature DB	°C	20
Inlet Relative Humidity	%	50
Outlet Temperature DB	°C	47,4
Outlet Relative Humidity	%	10,7
Fouling factor	(m ² K)/W	0
Pressure Drop	Pa	231
N° tubes for row	20	
Rows	4	
Fin Pitch	mm (2)	2,50
Nr of Skipped Tubes	0	

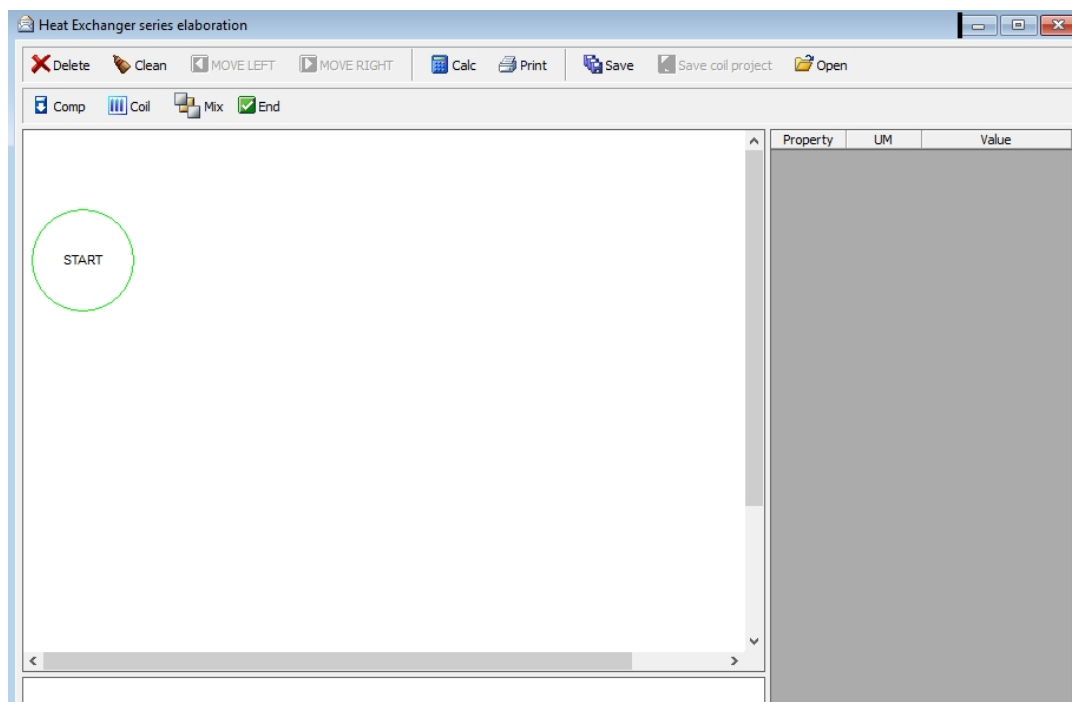
TUBE SIDE	
Fluid	WATER (PL)
Pressure	bar A 1
Inlet Temperature	°C 80
Outlet Temperature	°C 70
Pressure Drop	kPa 664,61
Fouling factor	(m ² K)/W 0
Fluid Velocity	m/s 5,98
Finned Length	mm (2) 1500
Circuits	10
Baffles n°	0


We add this project to the heat series calculation through the Calculate menu

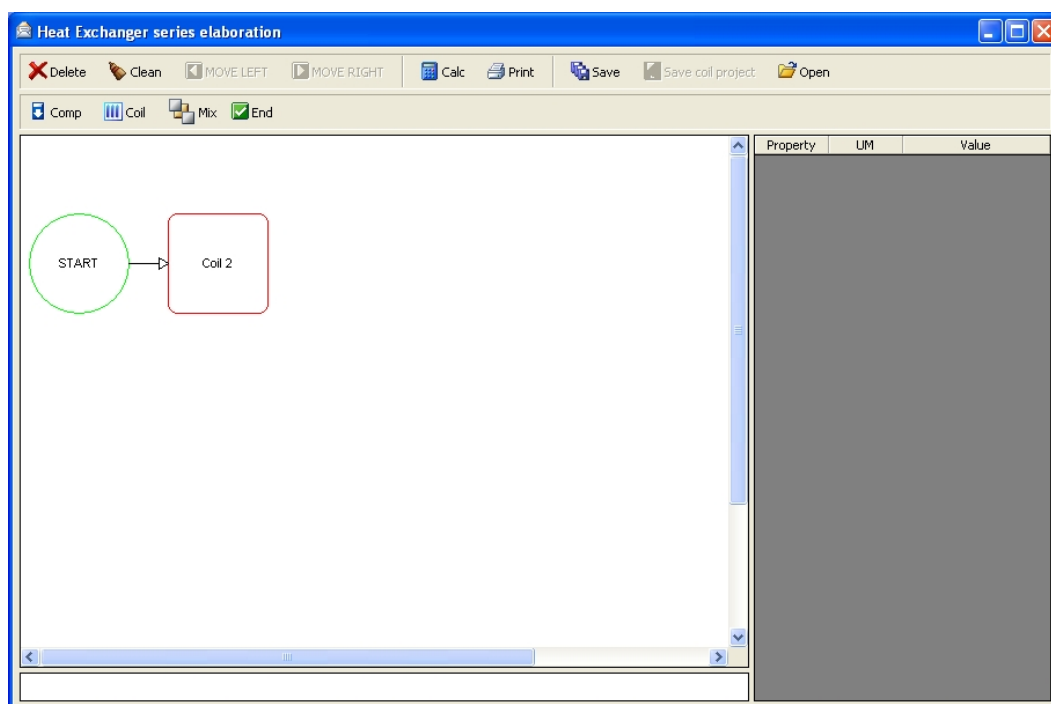
	Without Fins	F10
	External Mixture	F11
	Calculate	Ctrl+Invio
	Details	F2
	Psicrometric chart	F3
	Pressure vs. Enthalpy plot:	F4
	Functional point on the PH diagram	F5
	Distributor selection	F6
	Line Pressure Drops	F7
	Recuperators - bFly	F12
	Catalogues Generator	
	Refr. Cycle Project	
	Add Coil to Heat Series	
	Reset Coil Heat Series	
	Heat Exchanger Series Calculation	
	Coil Price Calculation	F9
	Snapshot	
	Revert	
	Modify the Design Profile	F8


We proceed to Heat Exchanger Series Calculation

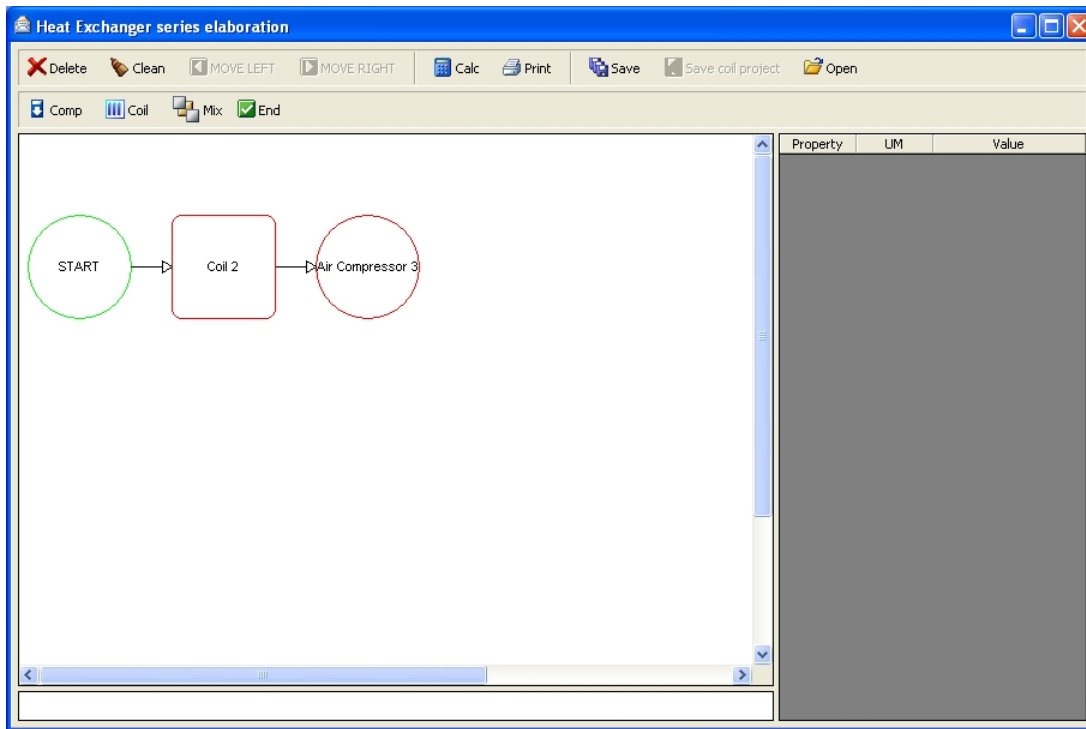
Heat Exchanger Series Calculation



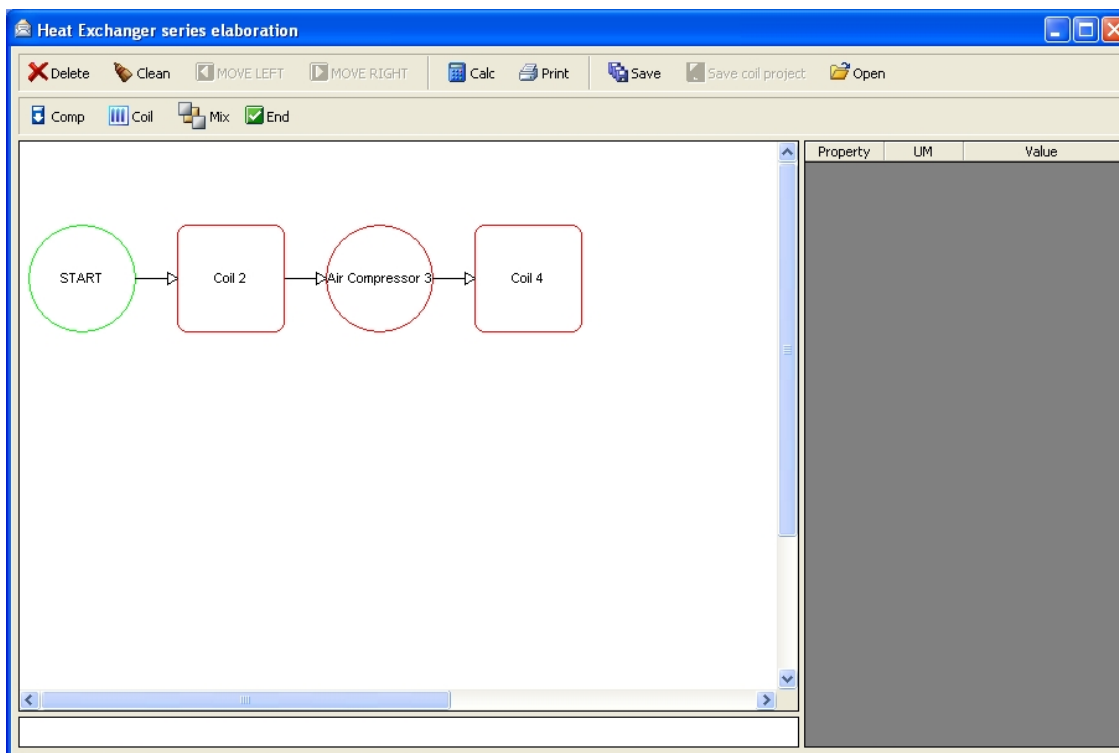
We click the  button to add a coil to our project



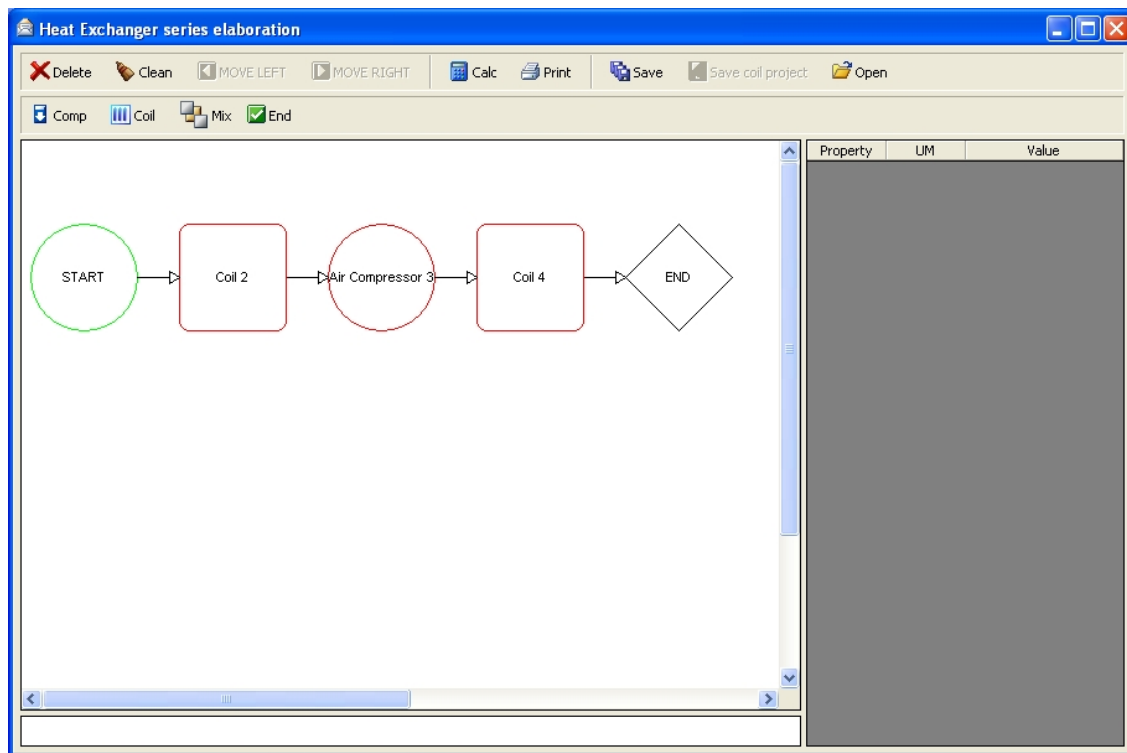
We click  to add a compressor



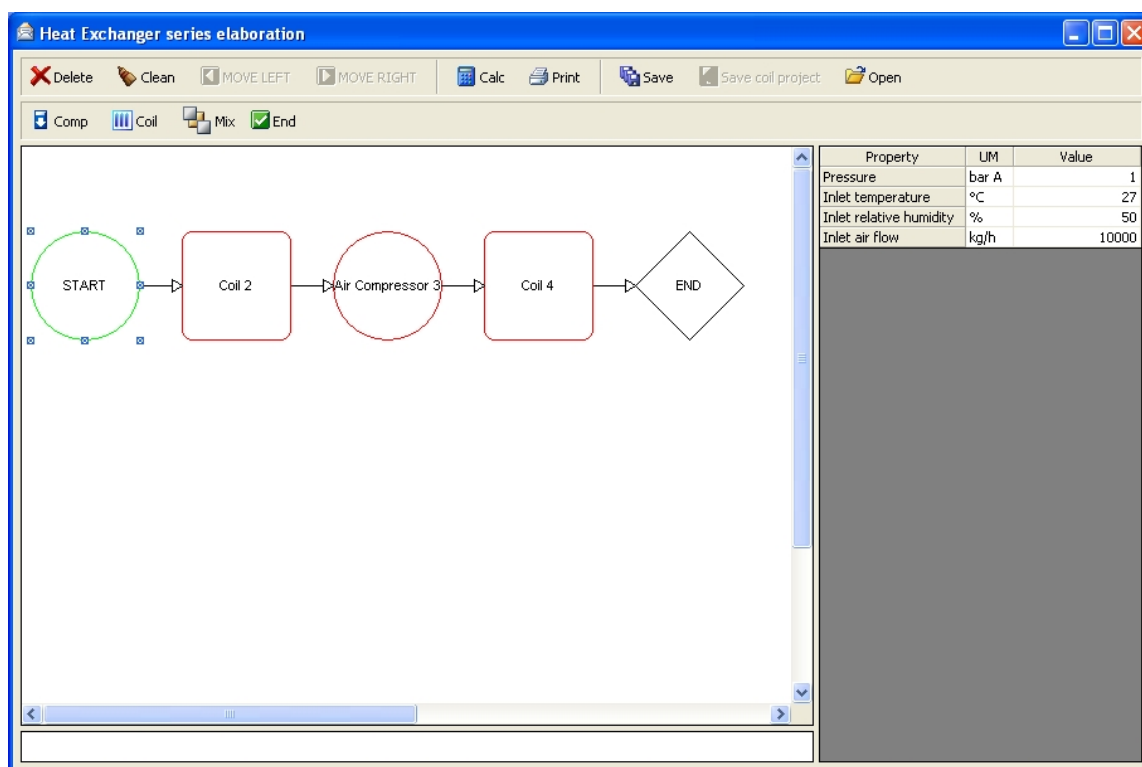
We click  to add another coil



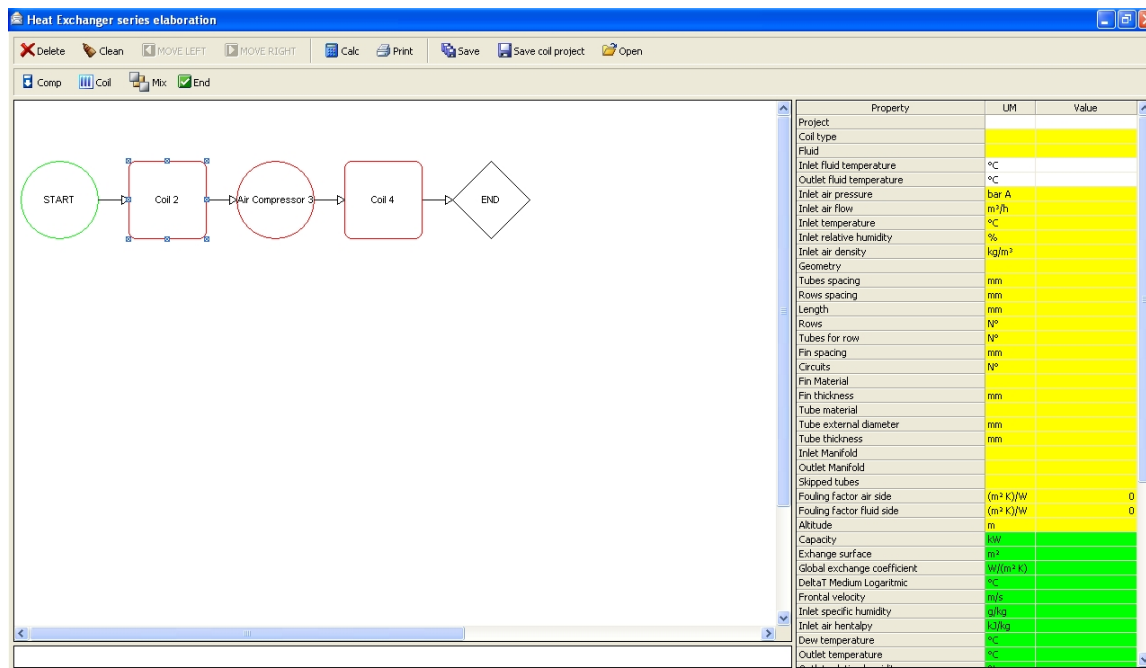
We click the  button to finish our unit



To set the data of each component we click on them

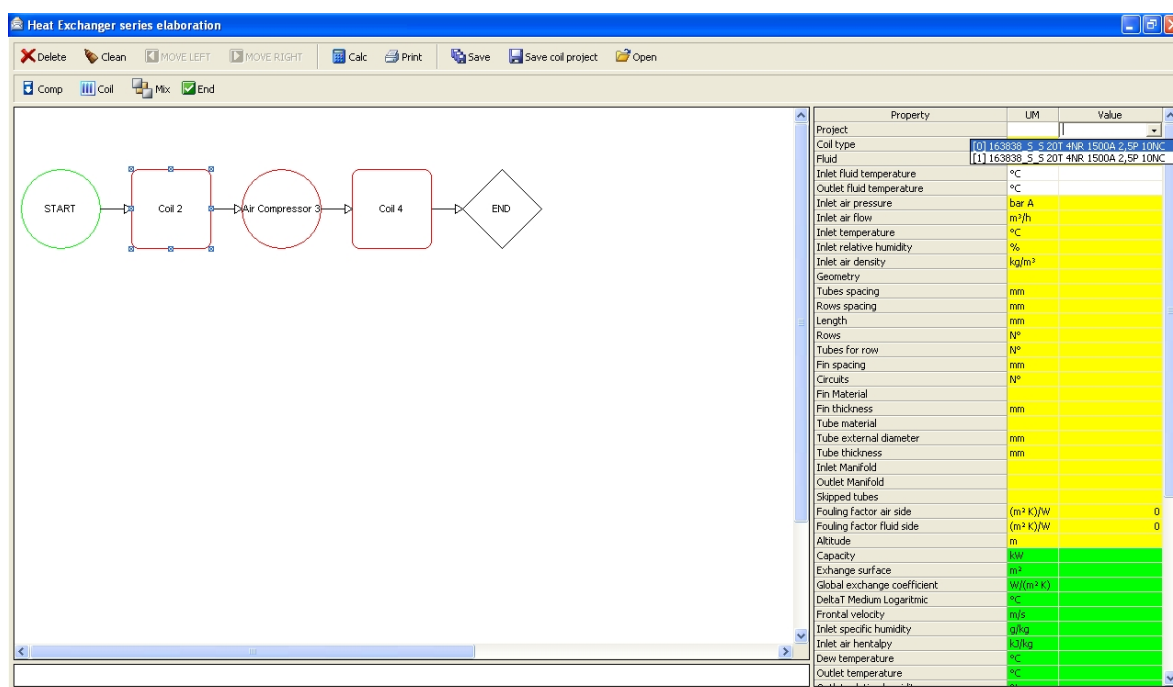


We click on "Coil 2"



To select one of the project data we saved before we click on the “project” line into the value field

When we double click on it, we get




All relative data are automatically compiled (the data in yellow fields and white are input data)

Heat Exchanger series elaboration

Delete Clean MOVE LEFT MOVE RIGHT Calc Print Save Save coil project Open

Comp Coil Mix End




Property	UM	Value
Project		NR 1500A 2,5P 10NC
Coil type		1
Fluid		WATER
Inlet fluid temperature	°C	80,0
Outlet fluid temperature	°C	70,0
Inlet air pressure	bar A	
Inlet air flow	m³/h	
Inlet temperature	°C	20,0
Inlet relative humidity	%	50
Inlet air density	kg/m³	
Geometry		163838_5_5
Tubes spacing	mm	38
Rows spacing	mm	38
Length	mm	1500
Rows	N°	4
Tubes for row	N°	20
Fin spacing	mm	2,5
Circuits	N°	10
Fin Material		Aluminium
Fin thickness	mm	0,12
Tube material		Copper
Tube external diameter	mm	16,5
Tube thickness	mm	0,35
Inlet Manifold		//
Outlet Manifold		//
Slipped tubes		0
Fouling factor air side	(m² K)/W	0,000000
Fouling factor fluid side	(m² K)/W	0,000000
Altitude	m	0,000
Capacity	kW	
Exchange surface	m²	
Global exchange coefficient	W/(m² K)	
DeltaT Medium Logarithmic	°C	
Frontal velocity	m/s	
Inlet specific humidity	g/kg	
Inlet air enthalpy	kJ/kg	
Dew temperature	°C	
Outlet temperature	°C	

We click on "Air Compressor 3"

Heat Exchanger series elaboration

Delete Clean MOVE LEFT MOVE RIGHT Calc Print Save Save coil project Open

Comp Coil Mix End




Property	UM	Value
Inlet air flow	m³/h	10000
Inlet pressure	bar A	1
Inlet temperature	°C	27
Inlet relative humidity	%	50
Outlet temperature	°C	37
Outlet pressure	bar A	3
Outlet air flow	m³/h	
Outlet air temperature	°C	
Outlet relative humidity	%	
Outlet specific humidity	g/kg	

We click on "Coil 4"

Heat Exchanger series elaboration

Delete Clean MOVE LEFT MOVE RIGHT Calc Print Save Save coil project Open

Comp Coil Mix End




Property	UM	Value
Project		
Coil type		[0] 163838_S_5_20T 4NR 1500A 2,5P 10NC
Fluid		[1] 163838_S_5_20T 4NR 1500A 2,5P 10NC
Inlet fluid temperature	°C	
Outlet fluid temperature	°C	
Inlet air pressure	bar A	
Inlet air flow	m³/h	
Inlet temperature	°C	
Inlet relative humidity	%	
Inlet air density	kg/m³	
Geometry		
Tubes spacing	mm	
Rows spacing	mm	
Length	mm	
Rows	Nº	
Tubes for row	Nº	
Fin spacing	mm	
Circuits	Nº	
Fin Material		
Fin thickness	mm	
Tube material		
Tube external diameter	mm	
Tube thickness	mm	
Inlet Manifold		
Outlet Manifold		
Skipped tubes		
Fouling factor air side	(m² K)/W	0
Fouling factor fluid side	(m² K)/W	0
Altitude	m	
Capacity	kW	
Exchange surface	m²	
Global exchange coefficient	W/(m² K)	
DeltaT Medium Logarithmic	°C	
Frontal velocity	m/s	
Inlet specific humidity	g/kg	
Inlet air henthalpy	kJ/kg	
Dew temperature	°C	
Outlet temperature	°C	

All data are automatically compiled (the data in yellow fields and white are input data)


Heat Exchanger series elaboration

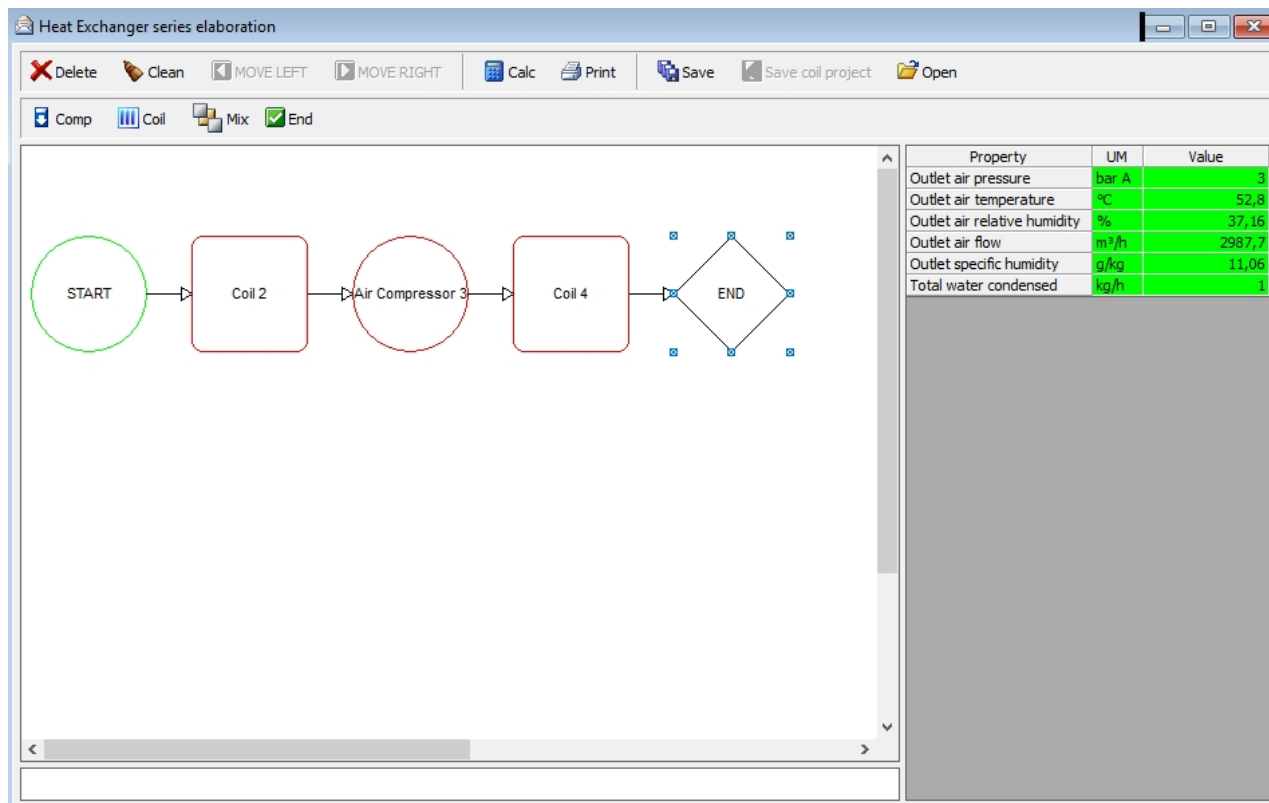
Delete Clean MOVE LEFT MOVE RIGHT Calc Print Save Save coil project Open

Comp Coil Mix End



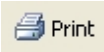
Property	UM	Value
Project		4NR 1500A 2,5P 10NC
Coil type		1
Fluid		WATER
Inlet fluid temperature	°C	80,0
Outlet fluid temperature	°C	70,0
Inlet air pressure	bar A	
Inlet air flow	m³/h	
Inlet temperature	°C	20,0
Inlet relative humidity	%	50
Inlet air density	kg/m³	
Geometry		163838_S_5
Tubes spacing	mm	38
Rows spacing	mm	38
Length	mm	1500
Rows	Nº	4
Tubes for row	Nº	20
Fin spacing	mm	2,5
Circuits	Nº	10
Fin Material		Aluminium
Fin thickness	mm	0,12
Tube material		Copper
Tube external diameter	mm	16,5
Tube thickness	mm	0,35
Inlet Manifold		//
Outlet Manifold		//
Skipped tubes		0
Fouling factor air side	(m² K)/W	0,000000
Fouling factor fluid side	(m² K)/W	0,000000
Altitude	m	0,000
Capacity	kW	
Exchange surface	m²	
Global exchange coefficient	W/(m² K)	
DeltaT Medium Logarithmic	°C	
Frontal velocity	m/s	
Inlet specific humidity	g/kg	
Inlet air henthalpy	kJ/kg	
Dew temperature	°C	
Outlet temperature	°C	

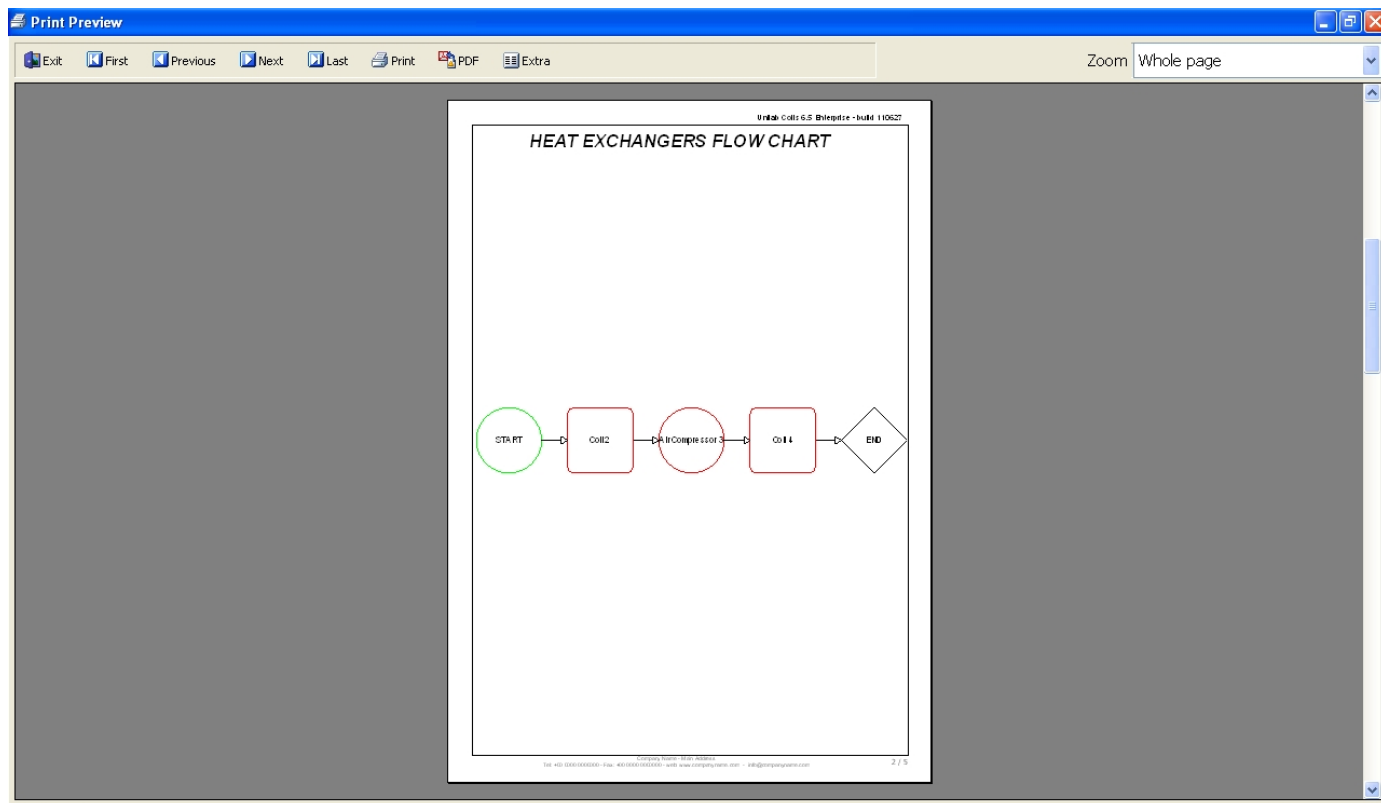
To calculate our system we click on the  button and get



Where we can see our results

Property	UM	Value
Outlet air pressure	bar A	3
Outlet air temperature	°C	52,8
Outlet air relative humidity	%	37,16
Outlet air flow	m³/h	2987,7
Outlet specific humidity	g/kg	11,06
Total water condensed	kg/h	1

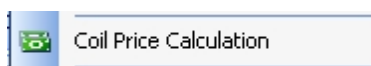
To print our calculation we click on the  button and get



Coils Price Calculation

Coils Price Calculation

1. The “Coil Price Calculation” voice

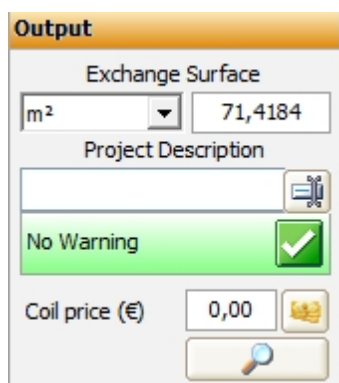


of the Calculate menu **Calculate** was disable:

now you can click on the button



available in each project inside the “Output” section of the form:



Output

Exchange Surface
m² 71,4184

Project Description
No Warning

Coil price (€) 0,00

And you get:

Coils cost calculation

Name calculation			Frame Material	Stainless Steel
Tubes for Row (N°) / Rows (N°)	40	4	Frame Thickness (mm)	1,500
Coil length (mm)	1100		Fin pitch (mm)	2,500
Circuits (N°)	20		Fin Thickness (mm)	0,100
Tubes spacing (mm)	25,00		Fin Material	Aluminium
Length of additional tubes (mm)	20		Rows spacing (mm)	21,65
			Skipped tubes (N°)	0
			Tube External Diameter (mm)	9,54
			Tube Thickness (mm)	0,350
			Tube Material	Copper
<input type="button" value="Price Surcharge"/> <input type="button" value="Manifolds"/> <input type="button" value="Material Man."/>			Waste (%)	4,0
Backpieces	40	2	Labour cost (€/h)	60,00
Above frame	40	1		
<input type="checkbox"/> Construction with hair-pins				
Total price: €			208,51	
<input type="button" value="Cost calculation"/> <input type="button" value="Print calculation"/> <input type="button" value="Exit"/>				

Here we fill with a name the “Name Calculation” field:

Name calculation

After clicking on the button “Price Surcharge” you can set Materials, Manpower and Accessories extra costs calculated from the related costs:

Materials surcharge (%)	2,0
Manpower surcharge (%)	0,0
Accessories surcharge (%)	0,0

After clicking on “Manifolds” button you can set the manifolds data:

Coils cost calculation

Name calculation:

Tubes for Row (N°) / Rows (N°):

Coil length (mm):

Circuits (N°):

Tubes spacing (mm):

Length of additional tubes (mm):

Frame Material:

Frame Thickness (mm):

Fin pitch (mm):

Fin Thickness (mm):

Fin Material:

Rows spacing (mm):

Skipped tubes (N°):

Tube External Diameter (mm):

Tube Thickness (mm):

Tube Material:

Price Surcharge:

Manifolds:

Material Man.:

INLET MANIFOLD

N° of manifolds:

Manifold external diameter (mm):

Manifold Thickness (mm):

Manifold Material:

OUTLET MANIFOLD

N° of manifolds:

Manifold external diameter (mm):

Manifold Thickness (mm):

Connector Length (mm):

Cost calculation:

Print calculation:

Exit:

Show Info:

Currency:

Click on "Material Man."

Material Man.

you can set the cost and density for each materials:

	Density (kg/m³)	Cost (€/kg)
Tube Price (€/kg)	<input type="text" value="8920,000"/>	<input type="text" value="7,967"/>
Fin Material	<input type="text" value="2700,000"/>	<input type="text" value="3,000"/>
Manifold Material	<input type="text" value="8920,000"/>	<input type="text" value="7,967"/>
Frame Material	<input type="text" value="7750,000"/>	<input type="text" value="0,600"/>

Save DataBase:

In the main mask, you see also the width of backpieces (40 mm) and the number which can be set as 0, 1 or 2:

Backpieces:

Above frame:

Then in the same mask, you can set the percentage of waste material, the labour cost and an extra cost to the material original cost already set in the previous step:

Waste (%):

Labour cost (€/h):

If we have a coil built with hair-pins, we can flag the related box:

☐ Construction with hair-pins

At this point, we can click on “Cost calculation”

Cost calculation

and

Print calculation

and we get the costs report:


Date 09/17/2018

Reference

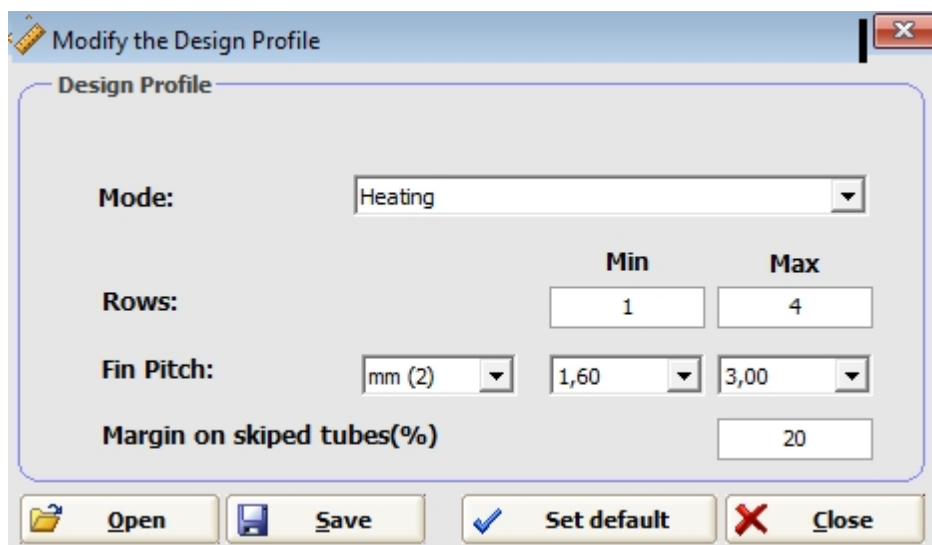
Coil 25 22 40T - 4R - 1100A - 20NC Tubi ut. :160				
Cost of fins material		3,00 €/kg		
Cost of tubes material		7,97 €/kg		
Cost of plate material		0,6000 €/kg		
DESCRIPTION	THICKNESS	AMOUNT	WEIGHT	COST
TUBES	0,3500 (mm)	186 (m)	16,8 (kg)	134,00 €
FINNED PACK	0,1000 (mm)	38,1 (m²)	10,3 (kg)	30,90 €
SIDES	1,50 (mm)	0,3332 (m²)	3,87 (kg)	2,32 €
CLOSING FRAMES	1,50 (mm)	0,2273 (m²)	2,64 (kg)	1,59 €
COLLECTORS	0 (mm)	2,00 (m)	0 (kg)	0,0000 €
CURVETTES	0,3500	140 (N°)	0,4522 (kg)	3,60 €
Material				172,00 €
Labour Cost from Materials Percentage				15 %
Manpower (60,00 €/h)				25,80 €
Waste (4,00 %)				6,89 €
Total material				179,00 €
Price				205,00 €
Surcharge (2,00 %) Material				3,58 €
Surcharge (0 %) Manpower				0,0000 €
Final Price				209,00 €
Total Time (Minutes)				25,8
Weight (kg)				34,1
Total meters (tubes)				186
Price at kg				6,12
Price at meter				1,12 €/m

Modify The Design Profile

Modify The Design Profile

1.  Modify the Design Profile F8 permits to set some fundamental information (like min and max

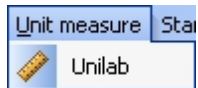
number of rows, of the fin pitch) for the each calculation mode, when you calculate in “Design”: for example, if you set min nr.of rows as 1 and max as 4, you will not get the coils with more than 4 rows among the results, and the same for fin pitch and skipped tubes.



Unit Measure

Unit Measure


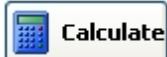
To set a unit measure system, we have to click on the “Unit measure” menu **Unit measure** on the menu bar




And choose the system selected





Calculate

The “Calculate” voice  Calculate Ctrl+Invio is equal to “Calculate” button  and it executes the calculation

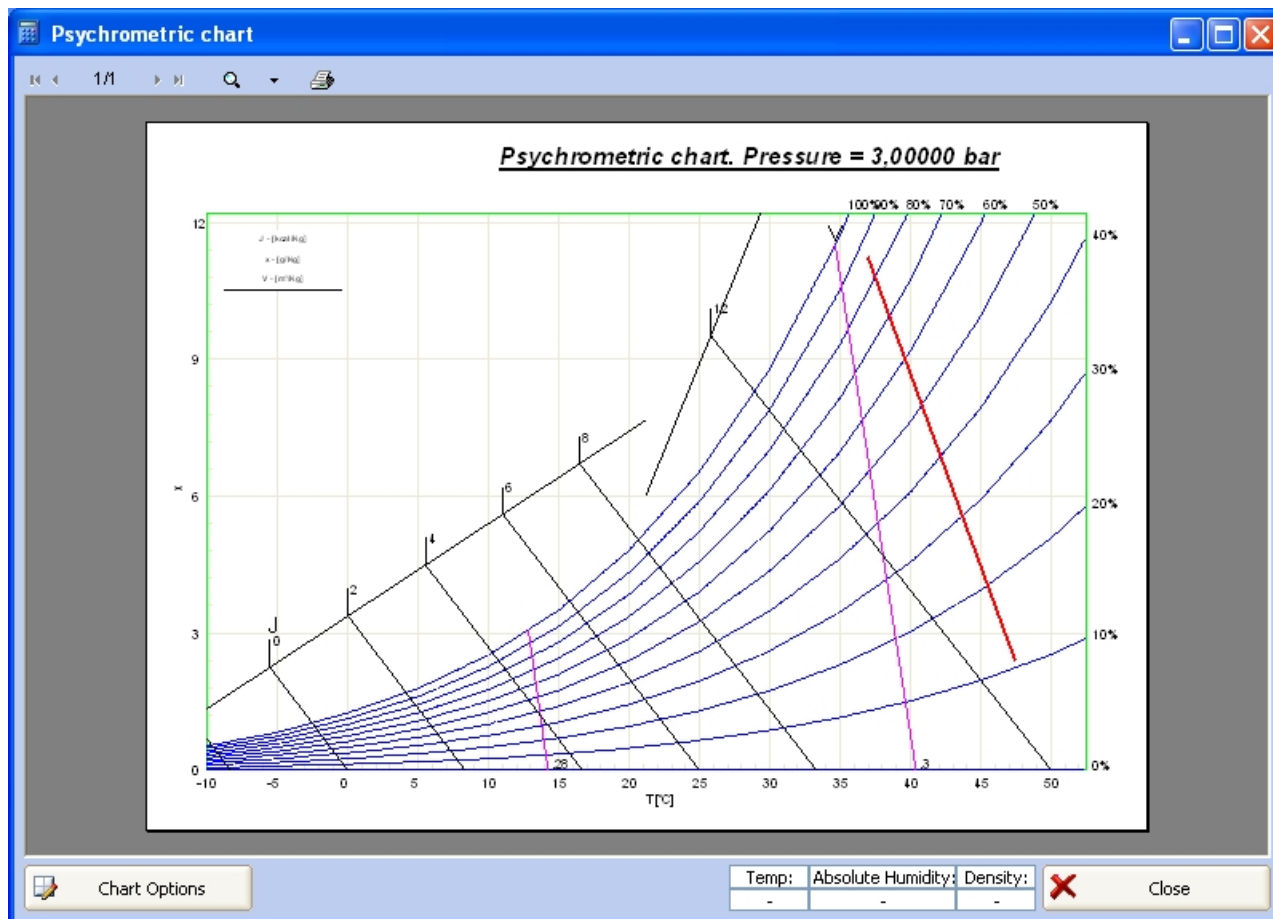
Details

The “Details” voice  Details F2 shows the following project details including all variables that We can export either to an Excel file or to cvs file

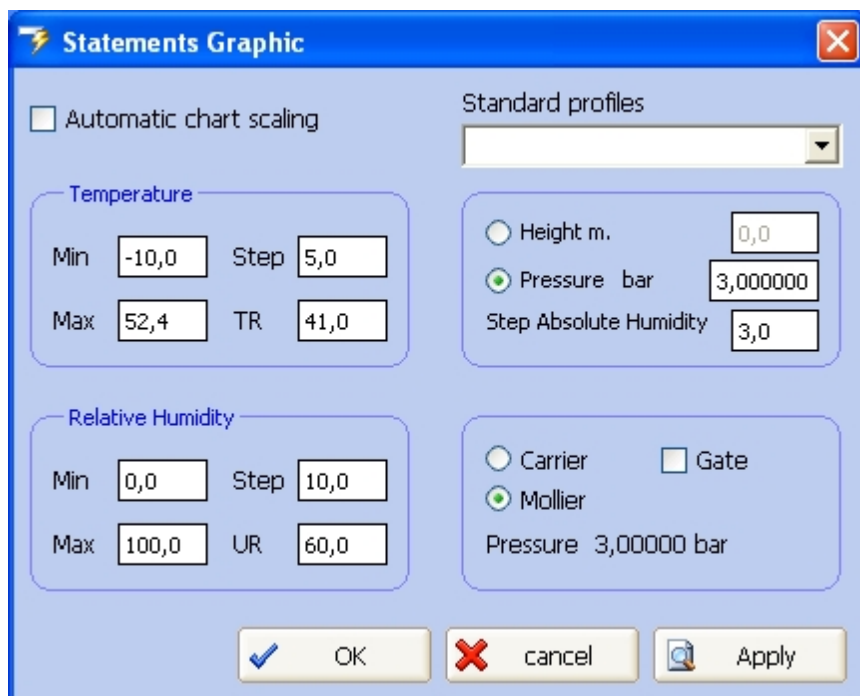
Project details			
Export table			
 Export to Excel file  Export to CVS file			
Description	Value	Unit measure	
[-] AIR SIDE			
Requested capacity	195,38	kW	
Calculated capacity	150,0761	kW	
Mass Flow	19.358,7	kg/h	
Volumetric Flow	2.987,8	m³/h	
[-] Air side/ fan			
Number of fans	0		
Kind of fan	0		
ESP	0	Pa	
[-] AIR SIDE			
Inlet Temperature DB	37	°C	
Inlet Temperature WB	13,76537	°C	
Inlet Relative Humidity	85,19		
Inlet Air Specific Humidity	7,189445		
Outlet Temperature DB	47,4222	°C	
Outlet Temperature WB	22,63969	°C	
Outlet Relative Humidity	10,773792		
Outlet Air Specific Humidity	7,189444		
Fouling Factor	0	(m² K)/W	
Pressure Drop	230,6677	Pa	
Frontal Velocity	6	m/s	
[-] FLUID SIDE			
Fluid	WATER		
[-] Fluid side / fluid data			
Kind of fluid	11		
Calculation temperature	75,0012	°C	
Density	974,842	kg/m³	
Viscosity	0,0003777335	kg/(m s)	
Thermal Conductivity	0,66679	W/(m K)	
Specific Heat	4.193,204	J/(kg K)	

Psychrometric chart

1. The “Psychrometric chart” shows the following



Where can also set other options by clicking “Chart Options”



Statements Graphic

☐ Automatic chart scaling

Standard profiles

Temperature

Min: -10,0 Step: 5,0

Max: 52,4 TR: 41,0

Relative Humidity

Min: 0,0 Step: 10,0

Max: 100,0 UR: 60,0

Standard profiles

☐ Height m. 0,0

☒ Pressure bar 3,000000

Step Absolute Humidity 3,0

☐ Carrier ☐ Gate

☒ Mollier

Pressure 3,00000 bar

OK cancel Apply

Snapshot

The “Snapshot” voice



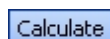
permits to have a snapshot of the screen

Revert

5. The “Revert” voice



of the Calculate menu



permits to go back to a

condition, saved like a snapshot, before the calculation

Condensing		AIR SIDE		Req.	Obt.	TUBES SIDE		
Calculation Mode		Capacity	W			49774	Fluid	R22
<input checked="" type="radio"/> Verify <input type="radio"/> Design		Airflow	m³/h			20000	Flow	kg/h
Geometry		Face Velocity	m/s			3,09	Condensing Temp.	°C
Subcooling Circ.		Inlet Temperature DB	°C			38	Overheating	K
Tube		Inlet Relative Humidity				50	Subcooling	K
Fin		Outlet Temperature DB	°C			46	Pressure Drop	kPa
Manifolds		Outlet Relative Humidity				33,3	Fouling factor	(m² K)/W
Air Side Details		Fouling factor	(m² K)/W			0	Fluid Velocity [Gas phase]	m/s
Output		Pressure Drop	Pa			61	N° tubes for row	
Exchange Surface							Rows	
m²							Fin Pitch	mm (2)
Project Description							Nr of Skipped Tubes	
Trial							Finned Length	mm
No Warning							Circuits	
Coil price (€)							Baffles n°	
0,00								
Calculate								
Print								

the above screen is shown before clicking the “Revert” voice




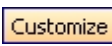
Revert

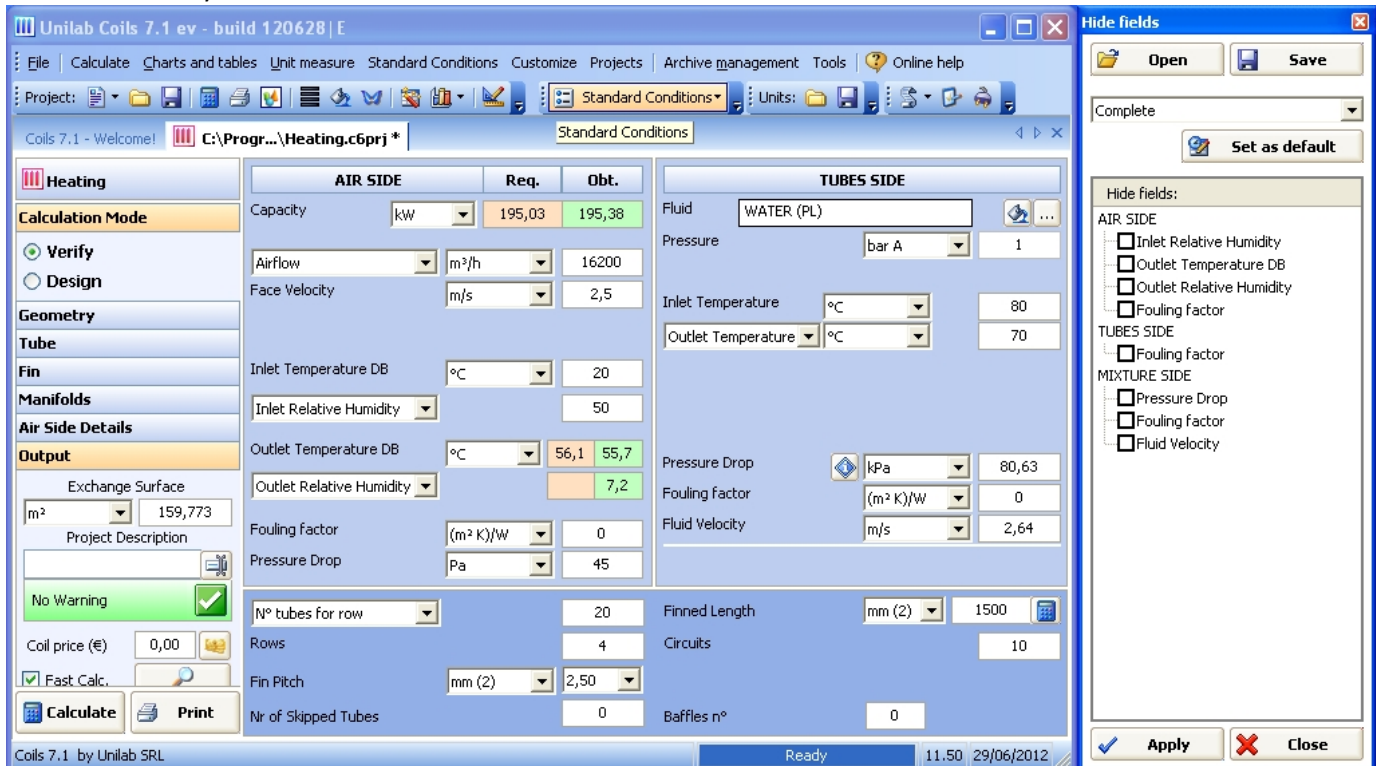
The screen after the revert voice is chosen, as you can see, the Face Velocity is set to 0 m/s.

Condensing		AIR SIDE		Req.	Obt.	TUBES SIDE		
Calculation Mode		Capacity	W			49775	Fluid	R22
<input checked="" type="radio"/> Verify <input type="radio"/> Design		Airflow	m³/h			20000	Flow	kg/h
Geometry		Face Velocity	m/s			0	Condensing Temp.	°C
Subcooling Circ.		Inlet Temperature DB	°C			38	Overheating	°C
Tube		Inlet Relative Humidity				50	Subcooling	°C
Fin		Outlet Temperature DB	°C			46	Pressure Drop	kPa
Manifolds		Outlet Relative Humidity				33,3	Fouling factor	(m² K)/W
Air Side Details		Fouling factor	(m² K)/W			0	Fluid Velocity [Gas phase]	m/s
Output		Pressure Drop	Pa			61	N° tubes for row	
Exchange Surface							Rows	
m²							Fin Pitch	mm (2)
Project Description							Nr of Skipped Tubes	
Trial							Finned Length	mm
No Warning							Circuits	
Coil price (€)							Baffles n°	
0,00								
Calculate								
Print								

CUSTOMIZE

CUSTOMIZE


The “Hide Fields” button  Hide fields Ctrl+N on the “Customize” menu  on the top of the mask, allows to set the fields you want to see in the calculation masks.

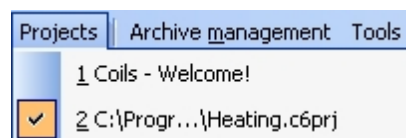


You can select the fields you want to hide for the particular mode of the coil (heating, cooling, etc.) and save this setting to open it in a future calculation.

PROJECTS

PROJECTS

The “Projects” menu  shows only the currently open projects

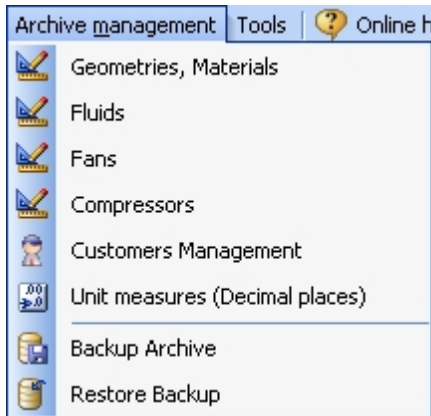


ARCHIVE MANAGEMENT

ARCHIVE MANAGEMENT

In this section, we will see how we can work with various archives of our software.

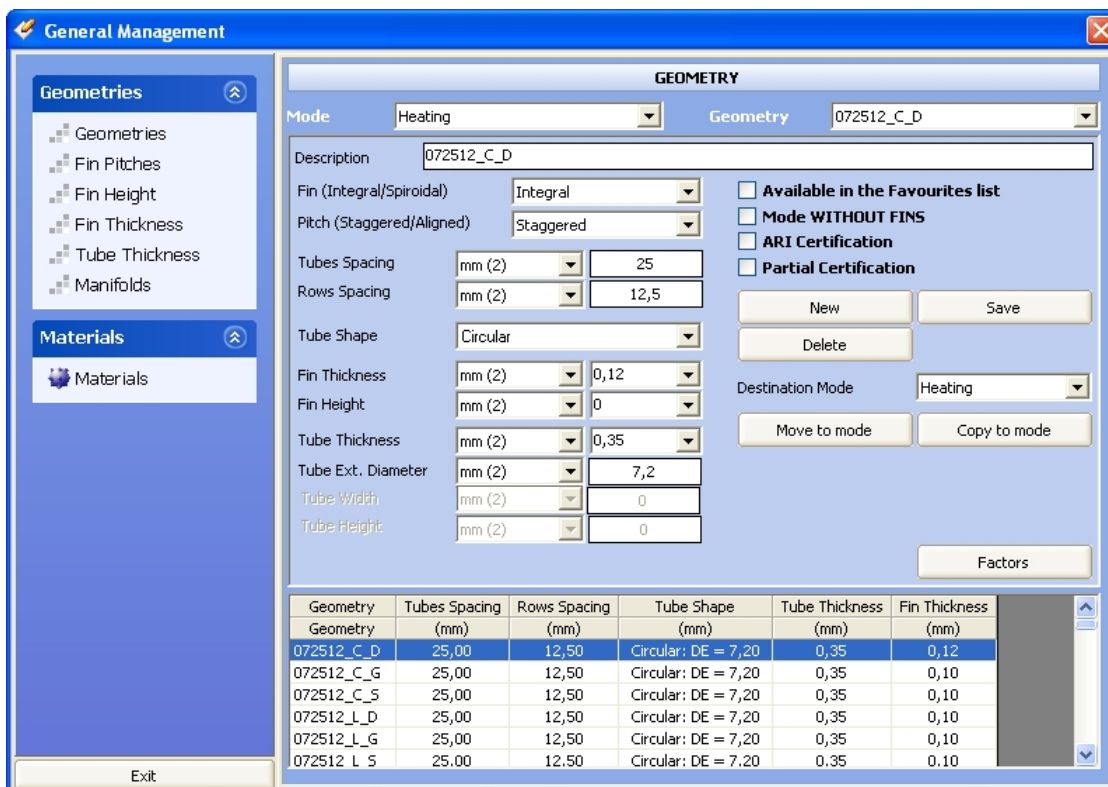
- Let's click on the "Archive management" **Archive management** on the menu bar.



Geometries, Materials

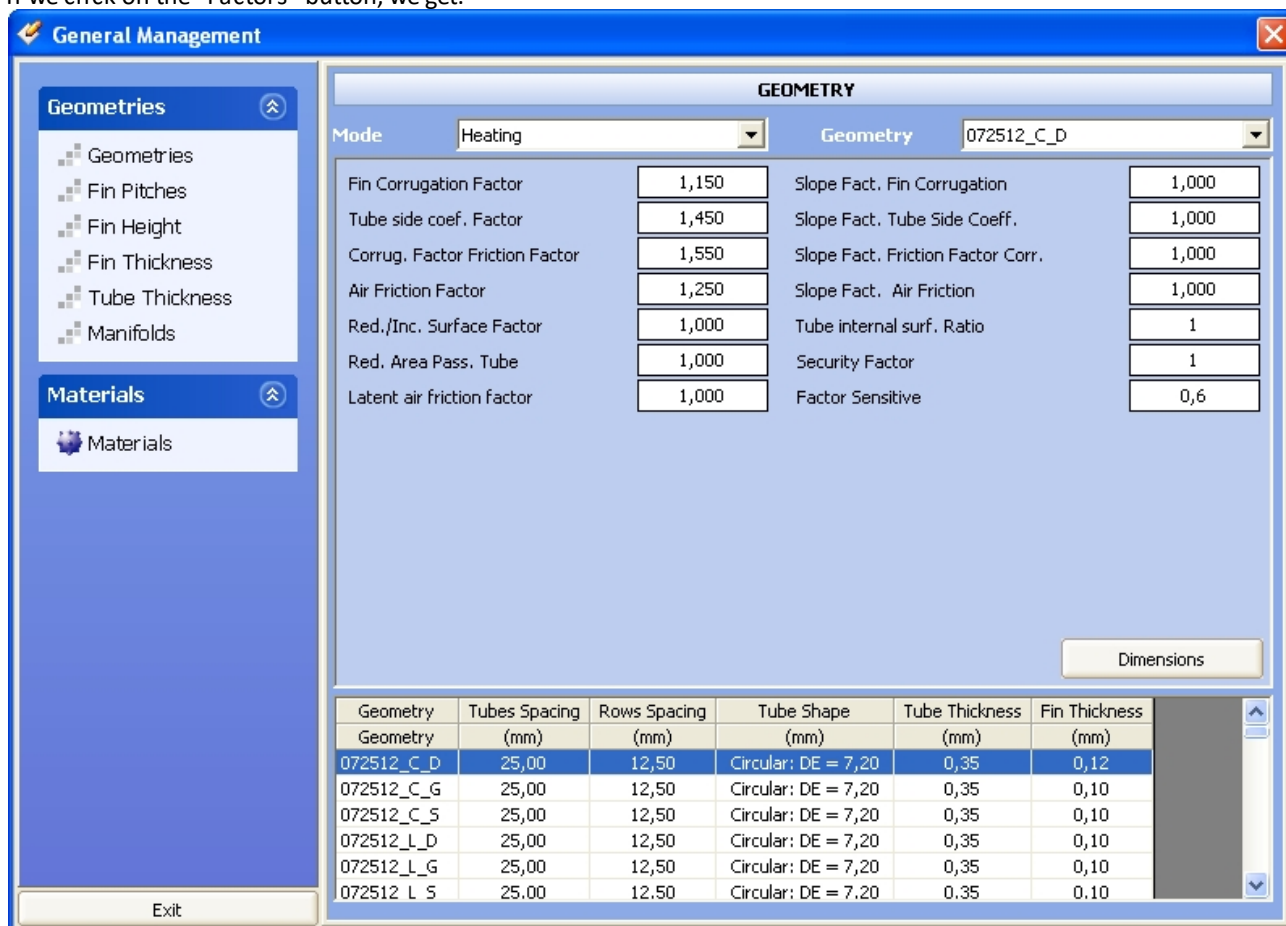
Geometries, Materials

- Let's click on **Geometries, Materials** of the "Archive management" menu **Archive management**



where we can add, delete or modify data relative to geometries and materials.

If we click on the “Factors” button, we get:



General Management

GEOMETRY

Mode: Heating Geometry: 072512_C_D

Fin Corrugation Factor	1,150	Slope Fact. Fin Corrugation	1,000
Tube side coef. Factor	1,450	Slope Fact. Tube Side Coeff.	1,000
Corrug. Factor Friction Factor	1,550	Slope Fact. Friction Factor Corr.	1,000
Air Friction Factor	1,250	Slope Fact. Air Friction	1,000
Red./Inc. Surface Factor	1,000	Tube internal surf. Ratio	1
Red. Area Pass. Tube	1,000	Security Factor	1
Latent air friction factor	1,000	Factor Sensitive	0,6

Dimensions

Geometry	Tubes Spacing (mm)	Rows Spacing (mm)	Tube Shape (mm)	Tube Thickness (mm)	Fin Thickness (mm)
072512_C_D	25,00	12,50	Circular: DE = 7,20	0,35	0,12
072512_C_G	25,00	12,50	Circular: DE = 7,20	0,35	0,10
072512_C_S	25,00	12,50	Circular: DE = 7,20	0,35	0,10
072512_L_D	25,00	12,50	Circular: DE = 7,20	0,35	0,10
072512_L_G	25,00	12,50	Circular: DE = 7,20	0,35	0,10
072512 L S	25,00	12,50	Circular: DE = 7,20	0,35	0,10

Exit

Here we can specify the factors related to the geometry. These factors are:

Fin corrugation factor/slope:

this parameter, defined as fin corrugation factor, represents the ratio (with the same air frontal velocity) between the exchange coefficient of a corrugated finned coil, and the corresponding exchange coefficient of a plain fin coil. This value is equal to 1 for plain fin. For further corrugation cases, the factors must be experimentally determined.

Tube side coef. factor/slope:

this parameter, defined as "coefficient factor inside tubes/slope", represents the ratio between the real exchange coefficient of internal tubes and the ideal one. This value is equal to 1 for cylindrical tubes with internal plain surface. For further cases, the factor must be experimentally determined

Correction factor of friction factor/slope:

this parameter, defined as "correction factor of friction factor/slope", represents the ratio between the real tubes internal side friction factor and the ideal one. This value is equal to 1 for cylindrical tubes with internal plain surface. For further cases, the factor must be experimentally determined.

Friction factor air side/slope:

this parameter, defined as "friction factor air side/slope", represents the ratio between the real tubes external side friction factor and the ideal one. This value is equal to 1 for plain fins. For further cases, the factor must be experimentally determined.

“Slope” factors

the coefficient of proportionality in logarithmic coordinates between the item at issue (fin etc...) and the related fluid speed. This parameter enables the user to find the correction factor in function of speed.

Red/Inc Surface factor:

this parameter, defined as the surface reduction/increase factor, is a nondimensional parameter which considers the possible calculation differences of the exchange surface. This factor permits to analyze those cases in which the geometry parameters are not constant, such as differentiated spacing coils (typical for direct expansion coils at very low temperature) or differentiated fin height coils.

Reduction Area Pass. Tube:

this parameter, defined as "tube passage reduction area", permits to consider possible elements which may reduce the fluid passage area. The value goes from 0 to 1.

Latent air friction factor

this factor applies specifically to calculations with dehumidification. In this type of application the fin is covered by water, which makes an increment on the air side pressure drops, calculated by a specific equation. This factor lets you trim the behavior of this equation.

Tube internal surface ratio

this parameter applies to grooved tubes and it lets you specify the ratio of the internal surface calculated like (Internal Grooved Surface / Internal Smooth Surface). This parameter is very important when the controlling resistance is tubes side. For a detailed explanation, please see the FAQ called “Considerations about grooved tubes” at the end of the manual.

Security factor

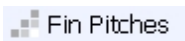
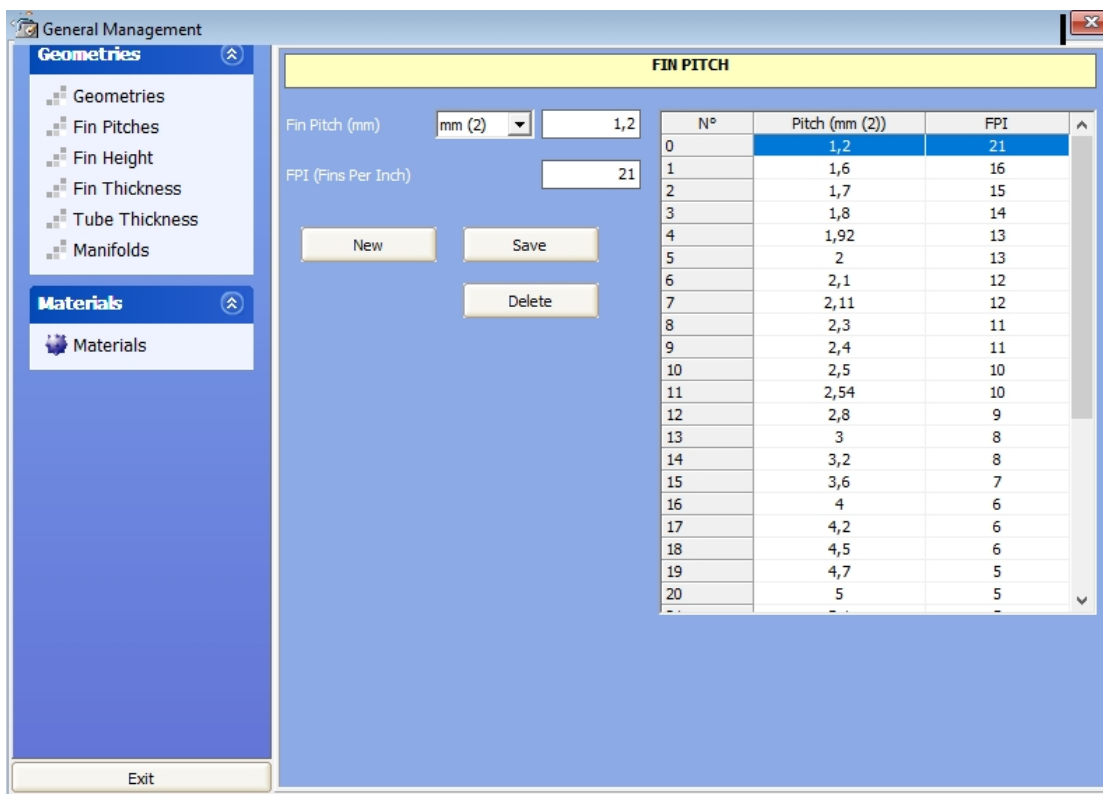
this parameter affects the entire calculation, and lets you increase or decrease the performance of the coil. It's intended to be a factor to gain some security margin.

Sensible factor

this parameter affects the sensible capacity of the coil. The standard value is 0.6 and it is not proportional.

All the above factors can have a positive effect on the calculation only if obtained by laboratory test. They should not be used to trim performances of the coils without knowing the possible consequences

- Let's click on the “Fin Pitches” option

General Management

Geometries

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

Materials

- Materials

FIN PITCH

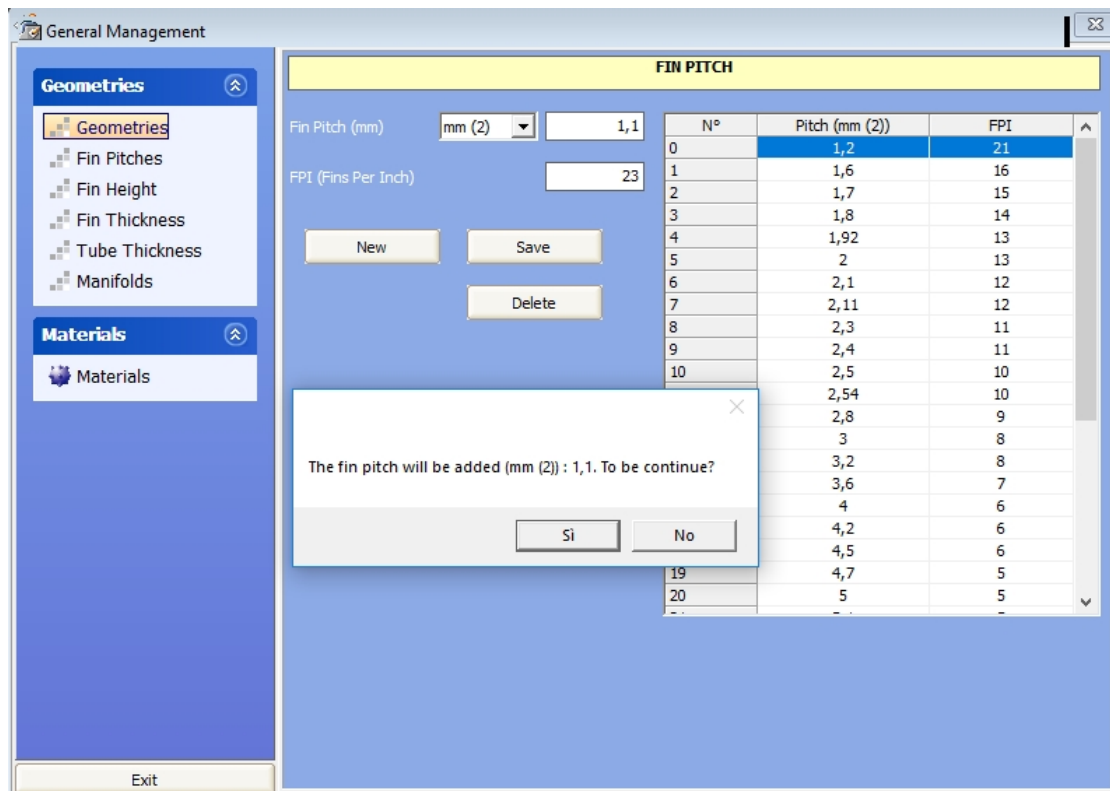
Fin Pitch (mm)

FPI (Fins Per Inch)

N°	Pitch (mm (2))	FPI
0	1,2	21
1	1,6	16
2	1,7	15
3	1,8	14
4	1,92	13
5	2	13
6	2,1	12
7	2,11	12
8	2,3	11
9	2,4	11
10	2,5	10
11	2,54	10
12	2,8	9
13	3	8
14	3,2	8
15	3,6	7
16	4	6
17	4,2	6
18	4,5	6
19	4,7	5
20	5	5

We have a possibility to add / delete Fin Pitch.


- Let's add a pitch of 1,1 mm by writing “1,1” in the box relative to the Fin Pitch

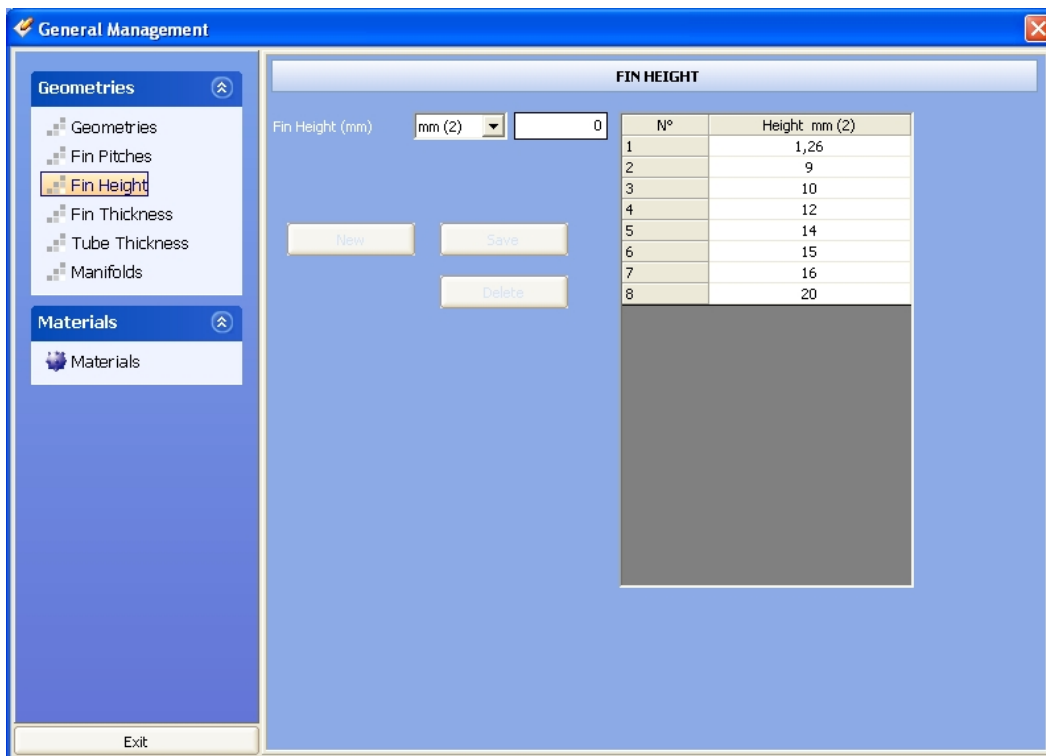


- of course, to continue let's click "Yes" ("Sì"), otherwise click "No"
- We can see the pitch We have just added the 1,1 pitch

N°	Pitch (mm (2))	FPI
0	1,1	23
1	1,2	21
2	1,6	16
3	1,7	15
4	1,8	14
5	1,92	13
6	2	13
7	2,1	12
8	2,11	12
9	2,3	11
10	2,4	11
11	2,5	10
12	2,54	10
13	2,8	9
14	3	8
15	3,2	8
16	3,6	7
17	4	6
18	4,2	6
19	4,5	6
20	4,7	5
...	-	-

- instead if we want to overwrite an already existing pitch, it's just a matter of clicking on the pitch to be overwritten inserting the value in the pitch box and click on the "Save" button

- Here is the "Fin Height" option 



General Management

Geometries

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

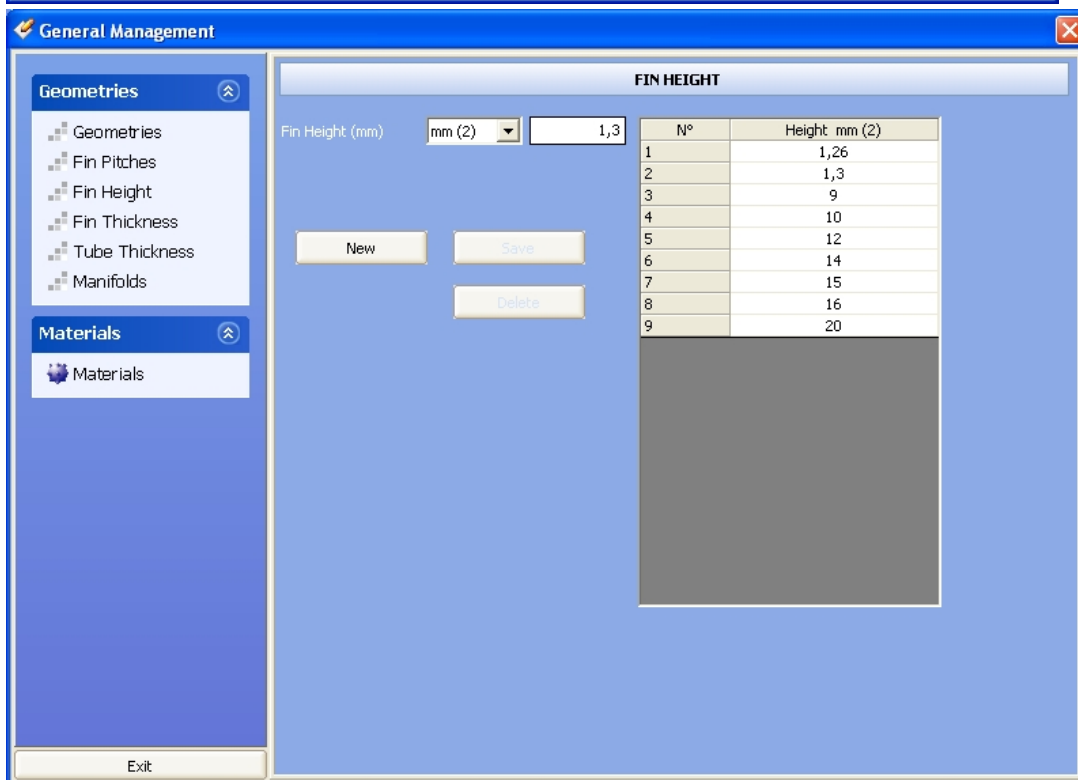
Materials

- Materials

FIN HEIGHT

Fin Height (mm) **mm (2)**

N°	Height mm (2)
1	1,26
2	9
3	10
4	12
5	14
6	15
7	16
8	20



General Management

Geometries

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

Materials

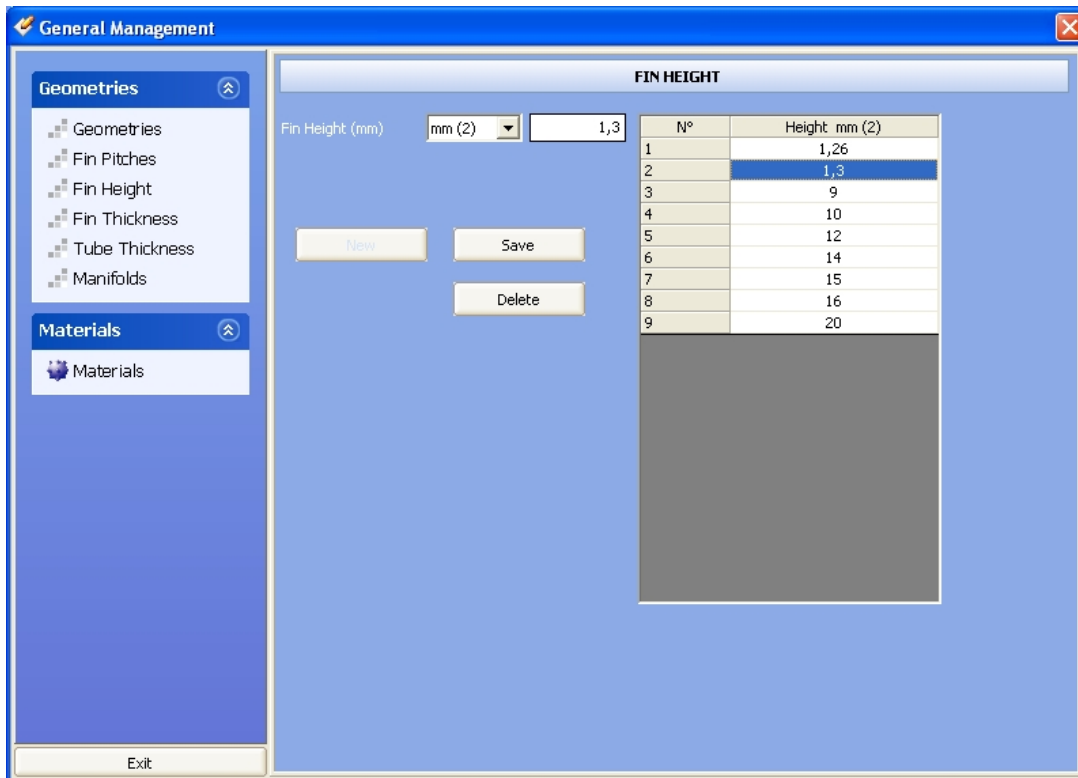
- Materials

FIN HEIGHT

Fin Height (mm) **mm (2)**

N°	Height mm (2)
1	1,26
2	1,3
3	9
4	10
5	12
6	14
7	15
8	16
9	20

Here again to add a new Height to see in the main program , we have to insert the value in the Fin Height box, then click on the “New” button . To replace an already existing Height, just insert the value in the box, then we click on “Save” button .

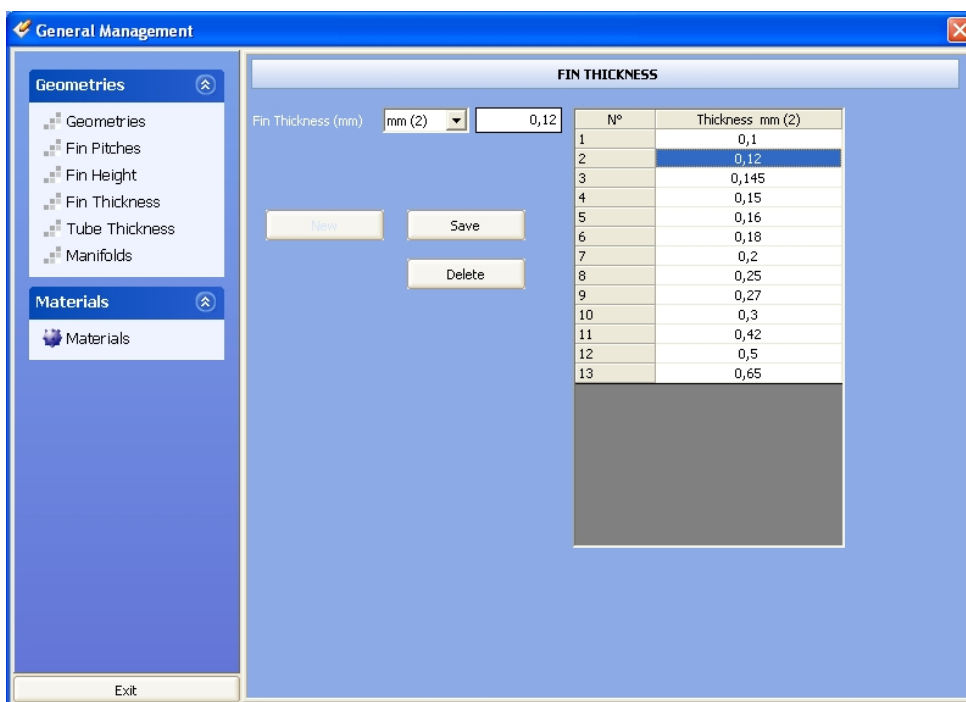


to delete a value , just click on it and then click on the “Delete” button

Delete

- Fin Thickness

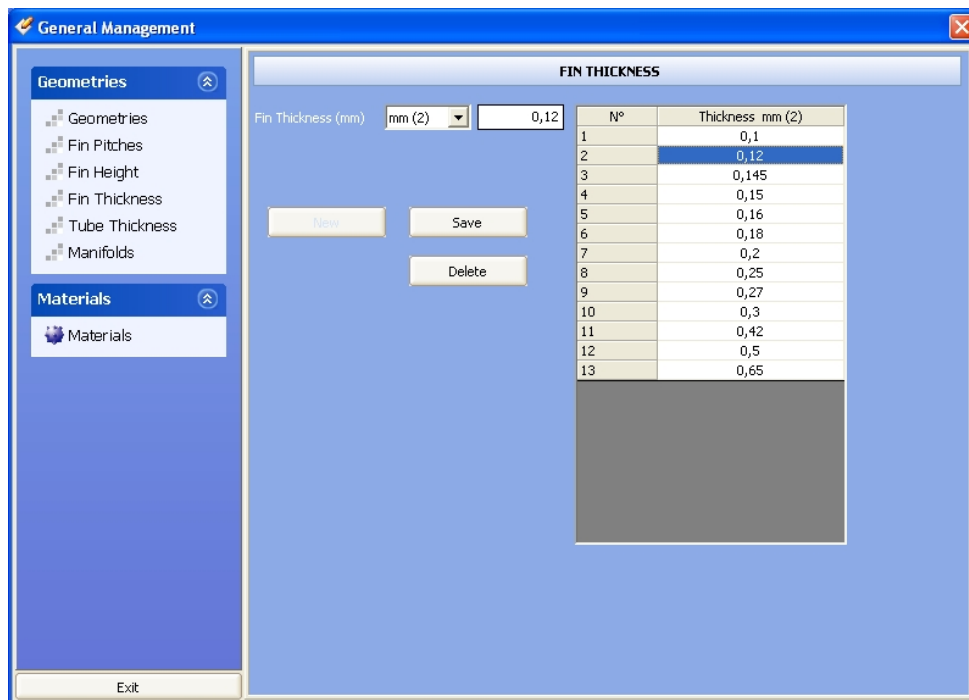
Fin Thickness



Here again to add a new Thickness to see in the main program , we have to insert the value in the Fin Thickness box, then click on the “New” button. To replace an already existing Thickness, just insert the value in the box, then we click on “Save” button.

New

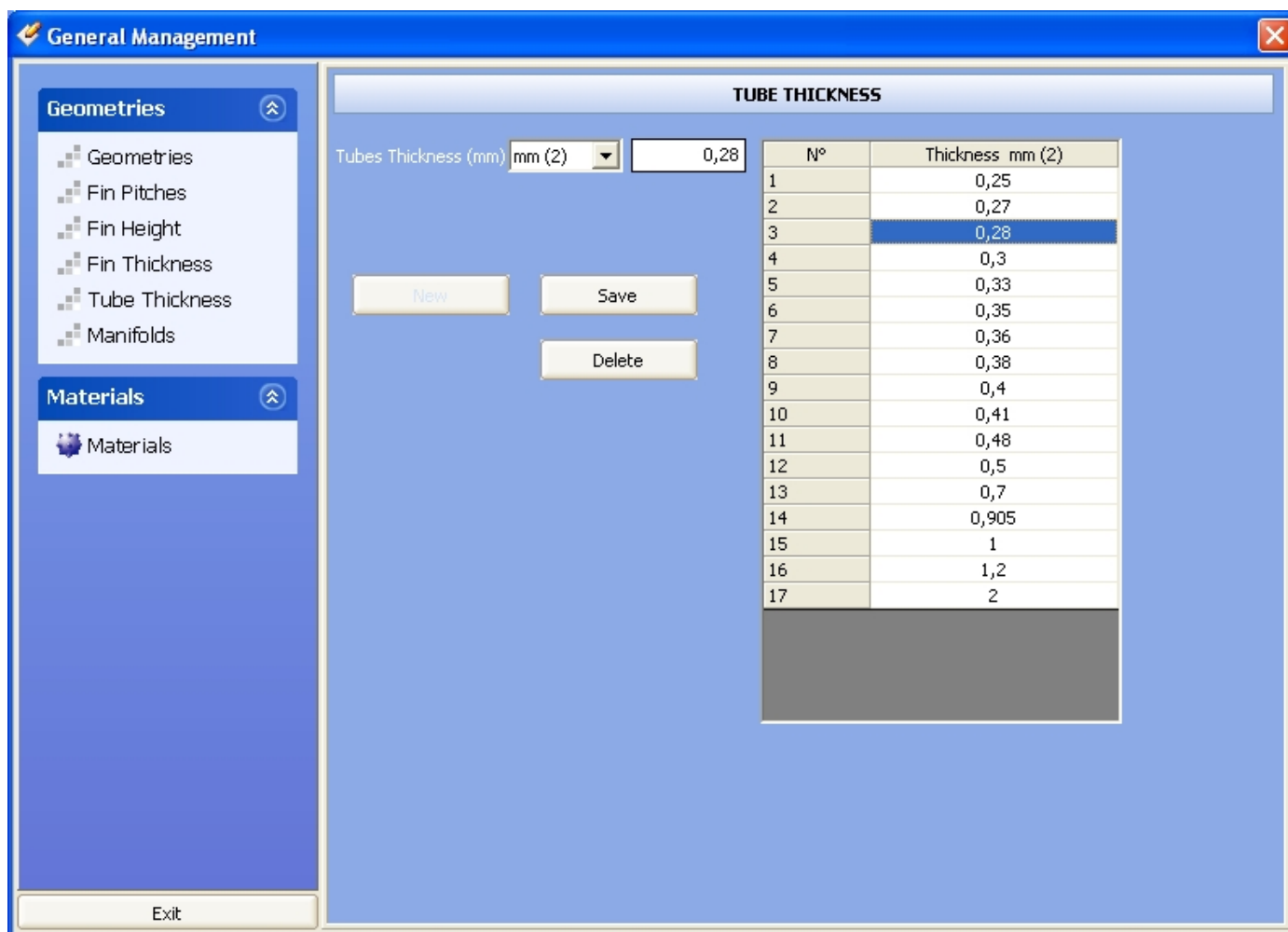
Save



to delete a value , just click on it and then click on the “Delete” button

Delete

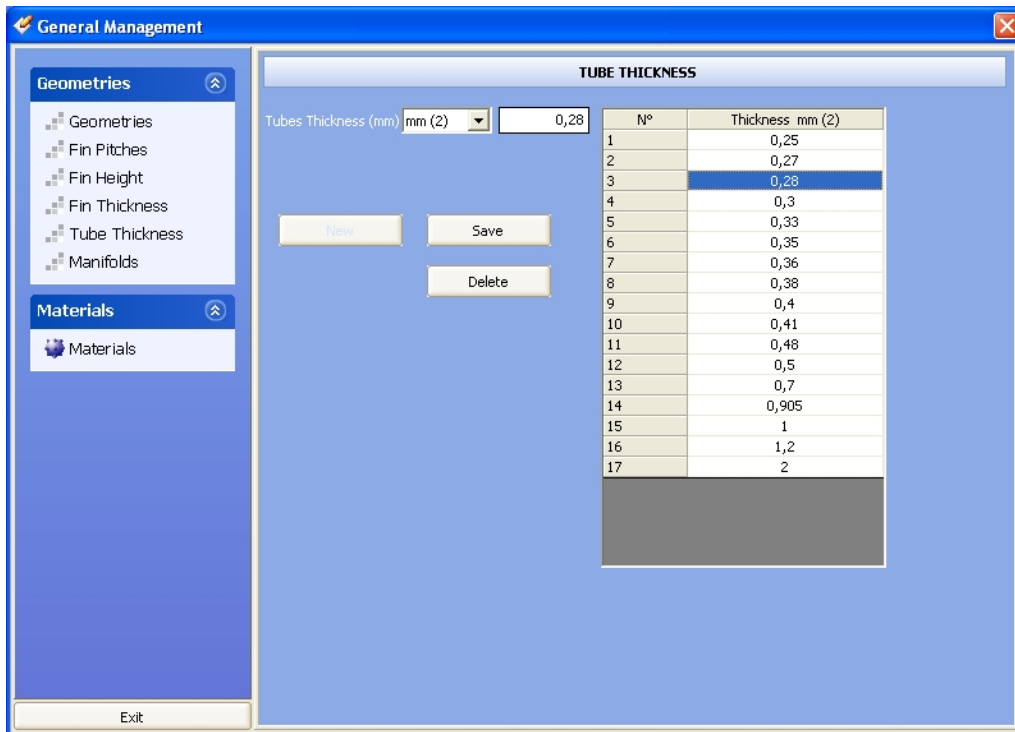
- Tube Thickness  Tube Thickness



Here again to add a new Thickness to see in the main program , we have to insert the value in the Tubes Thickness box, then click on the “New” button  . To replace an already existing Thickness, just

insert the value in the box, then we click on "Save" button

Save



General Management

Geometries

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

Materials

- Materials

TUBE THICKNESS

Tubes Thickness (mm) **mm (2)** 0,28

New Save Delete

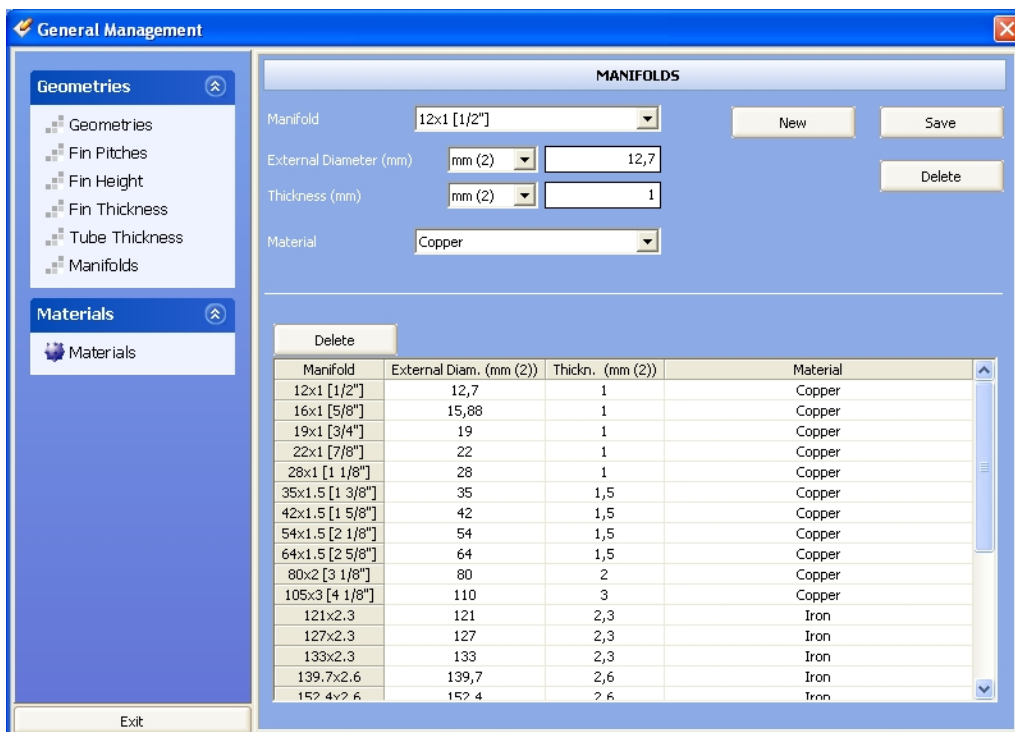
N°	Thickness mm (2)
1	0,25
2	0,27
3	0,28
4	0,3
5	0,33
6	0,35
7	0,36
8	0,38
9	0,4
10	0,41
11	0,48
12	0,5
13	0,7
14	0,905
15	1
16	1,2
17	2

Exit

to delete a value, just click on it and then click on the "Delete" button

Delete

- The Manifolds option  is shown below



General Management

Geometries

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

Materials

- Materials

MANIFOLDS

Manifold **12x1 [1/2"]** New Save

External Diameter (mm) **mm (2)** 12,7

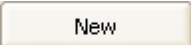
Thickness (mm) **mm (2)** 1 Delete

Material **Copper**

Delete

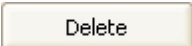
Manifold	External Diam. (mm (2))	Thickn. (mm (2))	Material
12x1 [1/2"]	12,7	1	Copper
16x1 [5/8"]	15,88	1	Copper
19x1 [3/4"]	19	1	Copper
22x1 [7/8"]	22	1	Copper
28x1 [1 1/8"]	28	1	Copper
35x1.5 [1 3/8"]	35	1,5	Copper
42x1.5 [1 5/8"]	42	1,5	Copper
54x1.5 [2 1/8"]	54	1,5	Copper
64x1.5 [2 5/8"]	64	1,5	Copper
80x2 [3 1/8"]	80	2	Copper
105x3 [4 1/8"]	110	3	Copper
121x2.3	121	2,3	Iron
127x2.3	127	2,3	Iron
133x2.3	133	2,3	Iron
139.7x2.6	139,7	2,6	Iron
152.4x2.6	152.4	2.6	Iron

Exit

Here we can manage the data of the manifolds to use in the main program. With the button  you can insert a new manifold and the relative data.

With the button  you can modify the data of the manifold selected in the combo

Manifold **12x1 [1/2"]**

The button  in the higher section of the mask, allows to delete the manifold selected in the combo

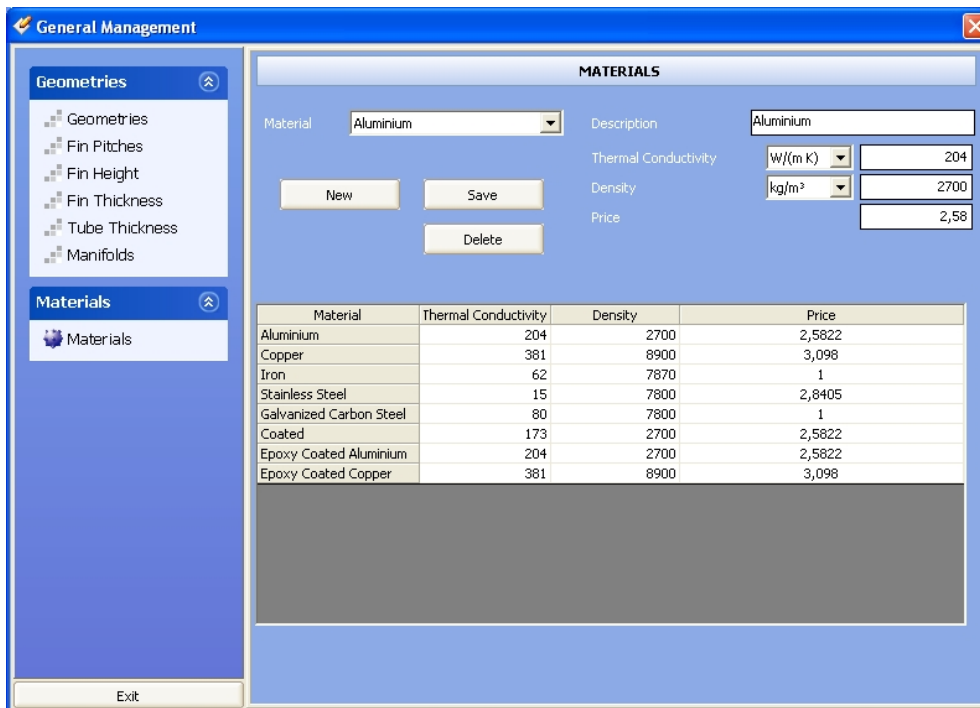
Manifold

Delete

The other button, just above the table, containing the complete list of manifolds saved in the archive, allows to delete the manifold selected in the table

Manifold	External Diam. (mm (2))	Thickn. (mm (2))	Material
12x1 [1/2"]	12,7	1	Copper
16x1 [5/8"]	15,88	1	Copper
19x1 [3/4"]	19	1	Copper
22x1 [7/8"]	22	1	Copper
28x1 [1 1/8"]	28	1	Copper
35x1.5 [1 3/8"]	35	1,5	Copper
42x1.5 [1 5/8"]	42	1,5	Copper
54x1.5 [2 1/8"]	54	1,5	Copper
64x1.5 [2 5/8"]	64	1,5	Copper
80x2 [3 1/8"]	80	2	Copper
105x3 [4 1/8"]	110	3	Copper
121x2.3	121	2,3	Iron
127x2.3	127	2,3	Iron
133x2.3	133	2,3	Iron
139.7x2.6	139,7	2,6	Iron
152.4x2.6	152.4	2.6	Iron

- The “Materials” voice



General Management

Geometries

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

Materials

- Materials

MATERIALS

Material: Description:

Thermal Conductivity:

Density:

Price:

New Save Delete

Material	Thermal Conductivity	Density	Price
Aluminium	204	2700	2,5822
Copper	381	8900	3,098
Iron	62	7870	1
Stainless Steel	15	7800	2,8405
Galvanized Carbon Steel	80	7800	1
Coated	173	2700	2,5822
Epoxy Coated Aluminium	204	2700	2,5822
Epoxy Coated Copper	381	8900	3,098


Exit

Here we can manage the data of the materials to use in the main program. With the button you can insert a new material and the relative data.

With the button you can modify the data of the material selected in the combo

Material

The button allows to delete the material selected in the combo

- to hide the menu on the side, just click on the arrows. 

Geometries

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

General Management

Geometries

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

Materials

- Materials

MATERIALS

Material:
Description:

Thermal Conductivity:
Density:
Price:

Material	Thermal Conductivity	Density	Price
Aluminium	204	2700	2,5822
Copper	381	8900	3,098
Iron	62	7870	1
Stainless Steel	15	7800	2,8405
Galvanized Carbon Steel	80	7800	1
Coated	173	2700	2,5822
Epoxy Coated Aluminium	204	2700	2,5822
Epoxy Coated Copper	381	8900	3,098

To exit this part, just click on the button

Fluids archive management

Fluids archive management

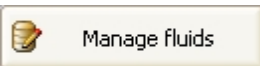
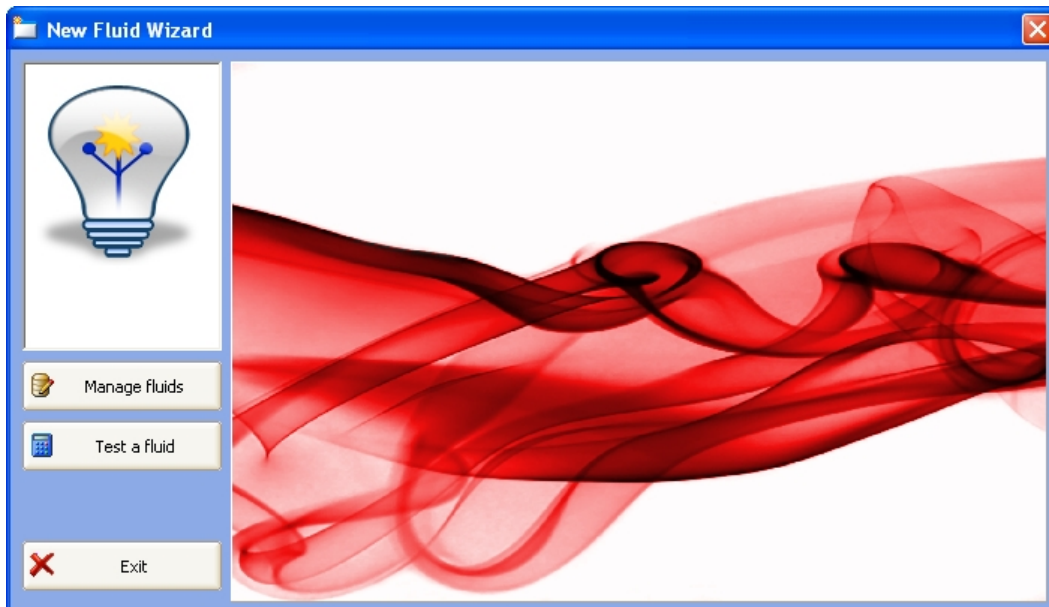
Let's click on the "Fluids" voice



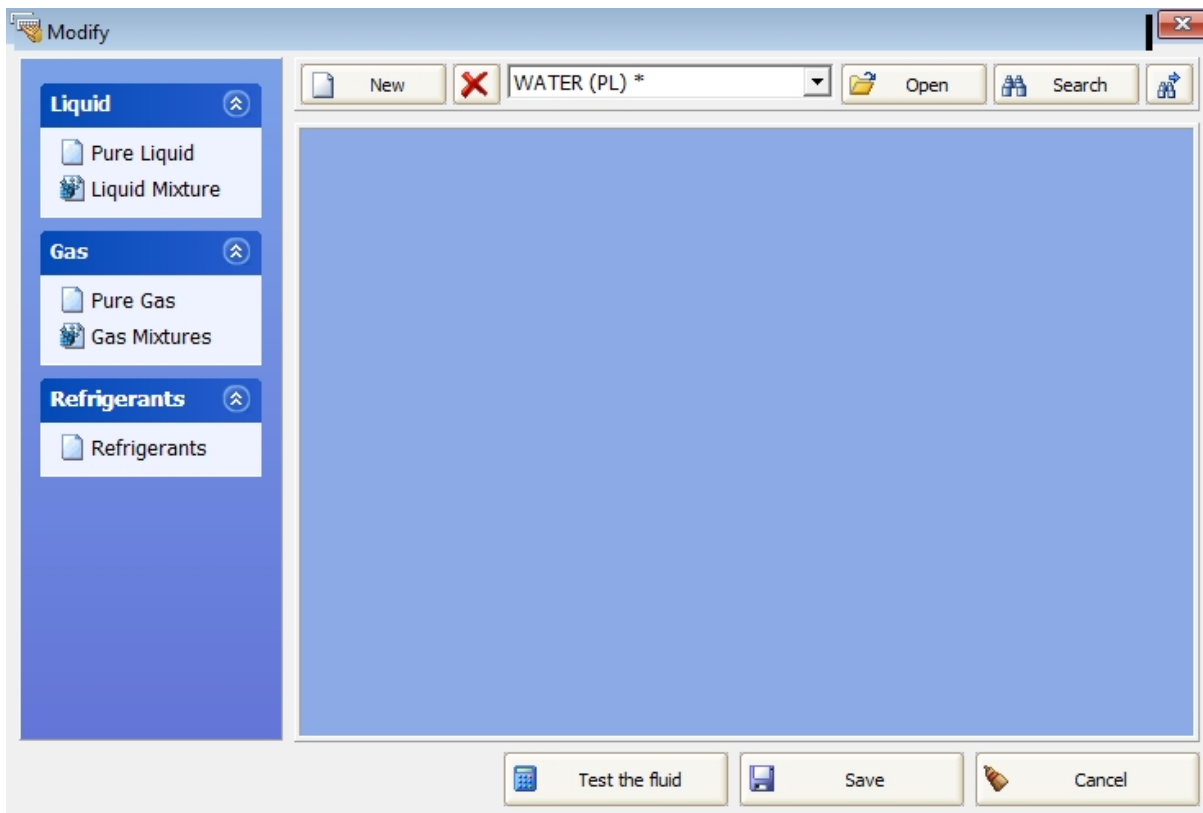
Fluids

of the menu

- The following opens



Let's click on the button



Here are the data relative to the liquids, gas, and freons and can be changed.

To insert a new fluid:

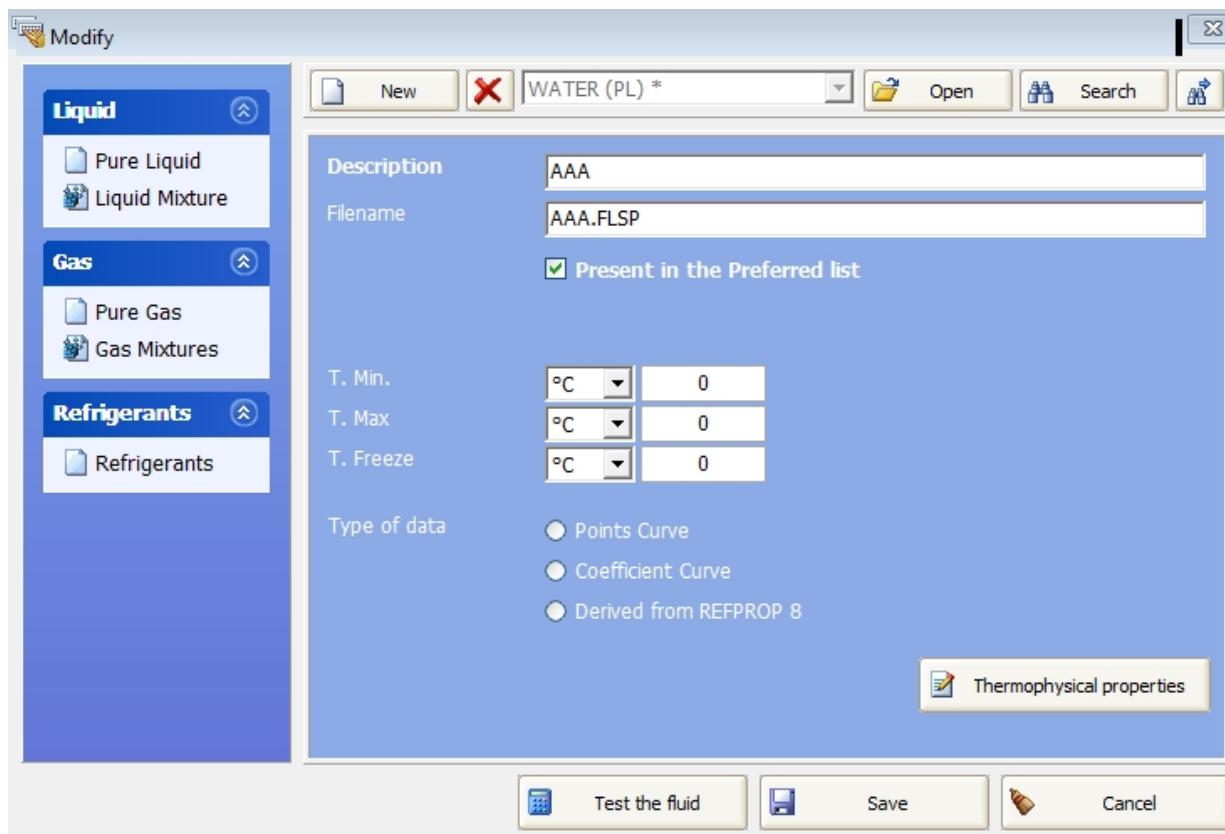
• Choose the types of the fluid between:

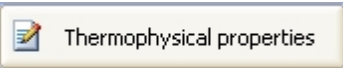
- "Pure Liquid" (PL)
- "Liquid Mixture" (LM)
- "Pure Gas" (PG)
- "Gas Mixtures" (GM)

(The 4 codes (PL, ML, PG, GM) that you find near the name of the fluids when you use the program indicates the type between above).

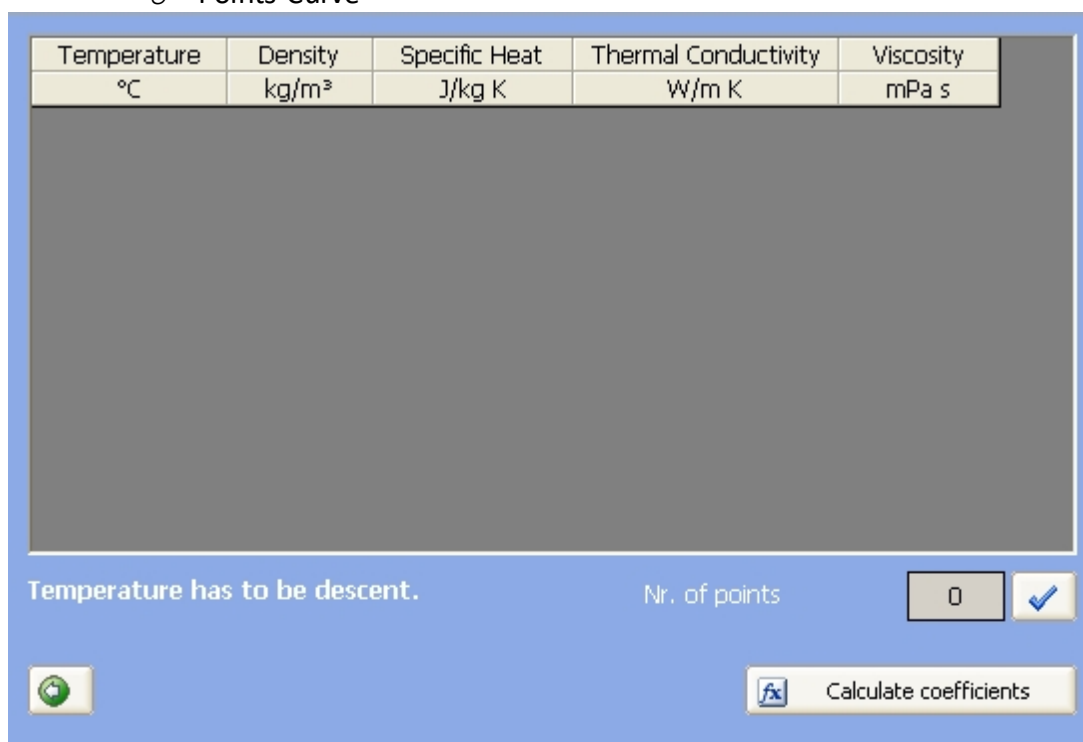
- "Refrigerants".

Now let's insert a new liquid, clicking on "New", then choose "Pure Liquid", insert the name of liquid "AAA" and the mask which appear is the following:



- Here you can insert the minimum and maximum temperature of validity of the fluid, the freeze temperature and the type of data that describe the fluid. Clicking on the button , the software shows you three different masks, according to the type of data selected before:

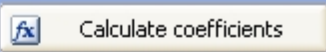
- Points Curve



Temperature	Density	Specific Heat	Thermal Conductivity	Viscosity
°C	kg/m³	J/kg K	W/m K	mPa s

Temperature has to be descent.

Nr. of points: 0 ☒



- Coefficient Curve



Coeff.	Density	Specific Heat	Thermal Conductivity	Viscosity
N°	kg/m³	J/kg K	W/m K	mPa s
1				
2				
3				
4				
5				
R2				


Attention: a R2 lower than 0.95 is too low.




- Derived from REFPROP library

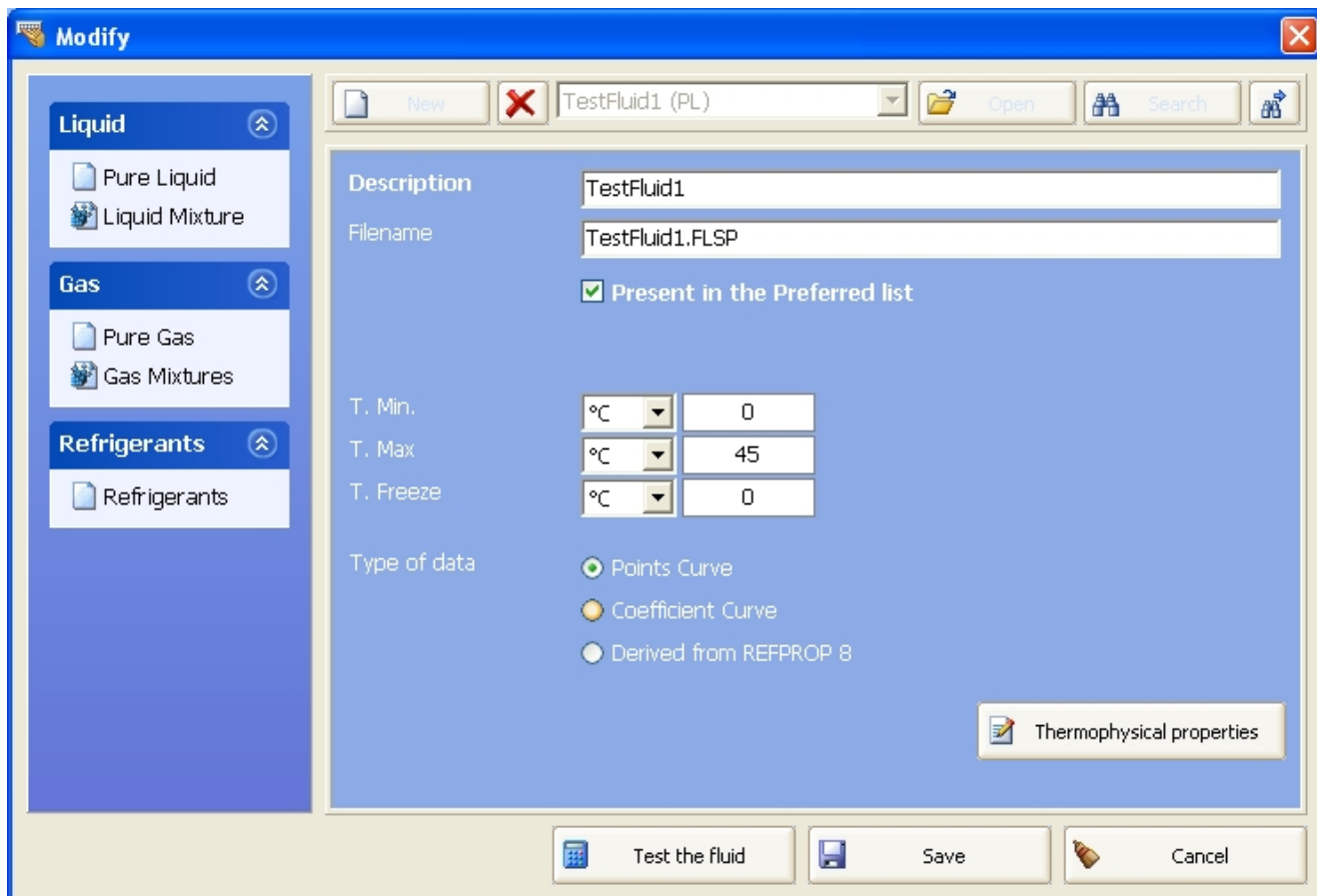
Id Fluid
 %







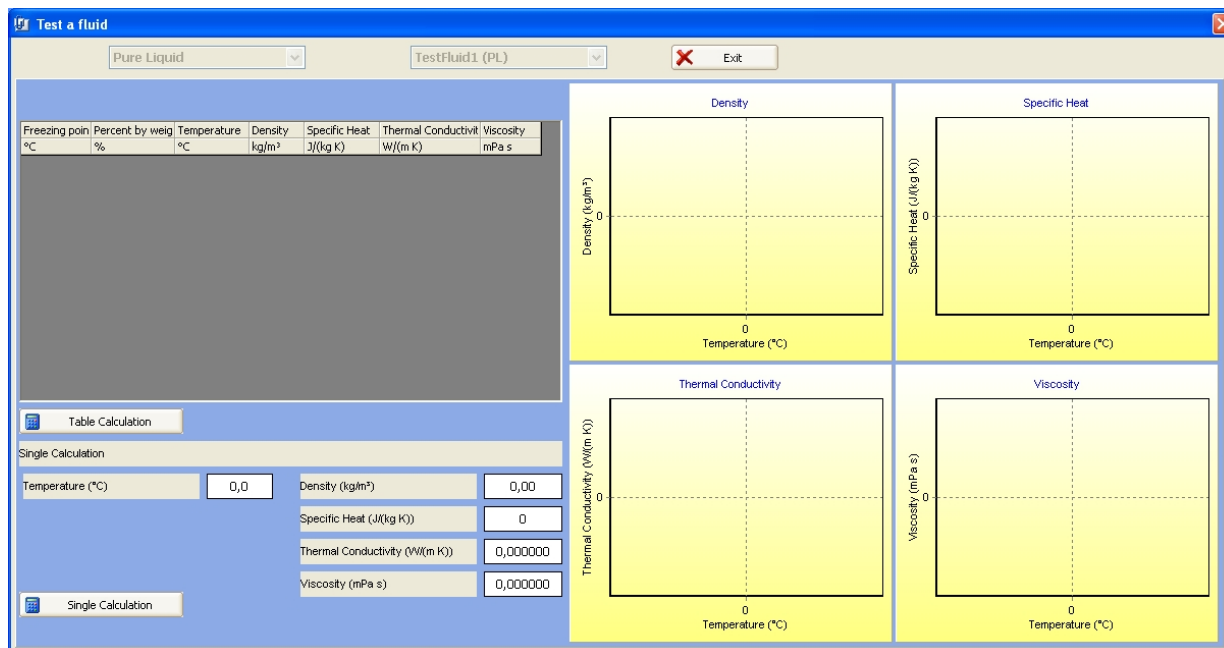
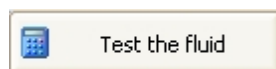
Warning: the percentages must be written in weight.


 Available:



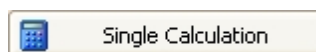
•Click on the button  Save to save the setting of the fluid.

By Clicking the button

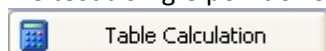


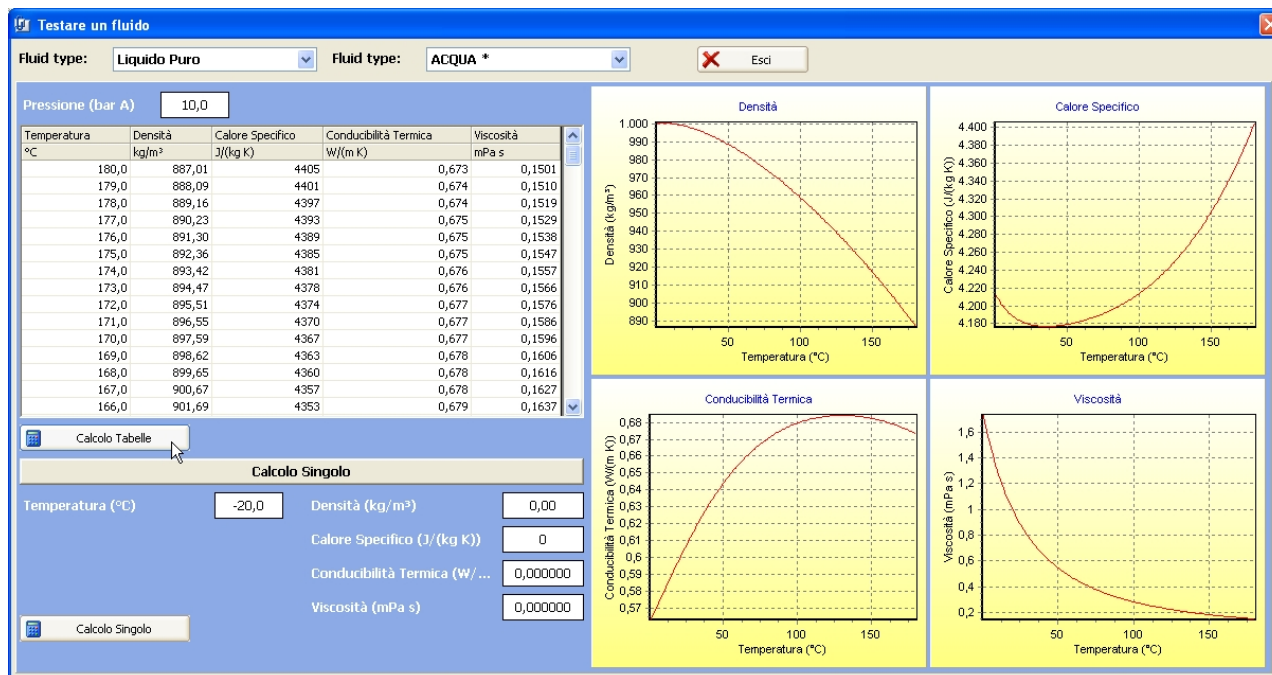
Where after choosing the Fluid Type and the Fluid

We test a single point of Calculation with the relative button



or create a calculation table






The button  closes the test Fluid section.

Fans Management

Fans Management

- Let's click on the voice  Fans of the Archive management menu Archive management. Will be open the following mask:

Fan Management

☐ Monophase Axial
☒ Triphase Axial

[Home](#)
[+ Add](#)
[Save changes](#)

FE040-VD_2C_
 Delta

Load Fan

☒ Points Data
☐ Coefficients Data

Points

#	Vol. (m³/h)	Perd. (Pa)
1	2136	122
2	2383	118
3	2638	112
4	2884	104
5	3139	95
6	3386	84
7	3633	71
8	3888	57
9	4144	40
10	4391	22
11	4646	1

Calc. Coefficients

Show Chart ☒

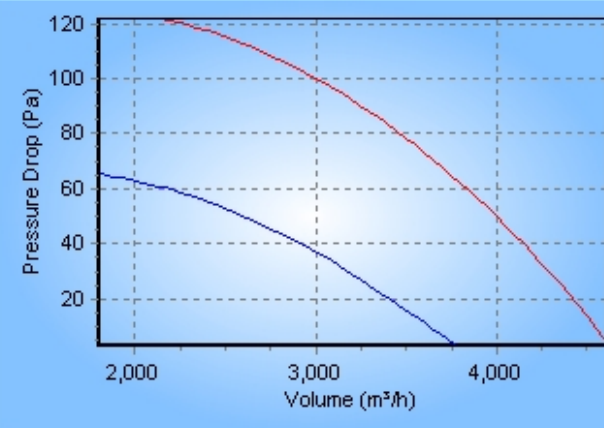
Builder
 Ziehl-Abegg


Series
 Series FE

Models
☒ FE040-VD_2C_
☐ FE042-VD_2F_
☐ FE045-SD_4F_
☐ FE045-VD_4F_
☐ FE050-SD_4F_
☐ FE050-VD_4I_
☐ FE056-AD_4F_
☐ FE056-SD_4F_
☐ FE056-VD_4M_
☐ FE063-AD_4I_
☐ FE063-SD_4I_
☐ FE063-VD_6N_
☐ FE071-AD_6F_
☐ FE071-ND_6F_
☐ FE071-SD_6F_

Voltage [V] **400**
 Frequency [Hz] **50**
 RPM [RPM] **1300**
 Absorbed power [W] **270**
 Absorbed current [A] **0.48**
 Min Flow [m³/h] **2136.8**
 Max Flow [m³/h] **4646.91**
 Ref. Density (kg/m³) **1.2**
 Sound Power [db(A)] **0**
 Sound Pressure Level [db(A)] **0**


Pressure Drop (Pa) vs Volume (m³/h)

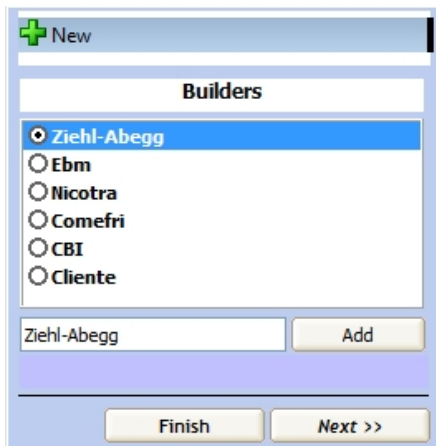


Here you can modify the data of the fans already inserted in the archive, insert a new one by the button  **Add**, or delete a model selected in the left list:

Models

☒ FE040-VD_2C_
☐ FE042-VD_2F_
☐ FE045-SD_4F_
☐ FE045-VD_4F_
☐ FE050-SD_4F_
☐ FE050-VD_4I_
☐ FE056-AD_4F_
☐ FE056-SD_4F_
☐ FE056-VD_4M_
☐ FE063-AD_4I_
☐ FE063-SD_4I_
☐ FE063-VD_6N_
☐ FE071-AD_6F_
☐ FE071-ND_6F_
☐ FE071-SD_6F_

If you click on  **Add** you have to choose a builder from the list or insert a new builder, inserting his name and clicking on "Add":



New

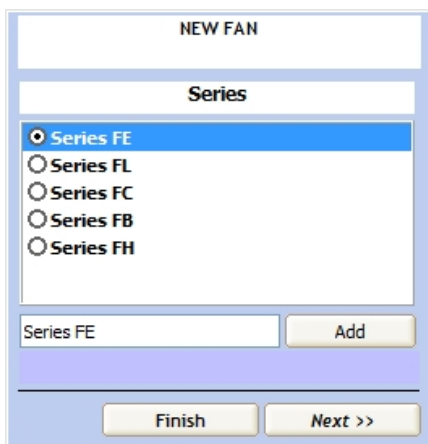
Builders

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

Ziehl-Abegg Add

Finish Next >>

Then click on “Next” and do the same for series:



NEW FAN

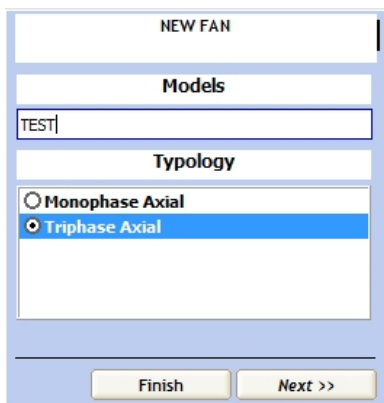
Series

- ☒ Series FE
- ☐ Series FL
- ☐ Series FC
- ☐ Series FB
- ☐ Series FH

Series FE Add

Finish Next >>

Now you can insert the name of the model and choose the typology:



NEW FAN

Models

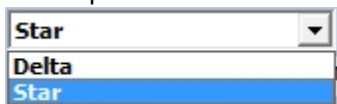
TEST

Typology

- ☐ Monophase Axial
- ☒ Triphase Axial

Finish Next >>

At this point for each electric supply:



Star

Delta

Star

You can insert the fan data:

Voltage [V]	400
Frequency [Hz]	50
RPM [RPM]	1300
Absorbed power [W]	270
Absorbed current [A]	0,48
Min Flow [m³/h]	2136,8
Max Flow [m³/h]	4646,91
Ref. Density (kg/m³)	1,2
Sound Power [db(A)]	0
Sound Pressure Level [db(A)]	0

And the points of the curve:

☒ Points Data
☐ Coefficients Data

Points

#	Vol. (m³/h)	Perd. (Pa)
1	1803,01	65,2
2	1991,95	63,03
3	2197,37	59,77
4	2402,85	55,15
5	2600,17	49,71
6	2805,73	43,46
7	3003,1	36,93
8	3200,55	28,77
9	3398,04	19,8
10	3603,73	10,82
11	3809,49	0,75

Calc. Coefficients

Or the coefficients already given by the builder:

☒ Coefficients Data

Coefficients


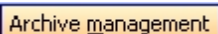
#	Valore
1	56,941333770752
2	8,38909950107336E-03
3	5,58910915060551E-06
4	-5,346709741616E-09
5	5,99814739977306E-13

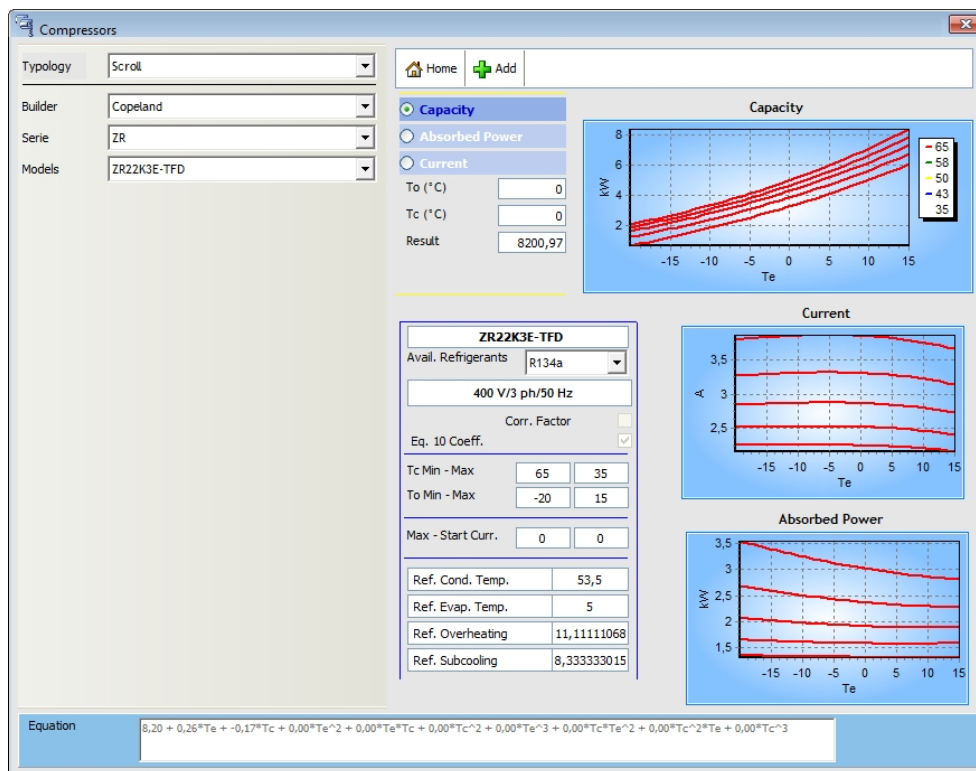
Then click on “Save changes” and the fan will be saved into the database.

To close the mask click on the button  Home

Compressors Management



Compressors Management

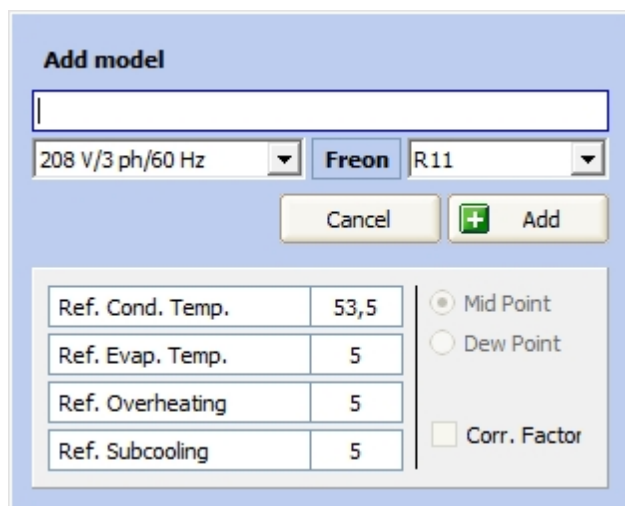
- Let's click on the voice  Compressors of the Archive management menu . Will be opened the following mask:



Here you can modify the data of the compressors already inserted in the archive, insert a new one by the button



If you click on  Add you have to choose a builder from the list or insert a new one with button . The same for "Serie", "Models" and "Freon":



You see this page:

Compressors

Typology: Scroll

Back Add Load Excel file Info Save

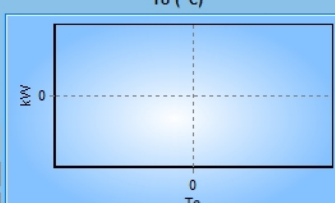
Builder: UNILAB Models: MODEL1
Serie: SERIE1 Freon: R134a

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

☒ Capacity $R^2 =$
☐ Absorbed Power $R^2 =$
☐ Current $R^2 =$
☒ Forward Method
☐ Backward Method
☐ Stepwise Method

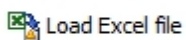
Fitting Capacity
Fitting All

To (°C)



Max - Start Curr. 10 Tc Min - Max 0 0
Start Current 120 To Min - Max 0 0

Equation: $0,00 + 0,00 \cdot T_c + 0,00 \cdot T_c^2 + 0,00 \cdot T_e + 0,00 \cdot T_c \cdot T_e + 0,00 \cdot T_c^2 \cdot T_e + 0,00 \cdot T_e^2 + 0,00 \cdot T_c \cdot T_e^2 + 0,00 \cdot T_c^2 \cdot T_e^2 + 0,00 \cdot T_e^3 + 0,00 \cdot T_e^3 \cdot T_c + 0,00 \cdot T_e^3 \cdot T_c^2$



Now you can click on "Load excel file "

to load the data from a previously saved excel file with this layout:

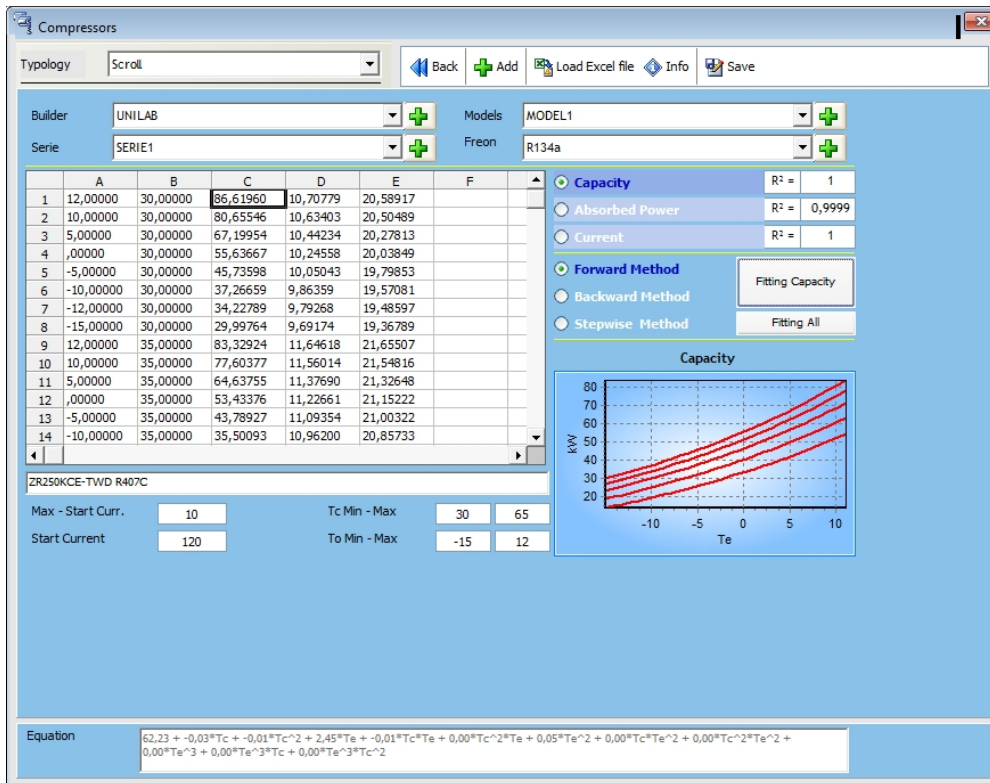
Excel spreadsheet showing data for ZR250KCE-TWD R407C.xls. The spreadsheet has columns A through T and rows 1 through 38. The data is organized into 5 columns (A-E) and 33 rows (1-33). The data is as follows:

	A	B	C	D	E
1	12	30	86,6196	10,70779	20,58917
2	10	30	80,65546	10,63403	20,50489
3	5	30	67,19954	10,44234	20,27813
4	0	30	55,63667	10,24558	20,03849
5	-5	30	45,73598	10,05043	19,79853
6	-10	30	37,26659	9,863588	19,57081
7	-12	30	34,22789	9,792676	19,48597
8	-15	30	29,99764	9,691744	19,36789
9	12	35	83,32924	11,64618	21,65507
10	10	35	77,60377	11,56014	21,54816
11	5	35	64,63755	11,3769	21,32648
12	0	35	53,43376	11,22661	21,15222
13	-5	35	43,78927	11,09354	21,00322
14	-10	35	35,50093	10,962	20,85733
15	-12	35	32,51981	10,90628	20,79488
16	-15	35	28,3656	10,81626	20,6924
17	12	40	79,71035	12,8515	23,1441
18	10	40	74,21108	12,76457	23,03124
19	5	40	61,7302	12,59632	22,82316
20	0	40	50,90852	12,47718	22,68926
21	-5	40	41,55706	12,3809	22,59002
22	-10	40	33,48686	12,28121	22,48589
23	-12	40	30,57521	12,2345	22,43403
24	-15	40	26,50894	12,15186	22,33738
25	12	45	75,76292	14,32375	25,05625
26	10	45	70,47741	14,24731	24,95413
27	5	45	58,47748	14,10059	24,76818
28	0	45	48,06093	13,9973	24,64963
29	-5	45	39,03936	13,9125	24,55892
30	-10	45	31,2244	13,82124	24,4565
31	-12	45	28,39407	13,77733	24,4034
32	-15	45	24,42766	13,69856	24,30283
33	12	50	71,48697	16,06292	27,39152
34	10	50	66,40274	16,00836	27,31684
35	5	50	54,8794	15,8897	27,16153
36	0	50	44,89099	15,78696	27,03331
37	-5	50	36,23616	15,68834	26,90993
38	-10	50	28,71354	15,58206	26,76916

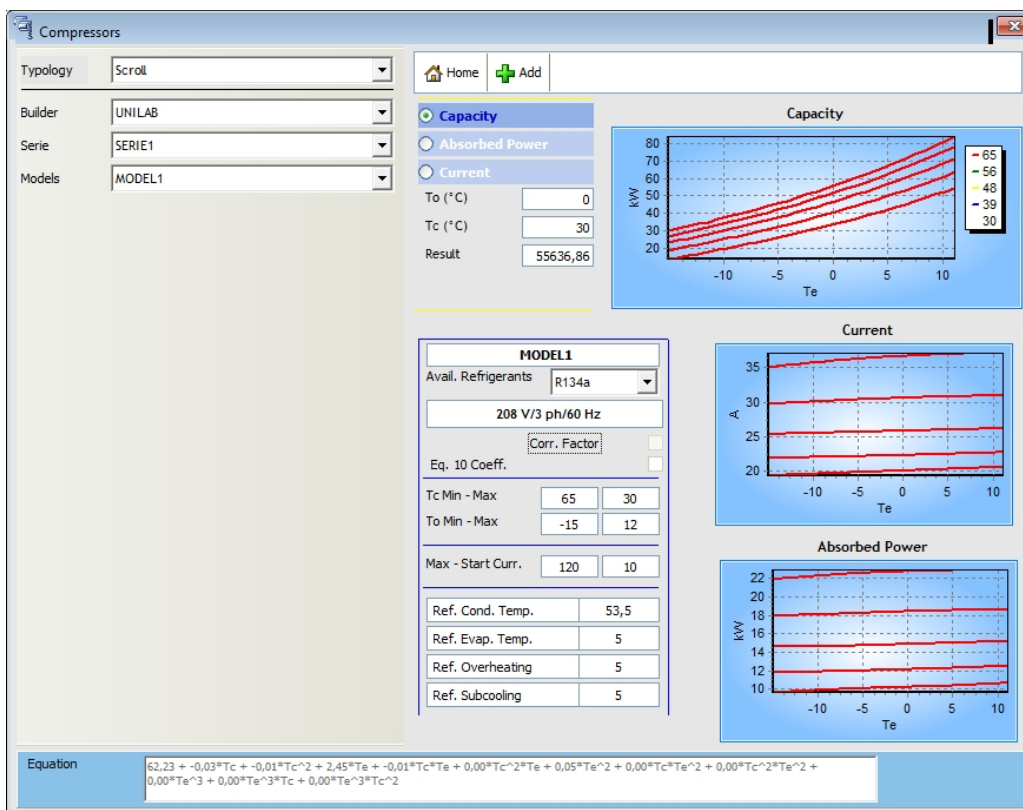
Where we have 5 columns which are

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

Then you click on “Fitting All” and you get:



Then click on “Save” and “Back”, you will see the capacity, current and absorbed power curves in the main mask:



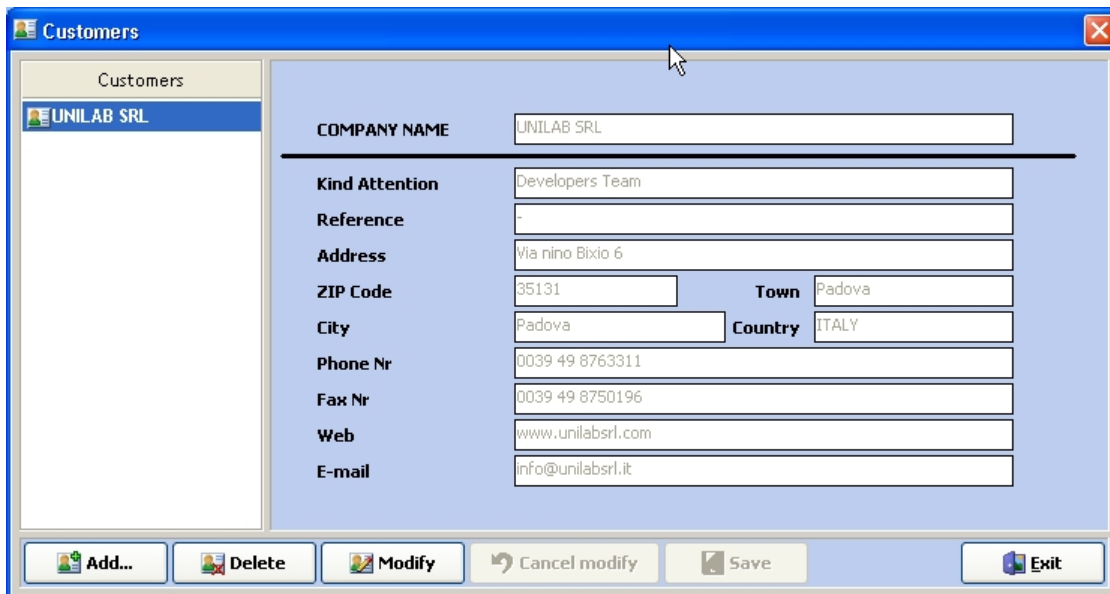
To close the mask click on the button

Customer's Management

Customer's Management

- Let's click on the voice  Customers Management of the Archive management menu
- UNILAB S.r.l. – Via N. Bixio 6 – 35131 – Padova (PD) – Italy – Phone: +39 (0) 49 8763311 – Fax: +39 (0) 49 8750196
- www.unilab.eu – info@unilab.eu

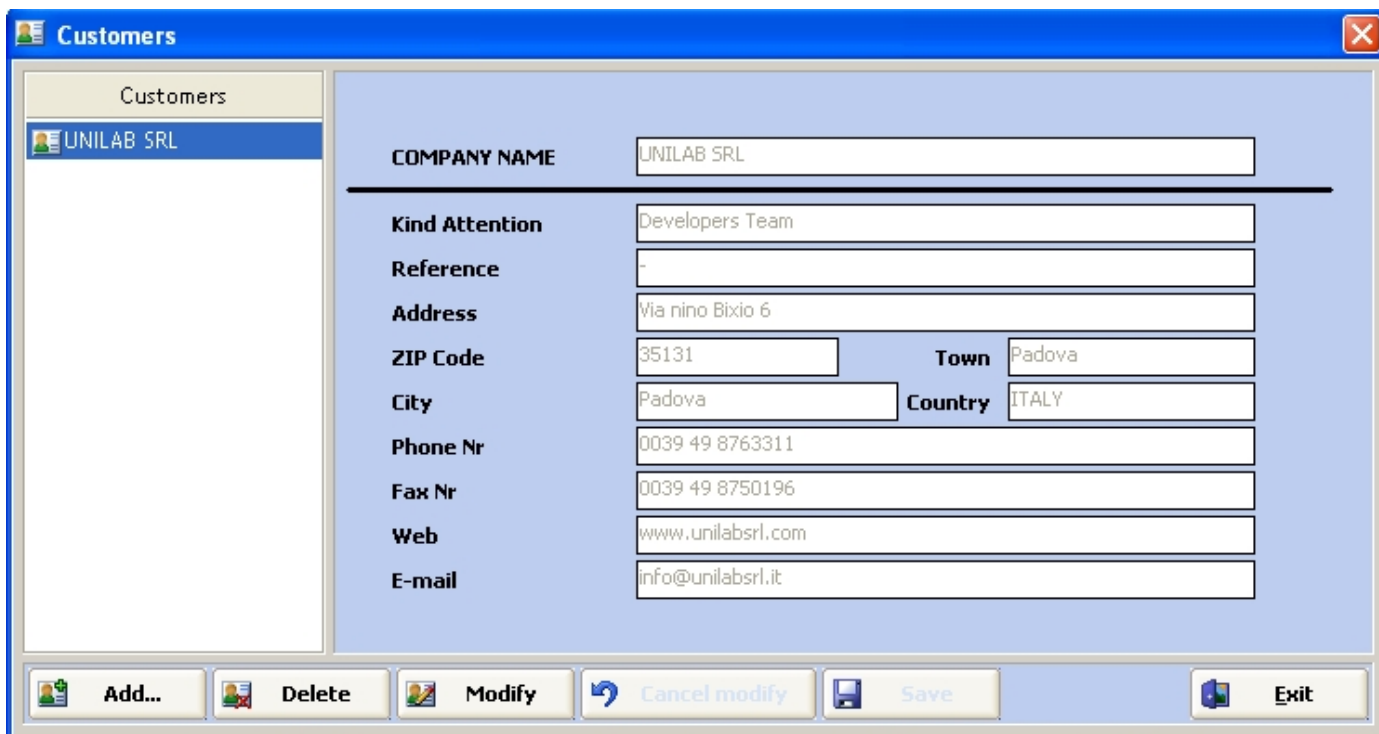
Archive management



COMPANY NAME	UNILAB SRL		
Kind Attention	Developers Team		
Reference	-		
Address	Via nino Bixio 6		
ZIP Code	35131	Town	Padova
City	Padova	Country	ITALY
Phone Nr	0039 49 8763311		
Fax Nr	0039 49 8750196		
Web	www.unilabsrl.com		
E-mail	info@unilabsrl.it		

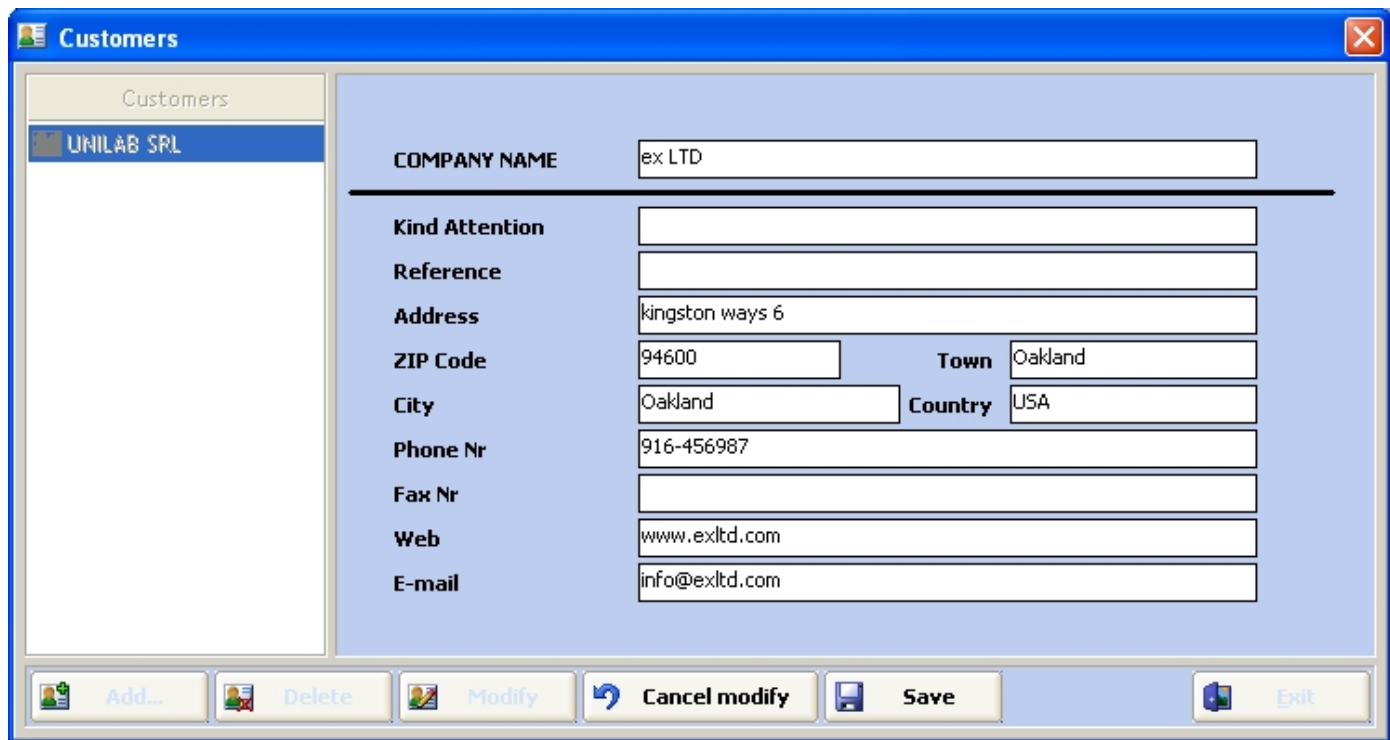
here it's possible to add, delete or modify customer data.

- Let's click on the "Modify" button



COMPANY NAME	UNILAB SRL		
Kind Attention	Developers Team		
Reference	-		
Address	Via nino Bixio 6		
ZIP Code	35131	Town	Padova
City	Padova	Country	ITALY
Phone Nr	0039 49 8763311		
Fax Nr	0039 49 8750196		
Web	www.unilabsrl.com		
E-mail	info@unilabsrl.it		

- For example, we could enter a new customer as in the next figure.



Customers

Customers

UNILAB SRL

COMPANY NAME ex LTD

Kind Attention

Reference

Address kingston ways 6

ZIP Code 94600 **Town** Oakland

City Oakland **Country** USA

Phone Nr 916-456987

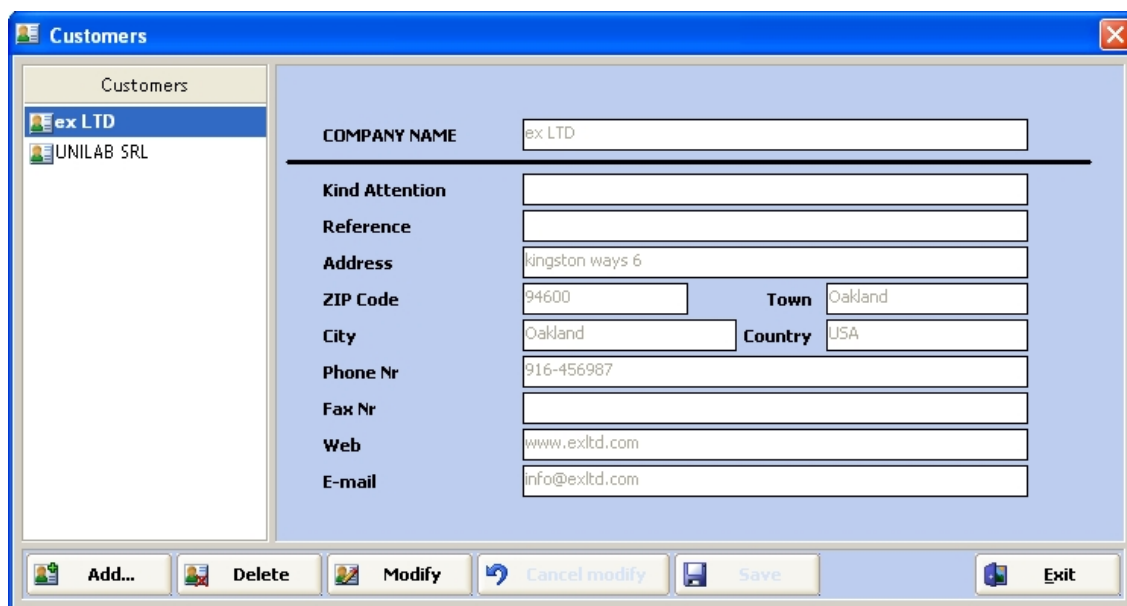
Fax Nr

Web www.exltd.com

E-mail info@exltd.com

Add... Delete Modify Cancel modify Save Exit

- then click the “Save” button



Customers

Customers

ex LTD

UNILAB SRL

COMPANY NAME ex LTD

Kind Attention

Reference

Address kingston ways 6

ZIP Code 94600 **Town** Oakland

City Oakland **Country** USA

Phone Nr 916-456987

Fax Nr

Web www.exltd.com


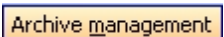
E-mail info@exltd.com

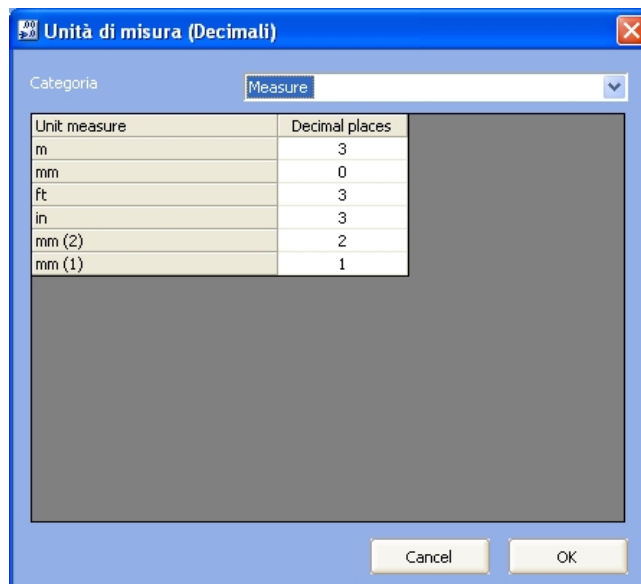
Add... Delete Modify Cancel modify Save Exit

our company “ex LTD” has been added.

Unit measures (Decimal places)

Unit measures (Decimal places)


- Let’s click on the voice  Unit measures (Decimal places) of the Archive management menu .

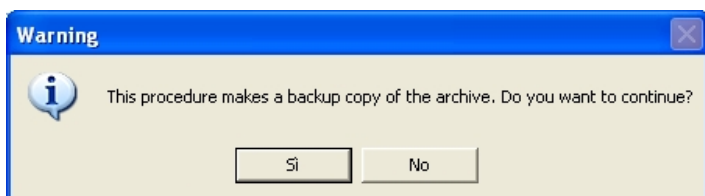


- Here you can set for each unit measure the number of decimals showed in the program.

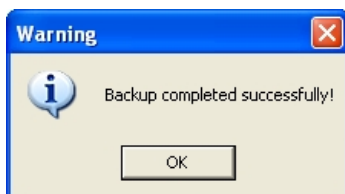
Backup Archive

Backup Archive

- Let's click on the voice  Backup Archive of the Archive management menu




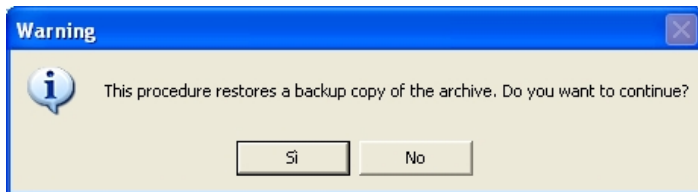
- If we click "Yes" (Si) , will get



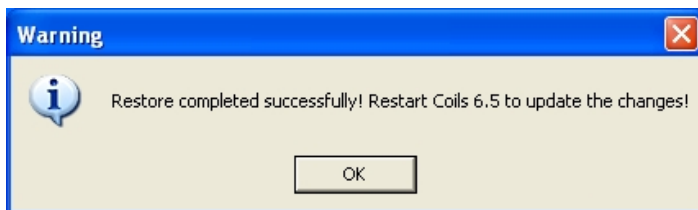
Restore Backup

Restore Backup

- Let's click on the voice  Restore Backup of the Archive management menu



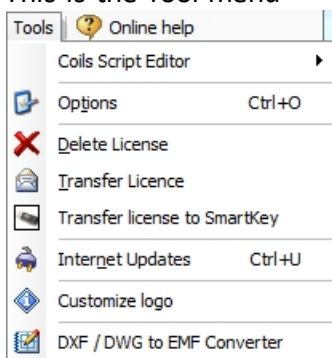
- If we click “Yes” (Si) , will get



TOOLS

TOOLS

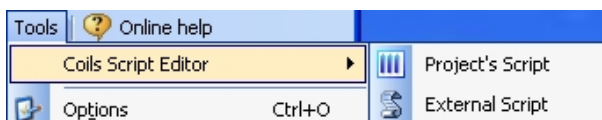
This is the Tool menu **Tools** :



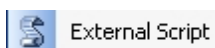
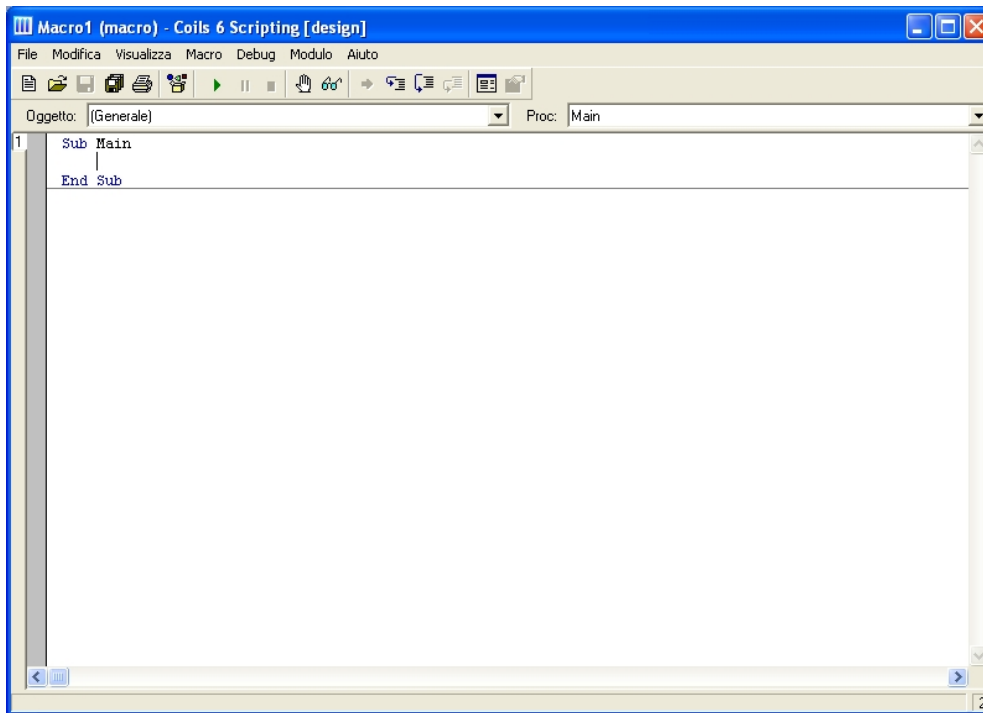
Coils script editor

Coils script editor

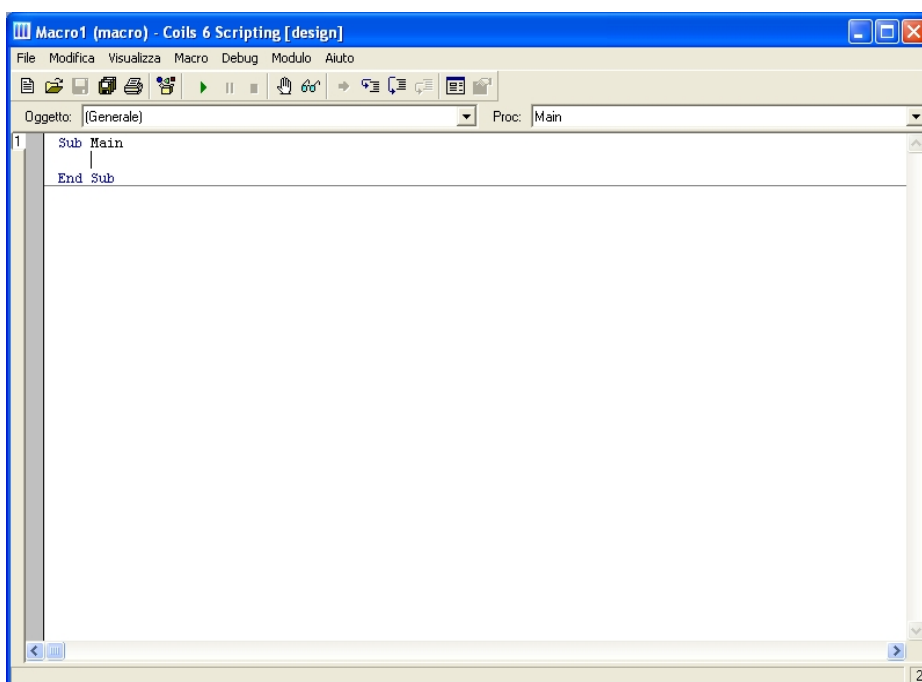
- By clicking on **Coils Script Editor** we get a sub menu with two voices



Project's Script permits to write in a programming environment a script and it is meant for either light or experienced programmers





permits to load and write an external script

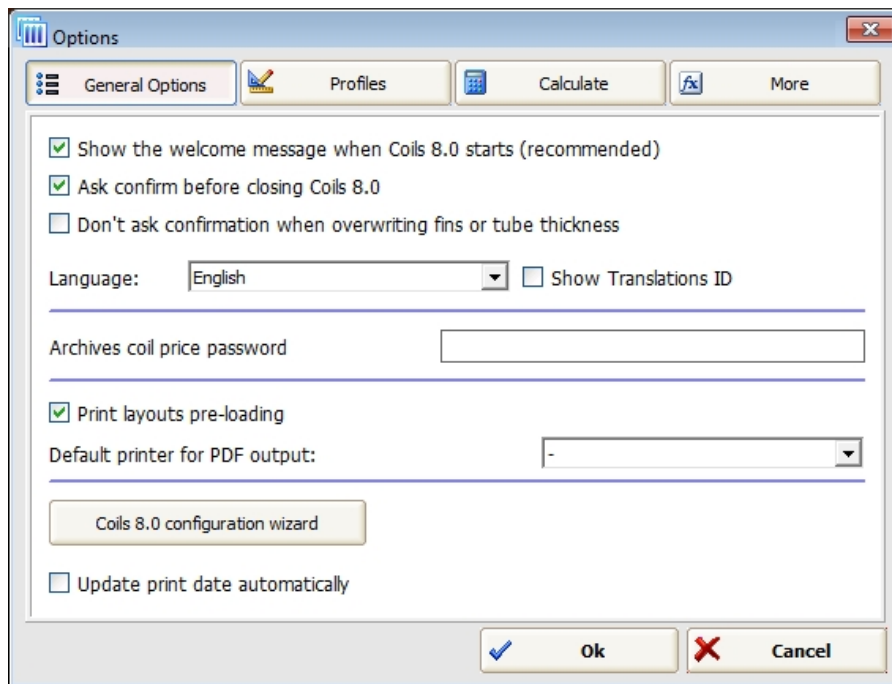


Options

Options

This voice permits to set general program options.

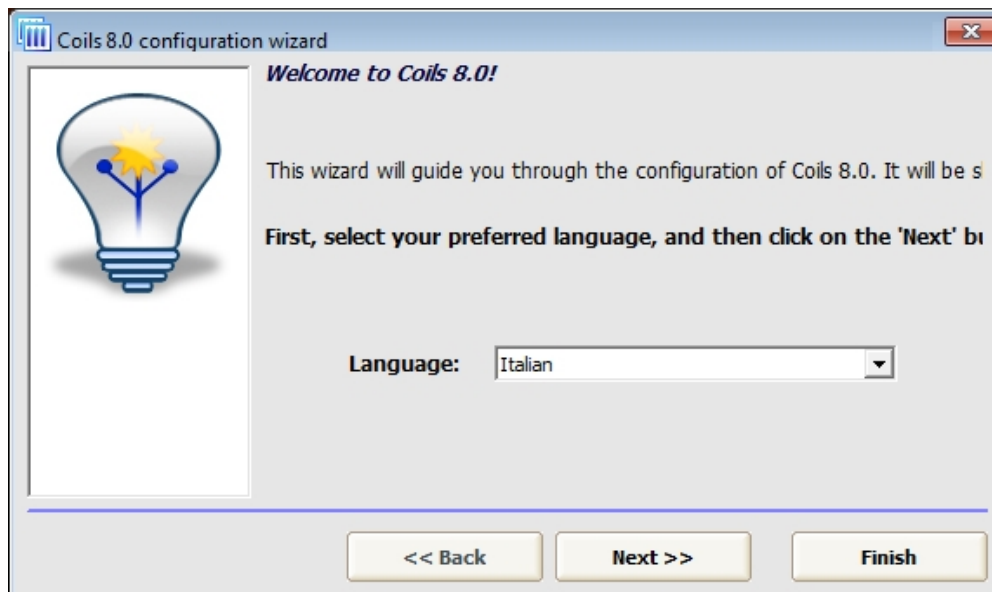
- Let's click on voice  Options Ctrl+O of the "Tool" menu 



In the general options mask you can set welcome message, language, calculation of cooling projects with Freons, allows subcooling analysis, ecc.

- If we click on the button

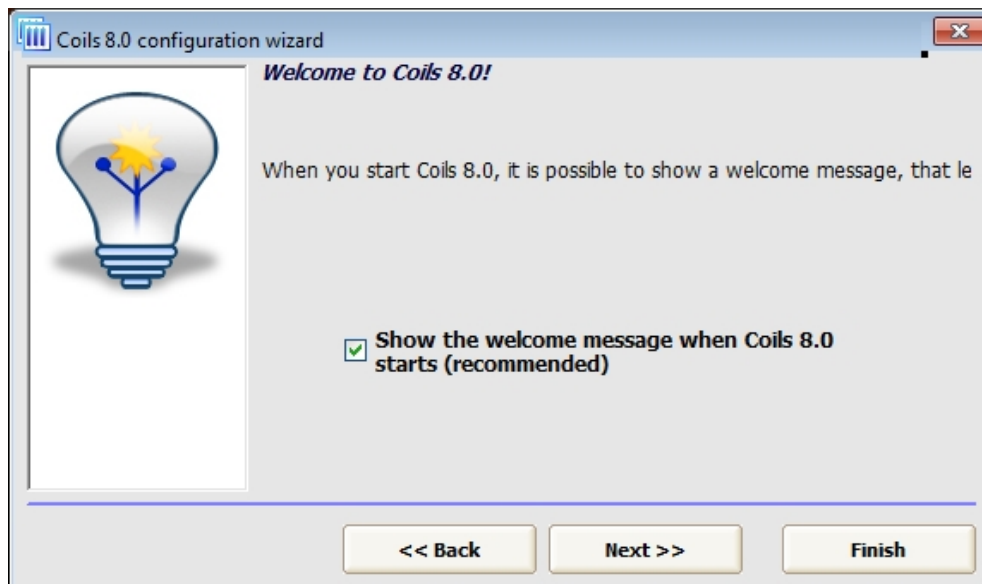
Coils 8.0 configuration wizard



We can choose the language shown the first time you run the software.

- After clicking the button

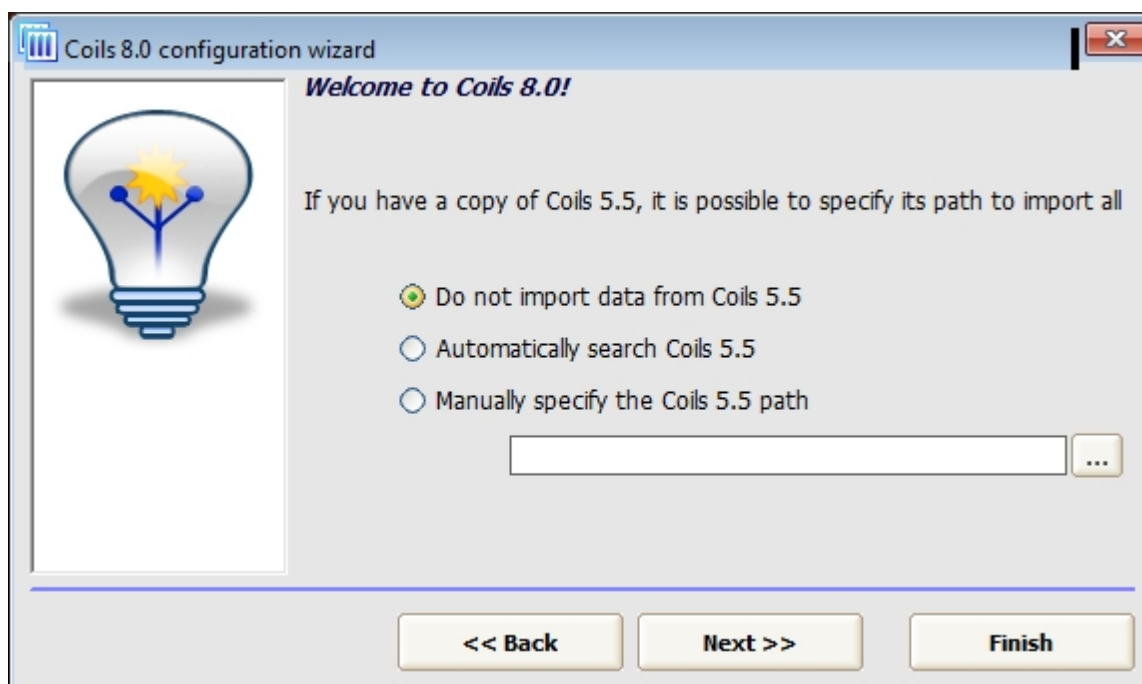
Next >>



- After clicking again on the

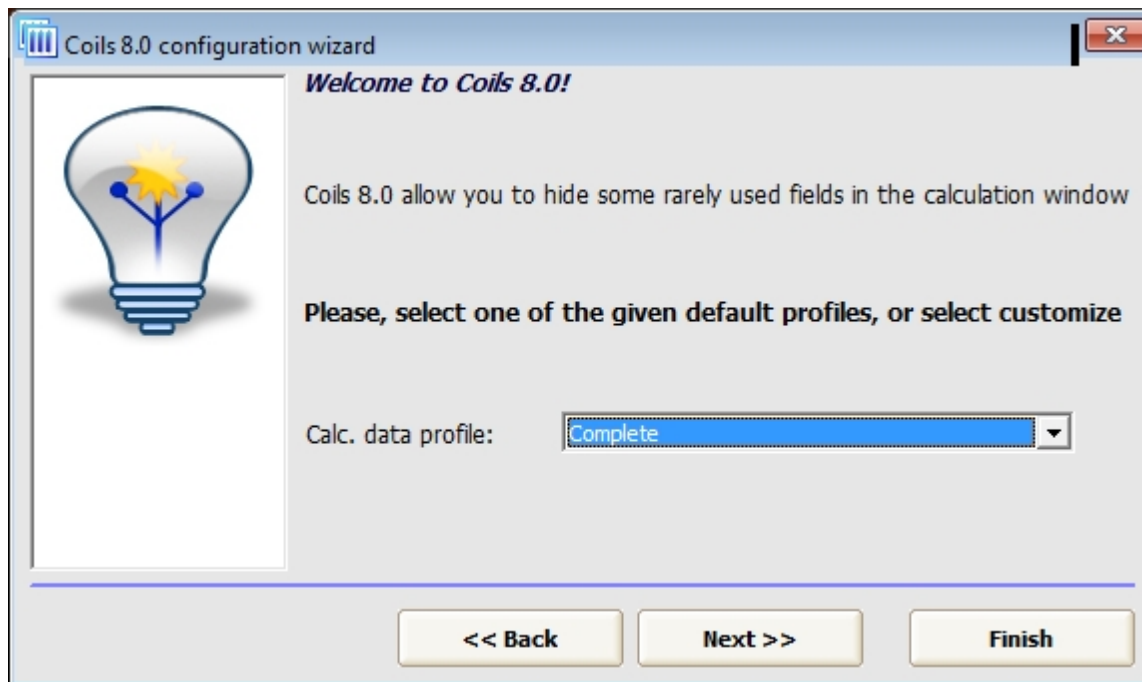
Next >>

Here we can choose to import the geometries from the previous Coils



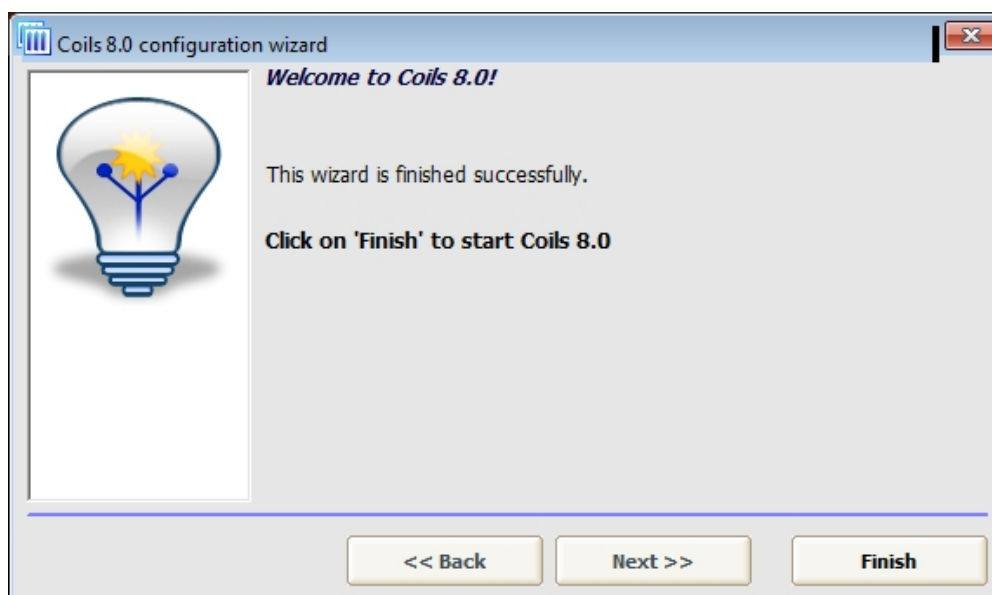
- After clicking again on the

Next >>




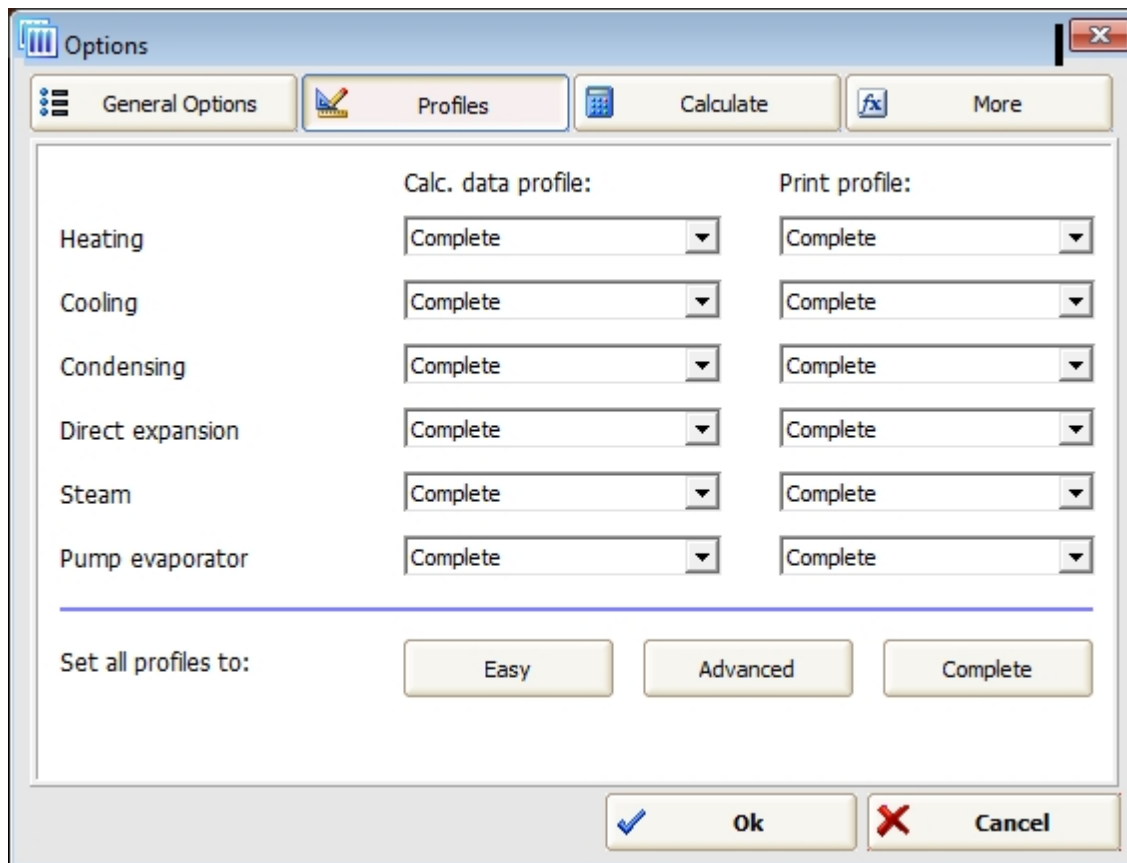
By clicking

Next >>

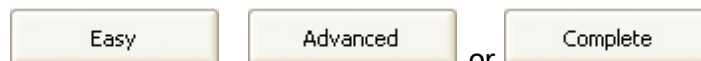



Click on the button **Finish** to close the Configuration Wizard.

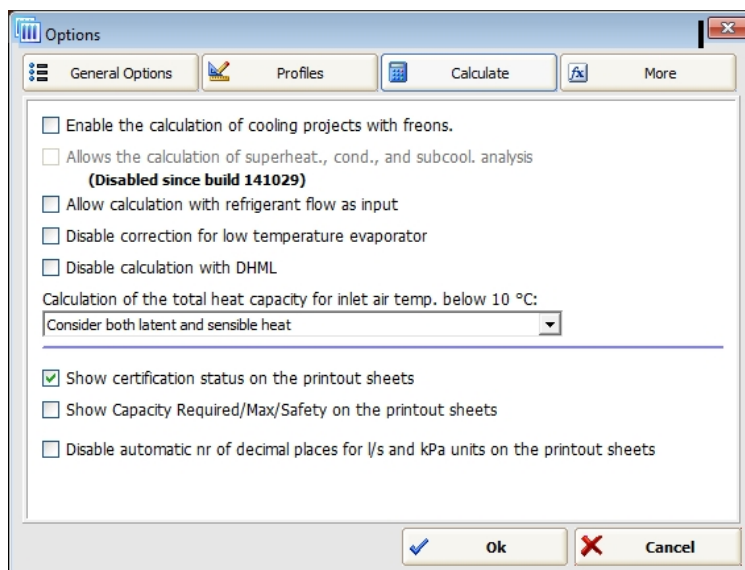
In the "Options" mask in the page  Profiles we have the following profiles




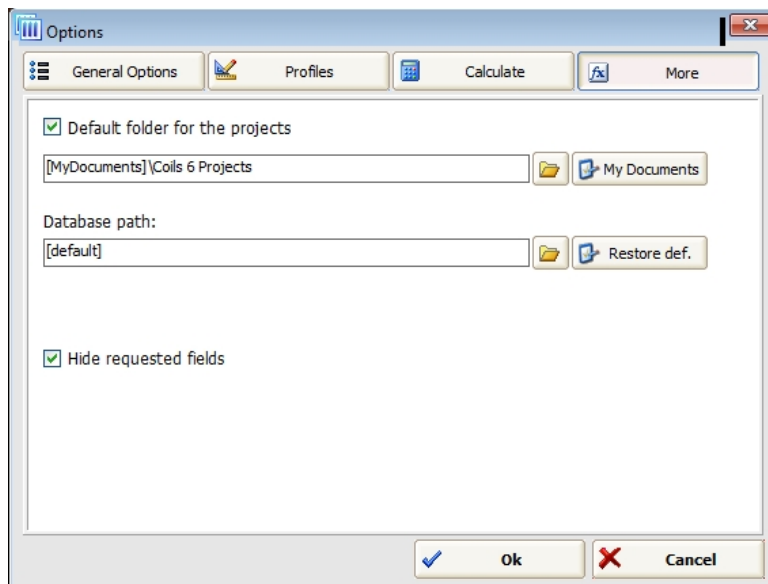
than can be set one by one or all by the buttons:

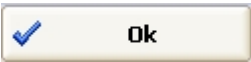


The page  **Calculate** allows to manage some information and settings about the coils calculation and the printouts, like the calculation of the superheating, the subcooling, the enable of the calculation of the cooling projects with freons, etc.



The page  **More** allows to set the default path where save the projects, and the path of the database.





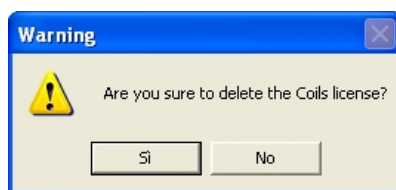
To confirm the settings of the Options click on  , otherwise to discard them click on



Delete License

Delete License

By clicking on  of the Tool menu  , we can delete the license. The following message appears

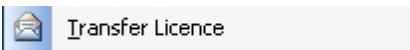



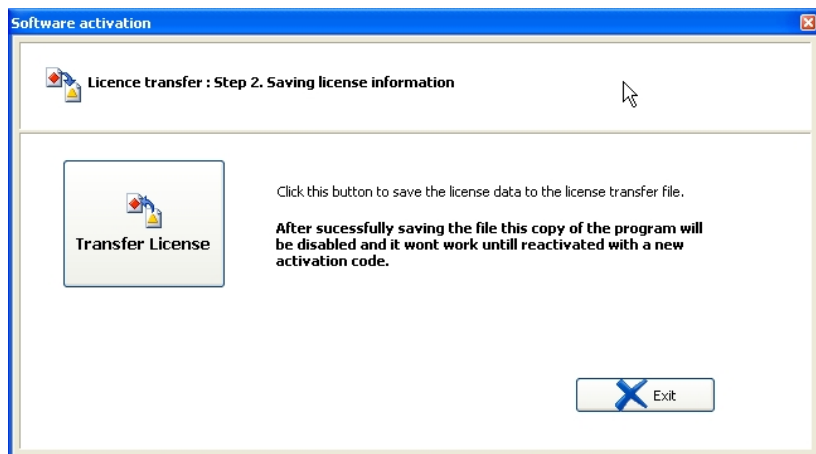
“Yes”(“Si”) confirms the elimination of the license.

Transfer License

Transfer License

This option allows to transfer the software license from the current computer to another one. It means, that using such procedure the same license cannot be used on the more than one computer at the same time.

By clicking the  of the Tool menu  , you will see get





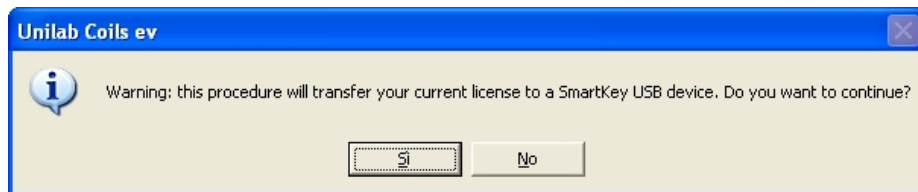
*To continue, we would click on the “Transfer License” button.
To exit, click on the “Exit” button.*

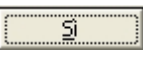
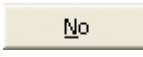
Transfer license to SmartKey

Transfer license to SmartKey (for clients with OLD activation system only)

This option allows to transfer the license information to a smart usb key, which is useful to avoid loss of license in case of computer damage. But even in this case, software cannot work at the same time on different more than one computer.

By clicking the  Transfer license to SmartKey of the Tool menu , we get the following message



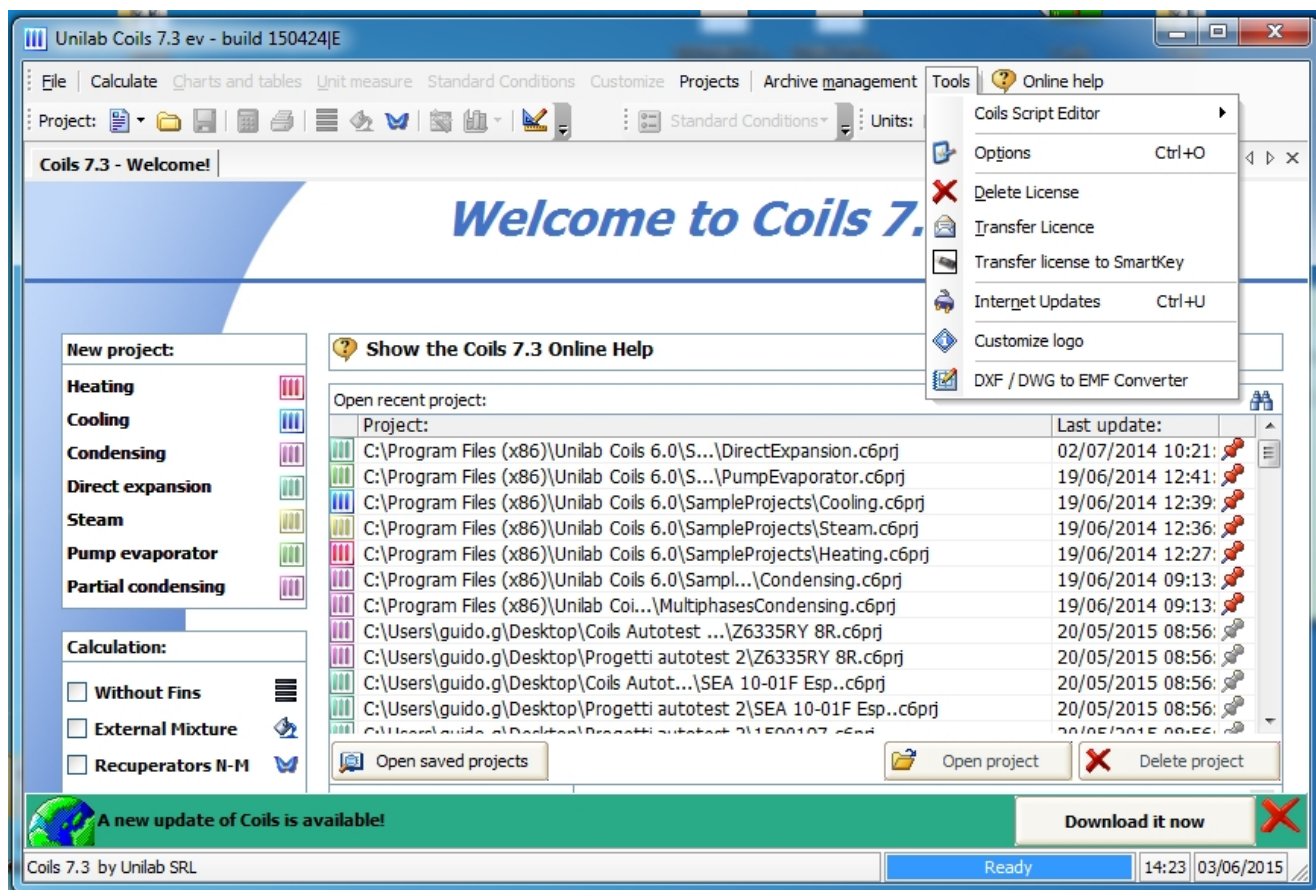
By clicking “Yes”(Si) , we continue the process, otherwise we click “No” 

Transfer online license

LICENSE TRANSFER TO ANOTHER PC

The following points show the procedure to transfer the program license from a computer where the program was installed and the license was activated to another pc:

- 1) Open the program in the computer where license is active and delete it with “Delete License” in its menu;




2) Launch the program in the pc where you want to transfer license;

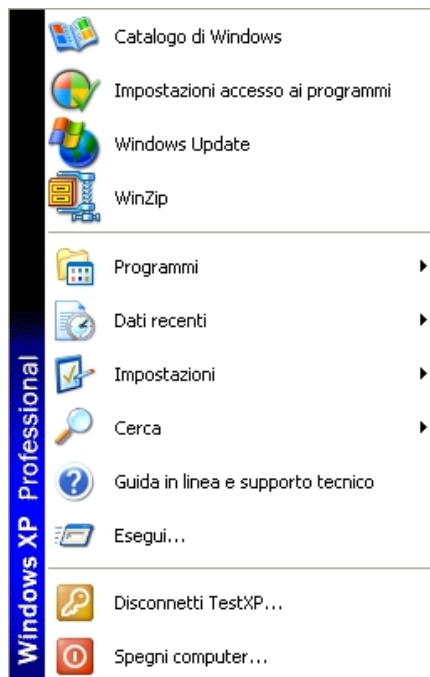
3) Input the same activation code you used on the other pc.

INTERNET UPDATE

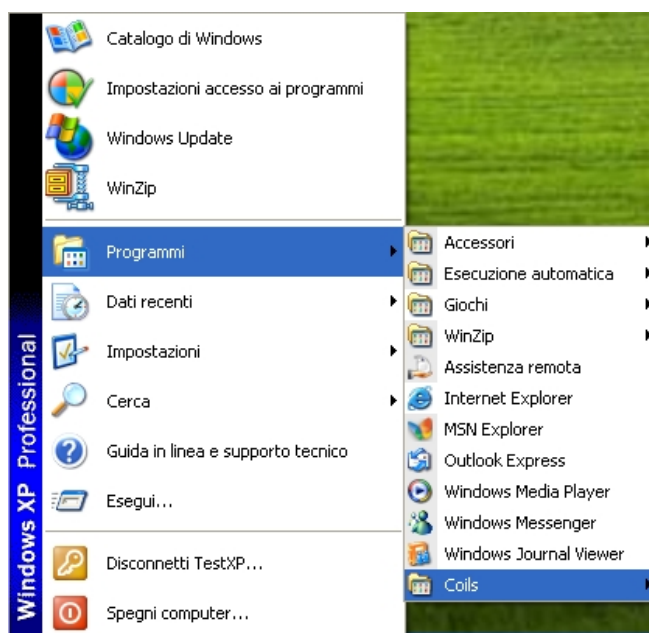
INTERNET UPDATE

In order to perform the update of “Coils” software these are the steps to be followed:

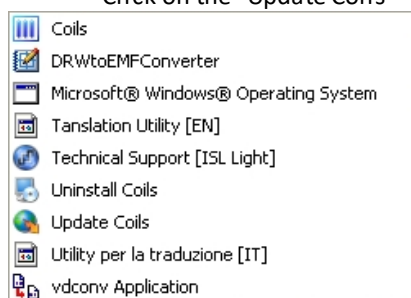
- Click on the Start button  on the start bar
- Click on the “Program” voice of menu



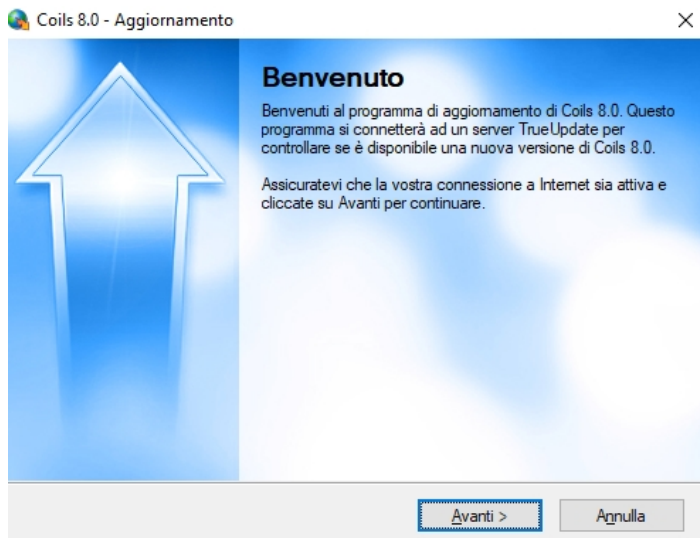
- Click on the “Unilab Coils ” voice of the menu and

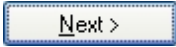


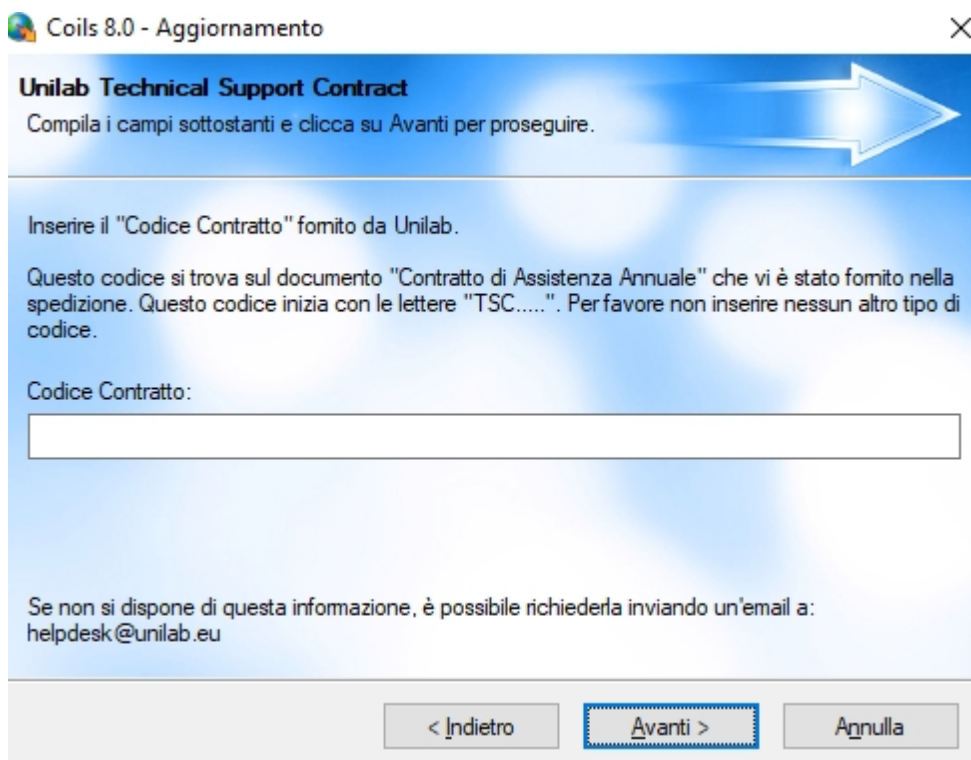
- Click on the “Update Coils”



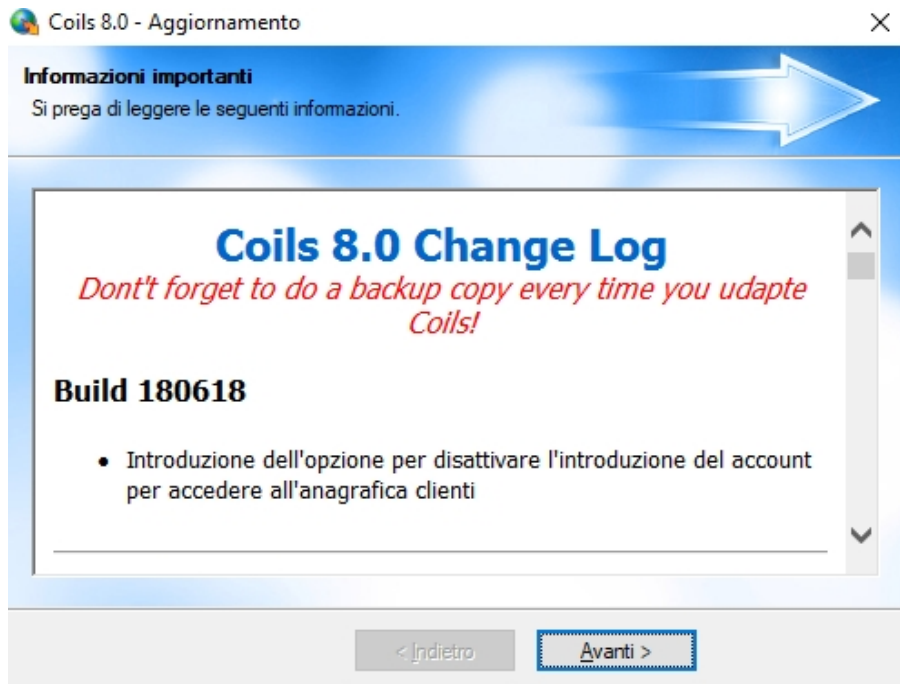
- The following screen appears



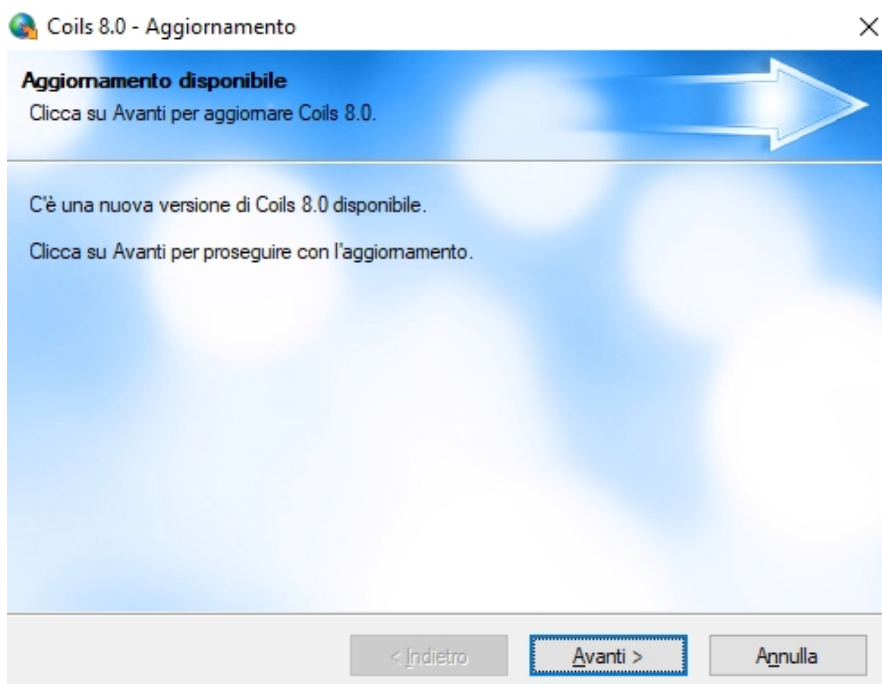
- Click on the button 
- The following screen opens and it asks for **contract code (= activation code)**, that you should have received with the download link or you can ask Unilab by sending an email to sales@unilab.eu



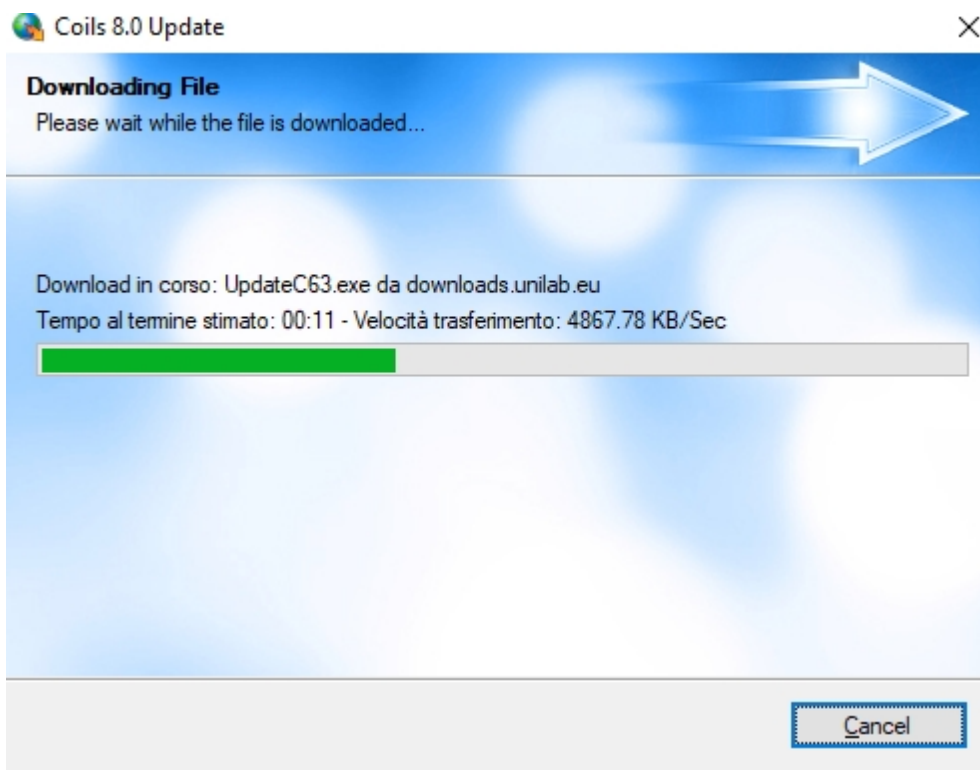
Please insert your code, for example, "TSC1234U" and the program goes to the next screen



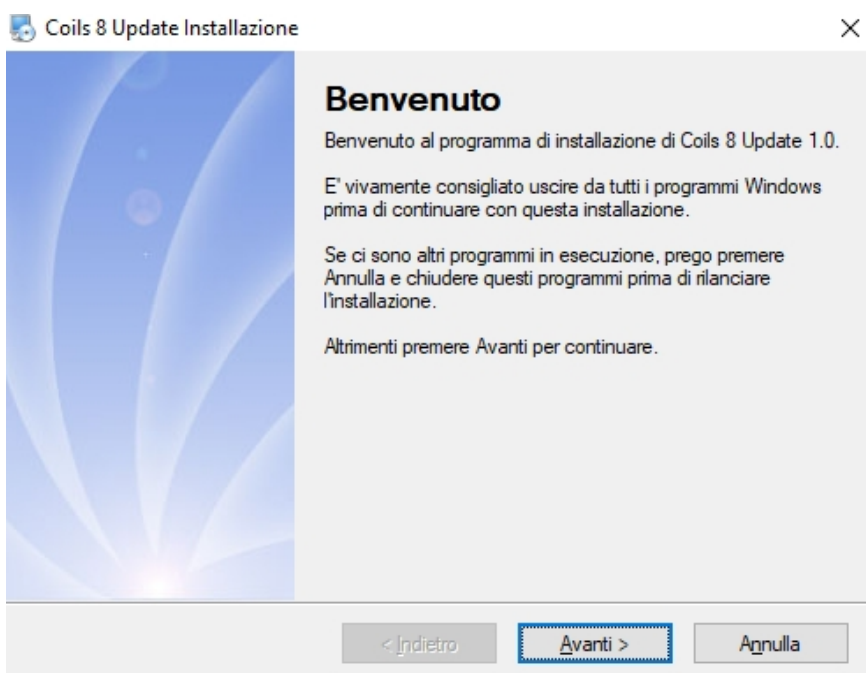
- A message that says that there is a newer version of the program



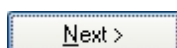
- We can click on the button  to start downloading the new version

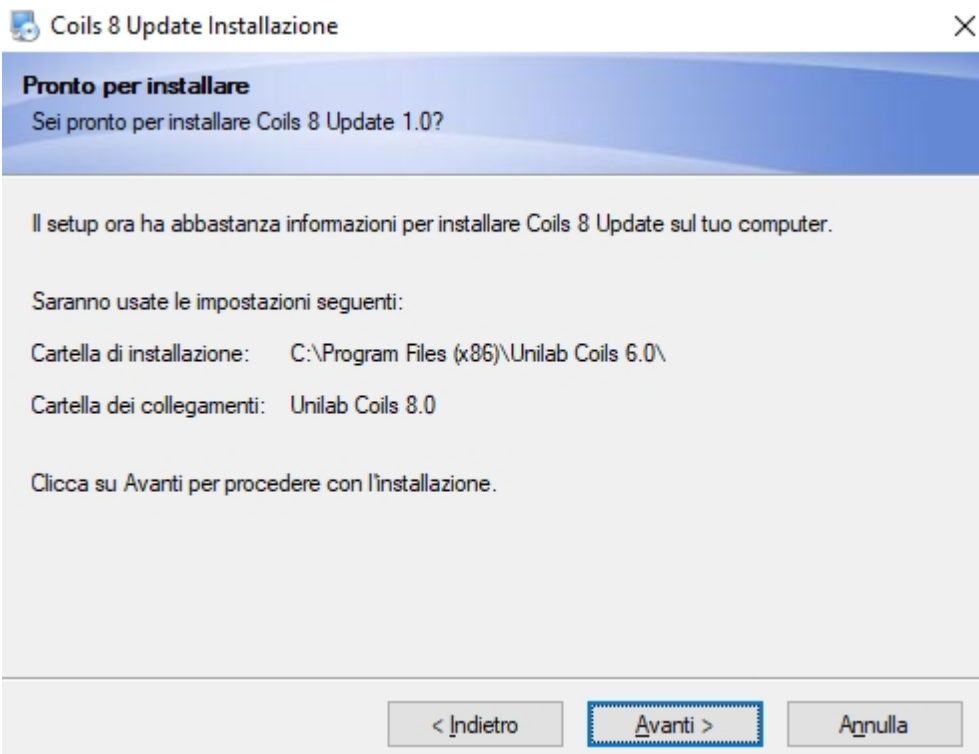


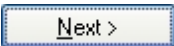
- The following screen shows, that we are about to start to download.

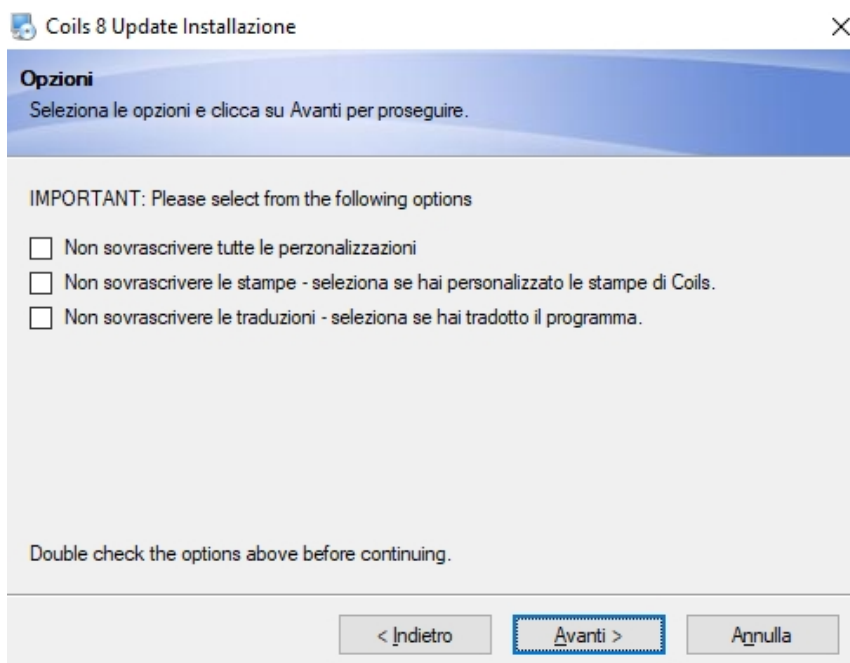


- After that we click on the button

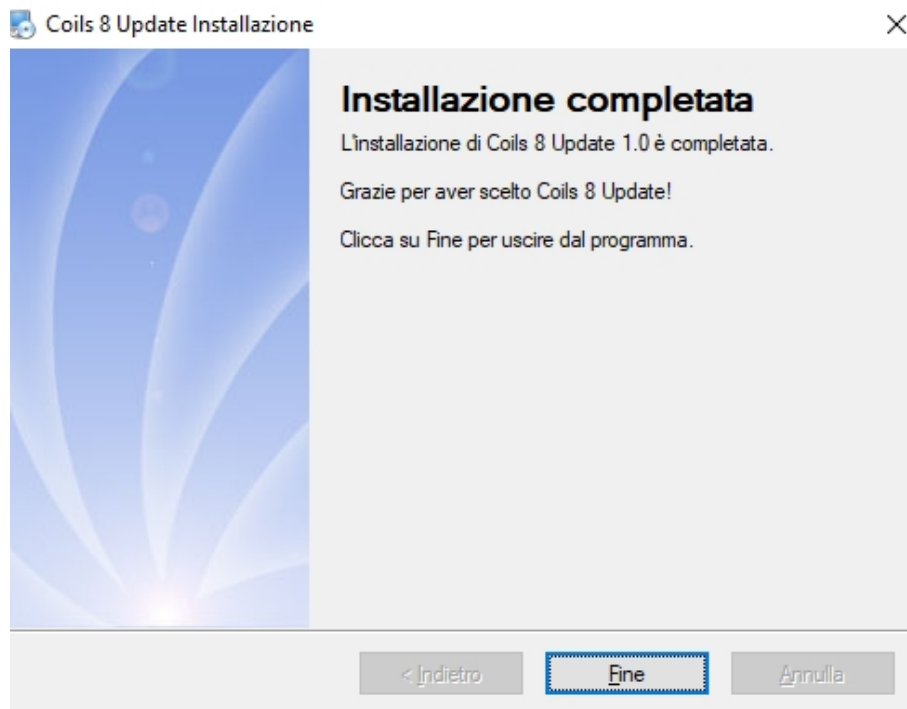




- The software tells where it will be installed and ask to go to  to continue



When the installation of the update software completes, the following screen appears



To end the process, please click on



Customize logo

Customize logo

The voice



on the Tools menu



allows to insert the company information and the logo.



BMP file for the logo

The field

allows you to insert the path of the image to use like logo. Click on the button



near it to select the image.

In the “Header / Company information” field

Header / Company information

Company Name
 Main Address
 Tel: +00 0000 00000000
 Fax: +00 0000 00000000
 web: www.companyname.com - info@companyname.com

allows you to insert the main information about the company.





The button allows to confirm the data inserted in previous fields.

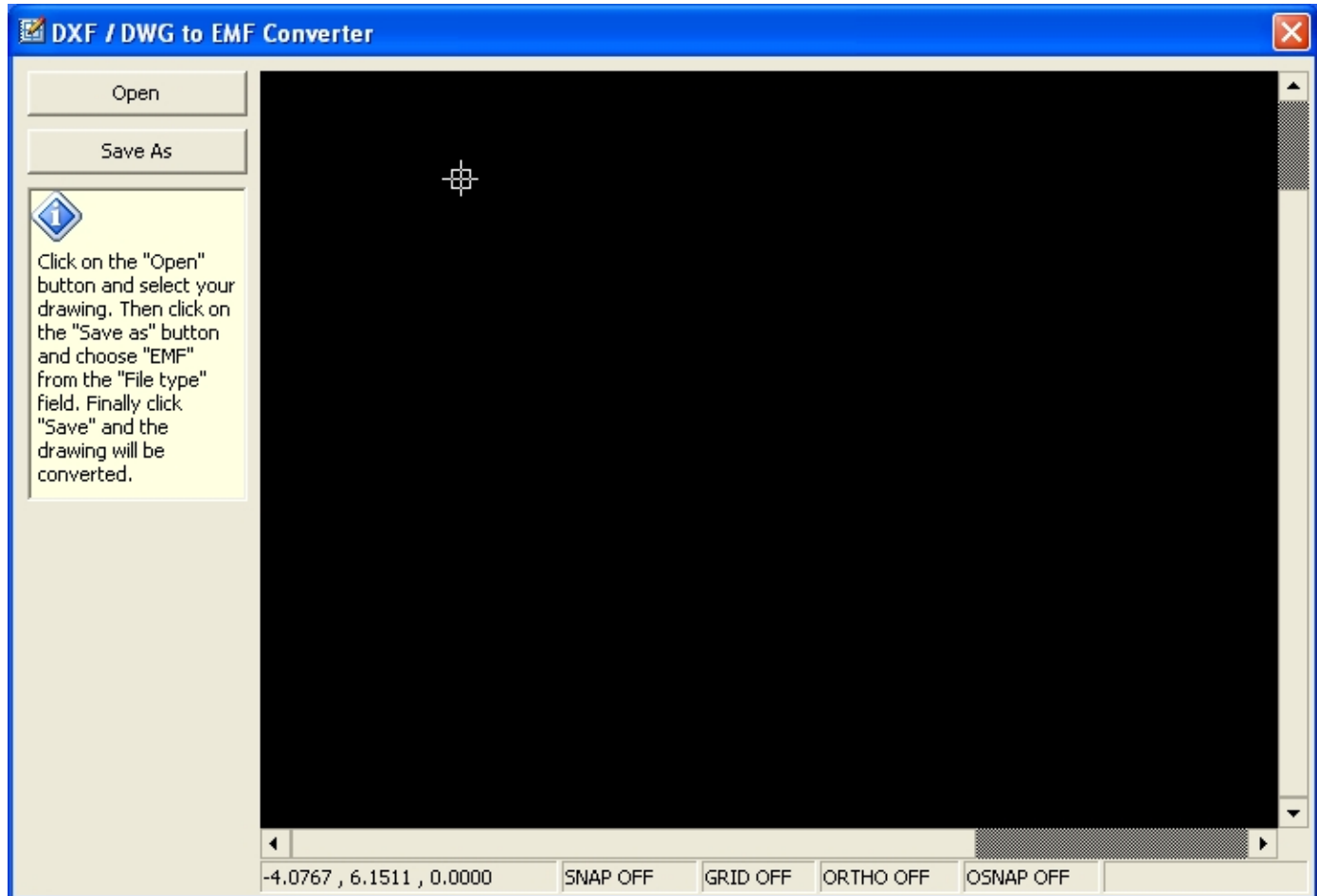


The button allows to discard the data inserted.

DXF / DWG to EMF Converter

DXF / DWG to EMF Converter


The voice  DXF / DWG to EMF Converter on the Tools menu  allows to convert a DXF file into an EMF file.

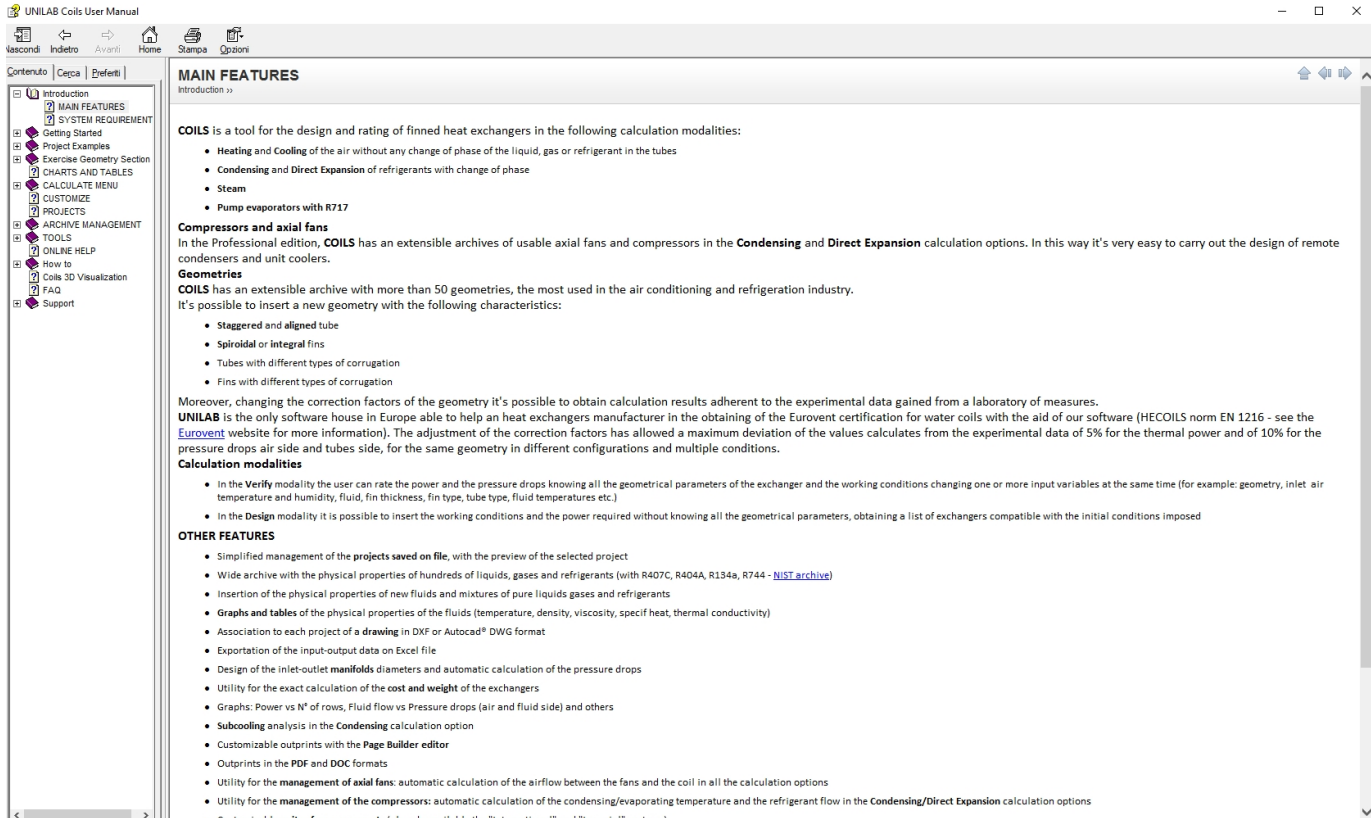


Here you can open a DXF / DWG file by  and save it into an EMF file by .

ONLINE HELP

ONLINE HELP

The menu  of the top bar allows to find needed information directly in Coils User Manual



MAIN FEATURES

COILS is a tool for the design and rating of finned heat exchangers in the following calculation modalities:

- Heating and Cooling of the air without any change of phase of the liquid, gas or refrigerant in the tubes
- Condensing and Direct Expansion of refrigerants with change of phase
- Steam
- Pump evaporators with R717

Compressors and axial fans
In the Professional edition, **COILS** has an extensible archives of usable axial fans and compressors in the **Condensing** and **Direct Expansion** calculation options. In this way it's very easy to carry out the design of remote condensers and unit coolers.

Geometries
COILS has an extensible archive with more than 50 geometries, the most used in the air conditioning and refrigeration industry. It's possible to insert a new geometry with the following characteristics:

- Staggered and aligned tube
- Spiraloid or integral fins
- Tubes with different types of corrugation
- Fins with different types of corrugation

Moreover, changing the correction factors of the geometry it's possible to obtain calculation results adherent to the experimental data gained from a laboratory of measures.

UNILAB is the only software house in Europe able to help an heat exchangers manufacturer in the obtaining of the Eurovent certification for water coils with the aid of our software (HECOILS norm EN 1216 - see the [Eurovent](#) website for more information). The adjustment of the correction factors has allowed a maximum deviation of the values calculates from the experimental data of 5% for the thermal power and of 10% for the pressure drops air side and tubes side, for the same geometry in different configurations and multiple conditions.

Calculation modalities

- In the **Verify** modality the user can rate the power and the pressure drops knowing all the geometrical parameters of the exchanger and the working conditions changing one or more input variables at the same time (for example: geometry, inlet air temperature and humidity, fluid, fin thickness, fin type, tube type, fluid temperatures etc.)
- In the **Design** modality it is possible to insert the working conditions and the power required without knowing all the geometrical parameters, obtaining a list of exchangers compatible with the initial conditions imposed

OTHER FEATURES

- Simplified management of the **projects saved on file**, with the preview of the selected project
- Wide archive with the physical properties of hundreds of liquids, gases and refrigerants (with R407C, R404A, R134a, R744 - [NIST archive](#))
- Insertion of the physical properties of new fluids and mixtures of pure liquids gases and refrigerants
- **Graphs and tables** of the physical properties of the fluids (temperature, density, viscosity, specif heat, thermal conductivity)
- Association to each project of a **drawing** in DXF or Autocad® DWG format
- Exportation of the input-output data on Excel file
- Design of the inlet-outlet **manifolds** diameters and automatic calculation of the pressure drops
- Utility for the exact calculation of the **cost and weight** of the exchangers
- Graphs: Power vs N° of rows, Fluid flow vs Pressure drops (air and fluid side) and others
- **Subcooling** analysis in the **Condensing** calculation option
- Customizable outprints with the **Page Builder** editor
- Outprints in the **PDF** and **DOC** formats
- Utility for the **management of axial fans**: automatic calculation of the airflow between the fans and the coil in all the calculation options
- Utility for the **management of the compressors**: automatic calculation of the condensing/evaporating temperature and the refrigerant flow in the **Condensing/Direct Expansion** calculation options
- Customizable table of management (layouts) available the "Refrigerants" and "Pressure" outprints

How to

How to change unit measure in page print out

How to

How to change unit measure in page print out

- After performing a Calculation, we click on the "Print" button

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www.unilab.eu – info@unilab.eu

Unilab Coils 8.0 ev - build 180912[E]

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | ? Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\Pr...\Condensing.c6prj *

Condensing

Calculation Mode

☒ Verify
☐ Design

Geometry

Subcooling Circ.

Tube

Fin

Manifolds

Air Side Details

Output

Exchange Surface
m² 159,773

Project Description
Trial [Icon]

No Warning [Checkmark]

Coil price (€) 0,00 [Icon]

Calculate **Print**

AIR SIDE

Capacity W 49628

Airflow m³/h 20000

Face Velocity m/s 3,09

Inlet Temperature DB °C 38

Inlet Relative Humidity % 50

Outlet Temperature DB °C 45,7

Outlet Relative Humidity % 33,4

Fouling factor (m² K)/W 0

Pressure Drop Pa 61

N° tubes for row 20

Rows 4

Fin Pitch mm (2) 2,50

Nr of Skipped Tubes 0

Obt.

TUBE SIDE

Fluid R134A [Icon]

Flow kg/h 1024

Condensing Temp. °C 53

Overheating K 18

Subcooling K 3

Pressure Drop kPa 22,51

Fouling factor (m² K)/W 0

Fluid Velocity [Gas phase] m/s 4,37

Finned Length mm 1500

Circuits 5

Baffles n° 0

We open the following print preview page

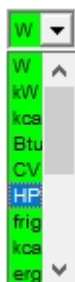
<div>Put your logo here</div>		Company Name	
		Main Address	
Tel: +00 0000 0000000		Fax: +00 0000 0000000	
web: www.companyname.com - info@companyname.com			
Customer	Date	17/09/2018	
To the k. a. of	Our Offer	-	
Your Reference	Description		
CONDENSING COIL - 168030_C_S 20T 4NR 1500A 2,5P 5NC			
Geometry	168030_C_S	Coil Length	1500 mm
Nr of Tubes per Row	20	Fin Pitch	2,50 mm
Nr of Rows	4	Nr of Circuits	5
		Tube Shape	Circular
Capacity	49628	W	
Exchange Surface	159,77	m ²	
Global Exchange Coefficient	30	W/(m ² K)	
DTML	10,3	°C	
Fins Material / Tubes Material	Aluminium / Copper		
Fin Thickness	0,1000	mm	
Coil Internal Volume	21,7	l	
Tubes External Diameter	15,9	mm	
Tubes Internal Diameter	15,2	mm	
Number of skipped tube	0		
AIR SIDE			
Atmospheric Pressure / Altitude	1,01 / 0,00	bar A / m	
Volumetric Air Flow	20000,0	m ³ /h	
Mass Air Flow	22335	kg/h	
Face Velocity on the Coil	3,09	m/s	
Inlet Air Density	1,12	kg/m ³	
Inlet Air Temperature	38,0	°C	
Inlet Air Relative Humidity	50,00	%	
Inlet Air Specific Humidity	20,80	g/kg DA	
Inlet Air Enthalpy	91,71	kJ / kg	
Outlet Air Temperature	45,7	°C	

To change the capacity from W to HP

- click on the unit measure W

<div style="border: 2px solid blue; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Put your logo here</h2> </div>		Company Name	
		Main Address	
Customer		Date 17/09/2018	
To the k. a. of		Our Offer -	
Your Reference		Description	
CONDENSING COIL - 166030_C_S 20T 4NR 1500A 2,5P 5NC			
Geometry	166030_C_S	Coil Length	1500 mm
Nr of Tubes per Row	20	Fin Pitch	2,50 mm
Nr of Rows	4	Nr of Circuits	5
		Tube Shape	Circular
Capacity	49628		W
Exchange Surface	159,77		m²
Global Exchange Coefficient	30		W/(m² K)
DTML	10,3		°C
Fins Material / Tubes Material	Aluminium / Copper		
Fin Thickness	0,1000		mm
Coil Internal Volume	21,7		l
Tubes External Diameter	15,9		mm
Tubes Internal Diameter	15,2		mm
Number of skipped tube	0		

- Let's click on the menu where We see W,



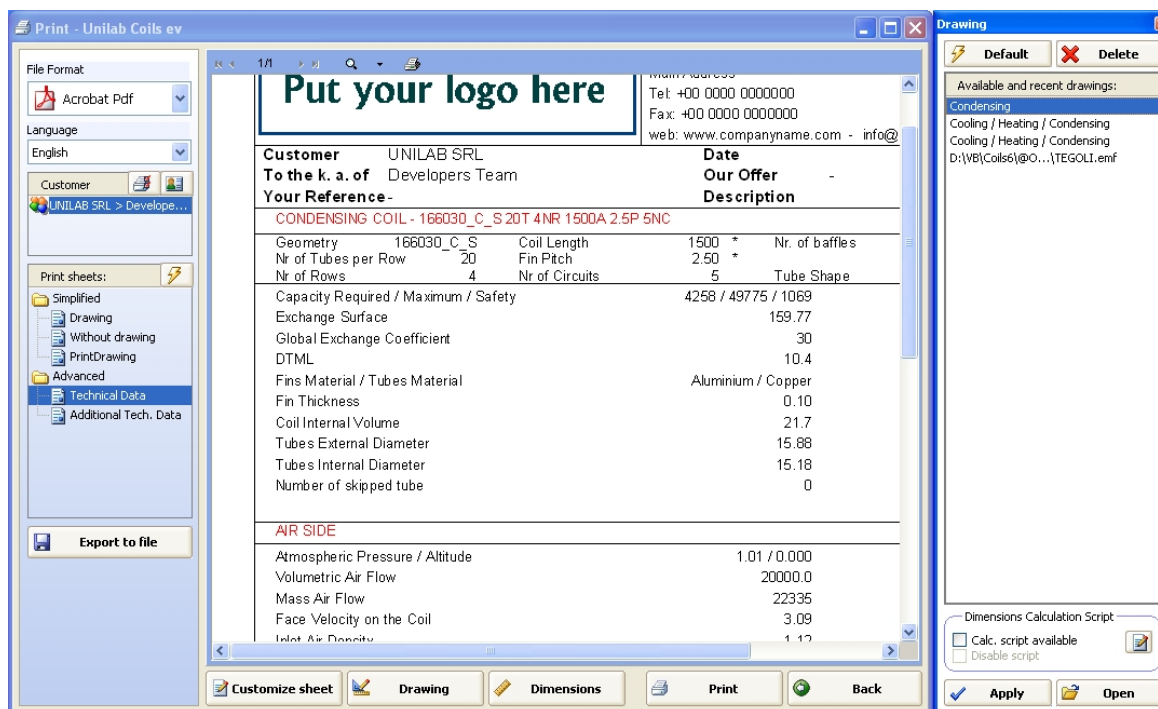
By changing unit measures, all values will be recalculated automatically.

<div style="border: 2px solid blue; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Put your logo here</h2> </div>		Company Name	
		Main Address	
Customer		Date 17/09/2018	
To the k. a. of		Our Offer -	
Your Reference		Description	
CONDENSING COIL - 166030_C_S 20T 4NR 1500A 2,5P 5NC			
Geometry	166030_C_S	Coil Length	1500 mm
Nr of Tubes per Row	20	Fin Pitch	2,50 mm
Nr of Rows	4	Nr of Circuits	5
		Tube Shape	Circular
Capacity	66,55		HP
Exchange Surface	159,77		m²
Global Exchange Coefficient	30		W/(m² K)
DTML	10,3		°C
Fins Material / Tubes Material	Aluminium / Copper		
Fin Thickness	0,1000		mm
Coil Internal Volume	21,7		l
Tubes External Diameter	15,9		mm
Tubes Internal Diameter	15,2		mm
Number of skipped tube	0		

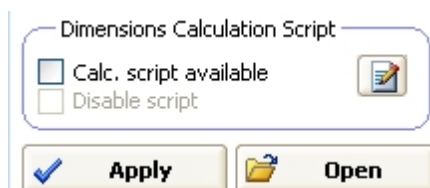
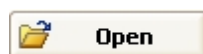
How to change the drawing

How to change the drawing

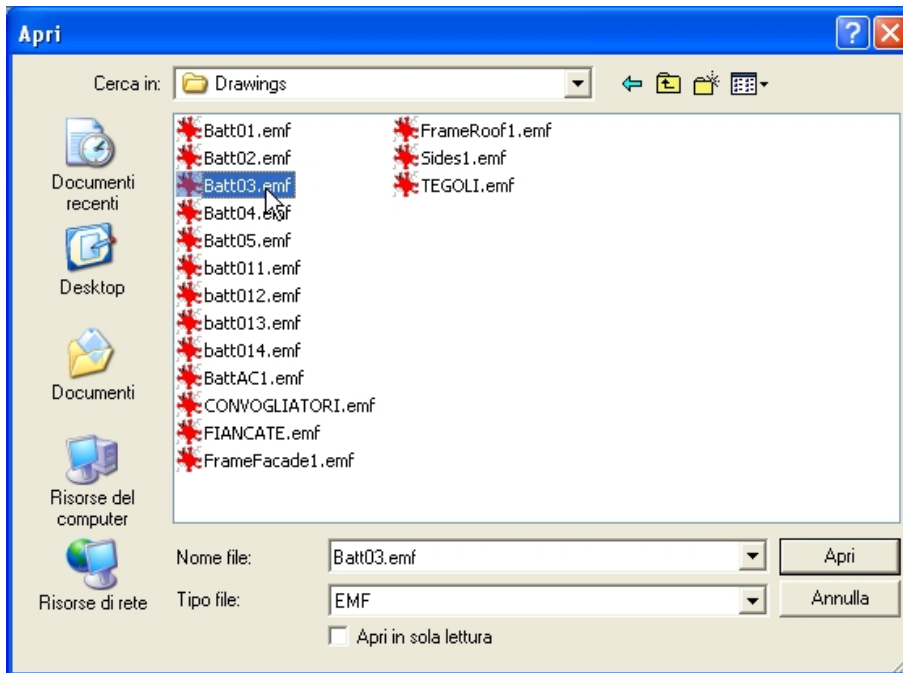
- In the “Print” page Let’s click on the button  **Drawing** on the bottom of the mask:



By clicking the “Open” button



By clicking the open button, we can charge a previously saved AutoCAD drawing.



How to balance fans or compressors with coils

How to balance fans or compressors with coils

- Let's Open a Direct Expansion's project

File Calculate Charts and tables Unit measure Standard Conditions Customize Projects Archive management Tools Online help

Project: Standard Conditions Units:

Coils 8.0 - Welcome! C:\DirectExpansion.c6prj

Direct Expansion

Calculation Mode

Verify

Design

Geometry

102522_C_S

Geometry Details

Search Geometry

Consider both latent and sensible

AIR SIDE		Total	Sensible
Capacity	W	70624	
Airflow	m³/h	10000	
Face Velocity	m/s	2,53	
Inlet Temperature DB	°C	30	
Inlet Relative Humidity	%	50	
Outlet Temperature DB	°C	16,7	
Outlet Relative Humidity	%	84,5	
Fouling factor	(m² K)/W	0	
Pressure Drop	Pa	93	

TUBE SIDE

Fluid: R1234ZE

Flow: kg/h

Evaporating Temp: °C 2

Quality: 0,2

Inlet press. of the valve: kPa 0

Overheating: K 0

Pressure Drop: kPa 82,78

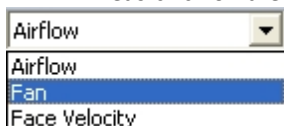
Fouling factor: (m² K)/W 0

Fluid Velocity [Gas phase]: m/s 31,31

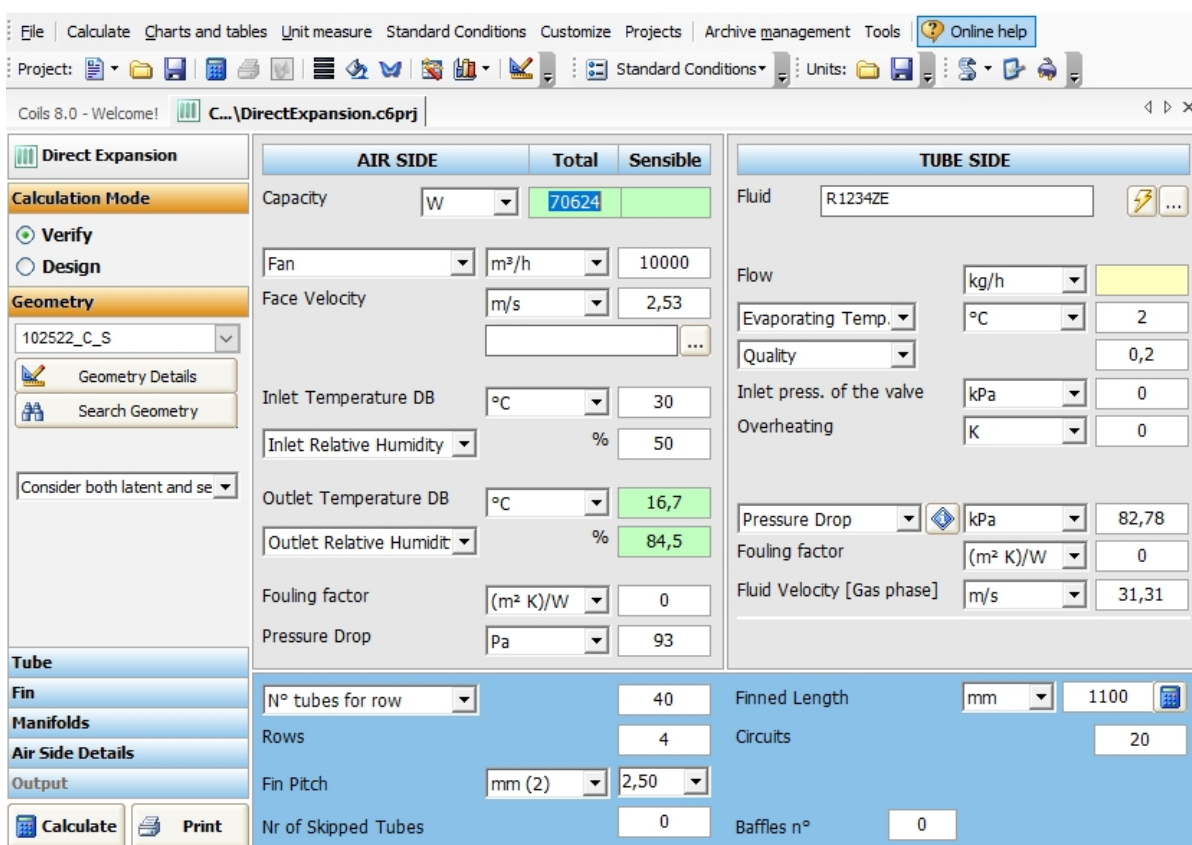
N° tubes for row	40	Finned Length	mm 1100
Rows	4	Circuits	20
Fin Pitch	mm (2) 2,50		
Nr of Skipped Tubes	0	Baffles n°	0

Calculate Print

- Let's click on the "Airflow" combo  in the Air Side of the mask and choose the Fan item



- The mask will be like the following:



Direct Expansion

Calculation Mode

- Verify
- Design

Geometry

102522_C_S

Geometry Details

Search Geometry

Consider both latent and sensible

Tube

Fin

Manifolds

Air Side Details

Output

Calculate Print

AIR SIDE

Capacity: W 70624

Fan m³/h 10000

Face Velocity m/s 2,53

Inlet Temperature DB °C 30

Inlet Relative Humidity % 50

Outlet Temperature DB °C 16,7

Outlet Relative Humidity % 84,5

Fouling factor (m² K)/W 0

Pressure Drop Pa 93

TUBE SIDE

Fluid R1234ZE

Flow kg/h

Evaporating Temp. °C 2

Quality 0,2

Inlet press. of the valve kPa 0

Overheating K 0

Pressure Drop kPa 82,78

Fouling factor (m² K)/W 0

Fluid Velocity [Gas phase] m/s 31,31

Finned Length mm 1100

Circuits 20

N° tubes for row 40

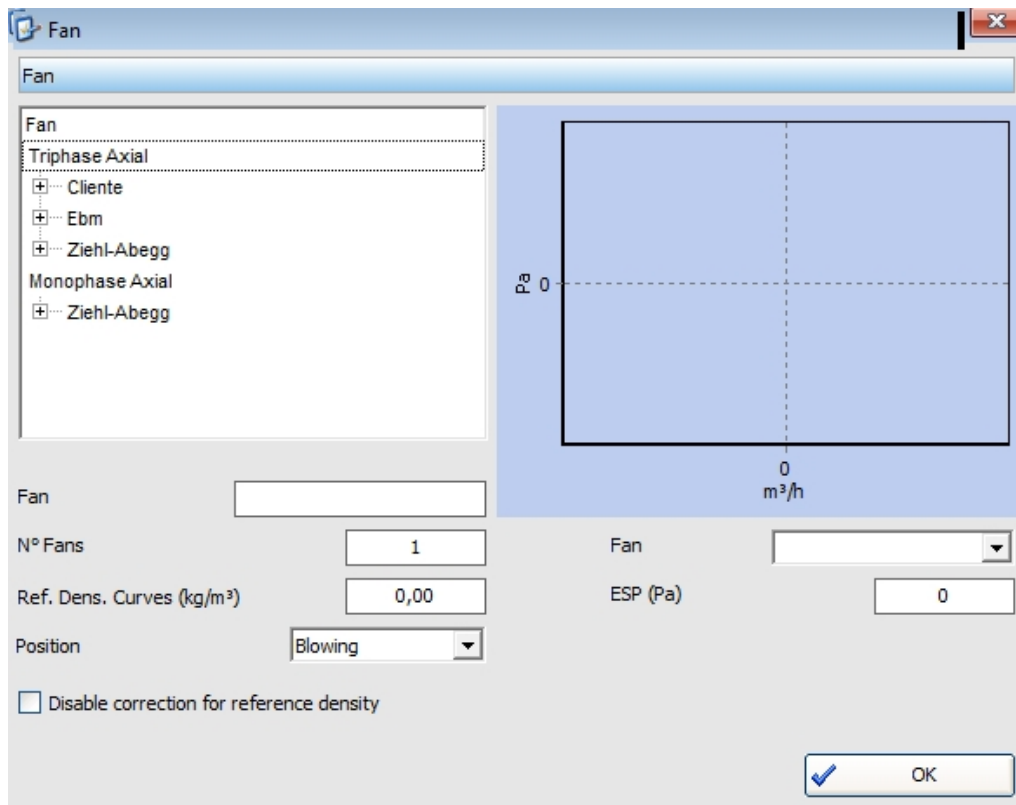
Rows 4

Fin Pitch mm (2) 2,50

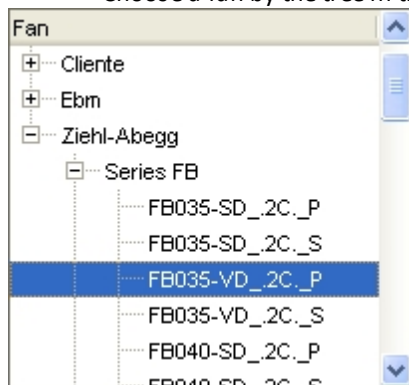
Nr of Skipped Tubes 0

Baffles n° 0

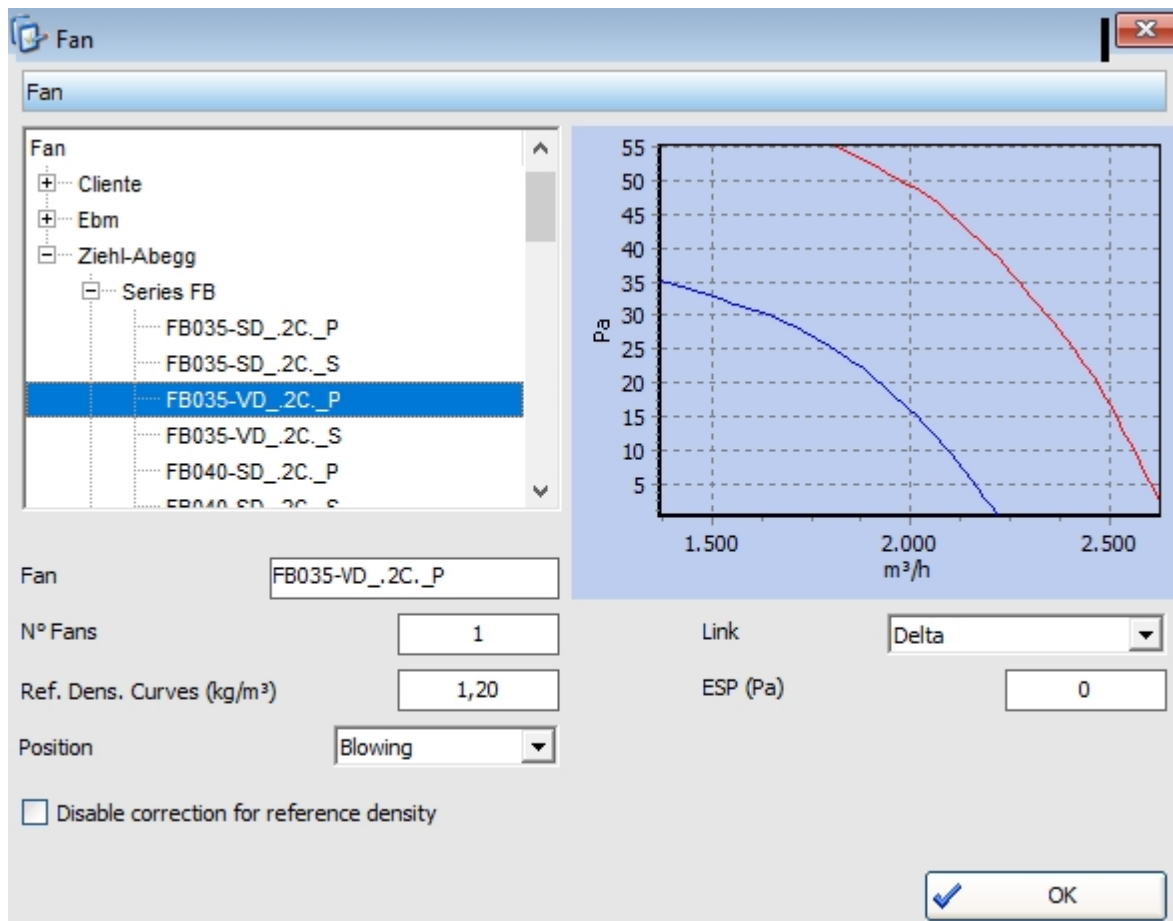
- Let's choose the "Fan" clicking on the button  appeared after the choose of the fan

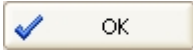


- Choose a fan by the tree in the top left side of the mask:



- The mask will be filled with the data of the selected fan model:



- Let's click on the button  to close the mask and confirm the selection. The calculation mask will be like the following:

File Calculate Charts and tables Unit measure Standard Conditions Customize Projects Archive management Tools ? Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\...\DirectExpansion.c6prj

Direct Expansion

Calculation Mode

☒ Verify
☐ Design

Geometry

102522_C_S

Geometry Details
Search Geometry

Consider both latent and sensible

Tube

Fin
Manifolds
Air Side Details
Output

Calculate Print

AIR SIDE	Total	Sensible
Capacity	W	70624
Fan	m ³ /h	10000
Face Velocity	m/s	2,53
	1 x FB035-VD_2C_P (1)	...
Inlet Temperature DB	°C	30
Inlet Relative Humidity	%	50
Outlet Temperature DB	°C	16,7
Outlet Relative Humidity	%	84,5
Fouling factor	(m ² K)/W	0
Pressure Drop	Pa	93

N° tubes for row	40
Rows	4
Fin Pitch	mm (2) 2,50
Nr of Skipped Tubes	0

TUBE SIDE

Fluid R1234ZE

Flow kg/h

Evaporating Temp. °C 2

Quality 0,2

Inlet press. of the valve kPa 0

Overheating K 0

Pressure Drop kPa 82,78

Fouling factor (m² K)/W 0

Fluid Velocity [Gas phase] m/s 31,31

Finned Length mm 1100

Circuits 20

Baffles n° 0

- Now let's choose the compressor. Then we have to choose from the "Evaporating Temp." combo Evaporating Temp., in the Tubes Side section of the mask, the Compressor's item:


Evaporating Temp.




























Evaporating Temp.


Absolute Pressure


Compressor

- The mask will be like the following:

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools |  Online help

Project:               Standard Conditions Units:             

Coils 8.0 - Welcome!  C:\...\DirectExpansion.c6prj



 Direct Expansion

Calculation Mode

☒ Verify
☐ Design

Geometry

102522_C_S

 Geometry Details
 Search Geometry

Consider both latent and sensible



Tube


Fin





Manifolds


Air Side Details


Output

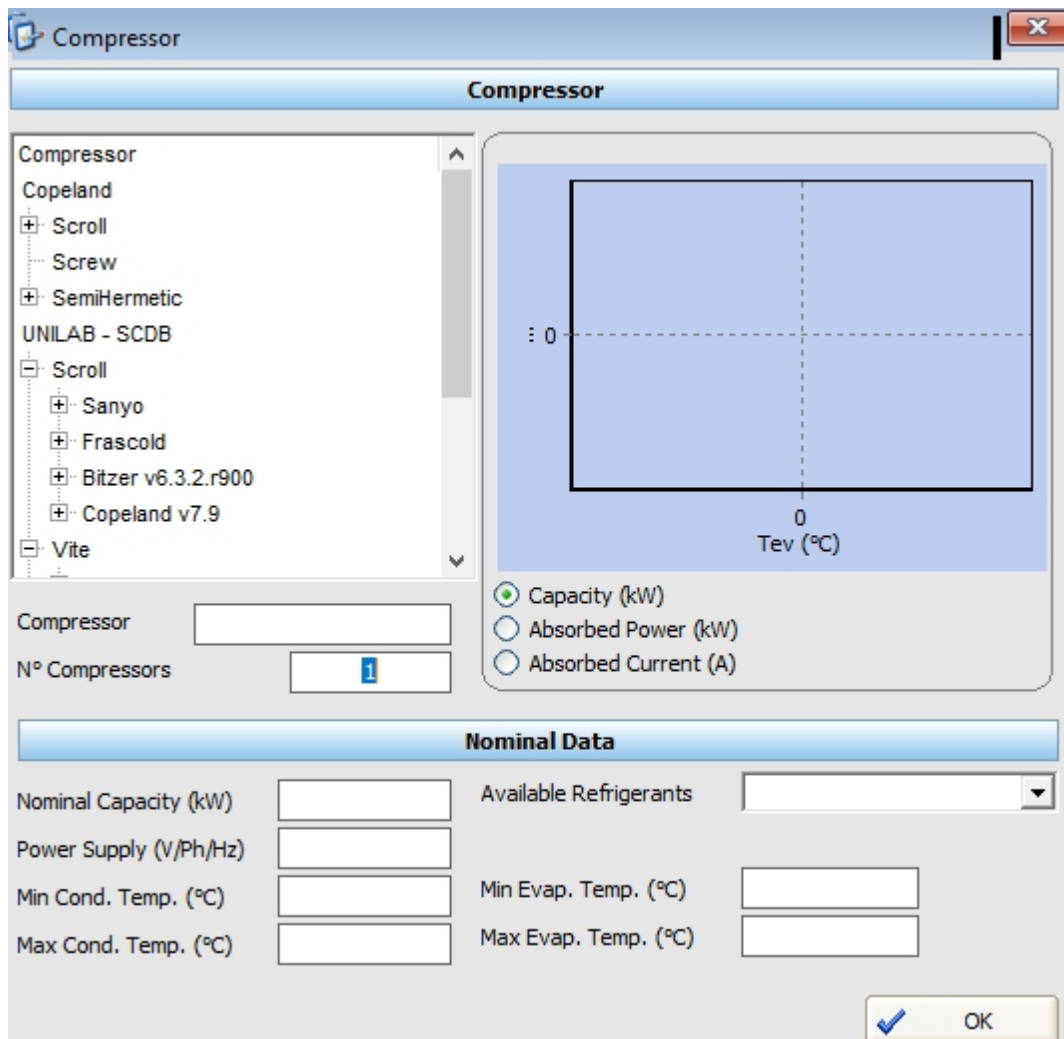
 Calculate  Print

AIR SIDE		Total	Sensible
Capacity	W	70624	
Fan	m³/h	10000	
Face Velocity	m/s	2,53	
1 x FB035-VD_2C_P (1) 			
Inlet Temperature DB	°C	30	
Inlet Relative Humidity	%	50	
Outlet Temperature DB	°C	16,7	
Outlet Relative Humidity	%	84,5	
Fouling factor	(m² K)/W	0	
Pressure Drop	Pa	93	

TUBE SIDE	
Fluid	R407C  
Flow	kg/h
Compressor	
Condensing Temp.	°C Middle 28,9
Overheating	K 0
Subcooling	K 0
Pressure Drop	 kPa 82,78
Fouling factor	(m² K)/W 0
Fluid Velocity [Gas phase]	m/s 31,31

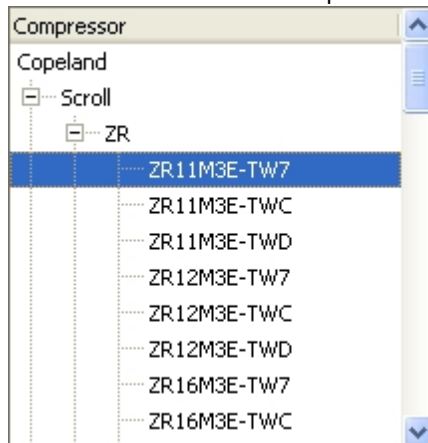
N° tubes for row	40	Finned Length	mm 1100 
Rows	4	Circuits	20
Fin Pitch	mm (2) 2,50		
Nr of Skipped Tubes	0	Baffles n°	0

- Let's click on the " " button just appeared  to choose the compressor to use. Will appear the following mask:



The screenshot shows the 'Compressor' configuration window. On the left, a tree view lists compressor models under 'Copeland' (Scroll, Screw, SemiHermetic) and 'UNILAB - SCDB' (Scroll, Sanyo, Frascold, Bitzer v6.3.2.r900, Copeland v7.9, Vite). The 'Nominal Data' section contains input fields for Nominal Capacity (kW), Power Supply (V/Ph/Hz), Min Cond. Temp. (°C), Max Cond. Temp. (°C), Available Refrigerants, Min Evap. Temp. (°C), and Max Evap. Temp. (°C). A graph on the right shows Capacity (kW) as a function of Tev (°C). The 'OK' button is at the bottom right.

- Let's choose the compressor model by the tree in the top left side of the mask:



The screenshot shows a close-up of the compressor model selection tree. The 'ZR' sub-category is expanded, showing a list of models: ZR11M3E-TW7, ZR11M3E-TWC, ZR11M3E-TWD, ZR12M3E-TW7, ZR12M3E-TWC, ZR12M3E-TWD, ZR16M3E-TW7, and ZR16M3E-TWC. The 'ZR11M3E-TW7' model is currently selected and highlighted in blue.

- The mask of the compressor will be filled with the data of the model selected:

Compressor

Compressor

Copeland

Scroll

ZR

ZR11M3E-TW7

ZR11M3E-TWC

ZR11M3E-TWD

ZR12M3E-TW7

ZR12M3E-TWC

ZR12M3E-TWD

ZR16M3E-TW7

ZR16M3E-TWC

Compressor

ZR11M3E-TW7

N° Compressors

1

Capacity (kW)

Absorbed Power (kW)

Absorbed Current (A)

Capacity (kW)

Absorbed Power (kW)

Absorbed Current (A)

Nominal Data

Nominal Capacity (kW)

0

Available Refrigerants

R134a

Power Supply (V/Ph/Hz)

380 V/3 ph/60 Hz

Min Cond. Temp. (°C)

35

Min Evap. Temp. (°C)

-20

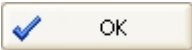
Max Cond. Temp. (°C)

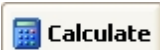
65

Max Evap. Temp. (°C)

15

OK

- Click the button 
- The calculation mask will be set as following:

- We click the button  and obtain a capacity result.

File | Calculate | Charts and tables | Unit measure | Standard Conditions | Customize | Projects | Archive management | Tools | Online help

Project: [Icons] Standard Conditions Units: [Icons]

Coils 8.0 - Welcome! C:\...\DirectExpansion.c6prj

Direct Expansion

Calculation Mode

☒ Verify
☐ Design

Geometry

102522_C_S

Geometry Details
Search Geometry

Consider both latent and sensible

Tube

Fin

Manifolds

Air Side Details

Output

Calculate Print

AIR SIDE	Total	Sensible
Capacity	W	70624
Fan	m³/h	10000
Face Velocity	m/s	2,53
1 x FB035-VD_2C_P (1)		
Inlet Temperature DB	°C	30
Inlet Relative Humidity	%	50
Outlet Temperature DB	°C	16,7
Outlet Relative Humidity	%	84,5
Fouling factor	(m² K)/W	0
Pressure Drop	Pa	93

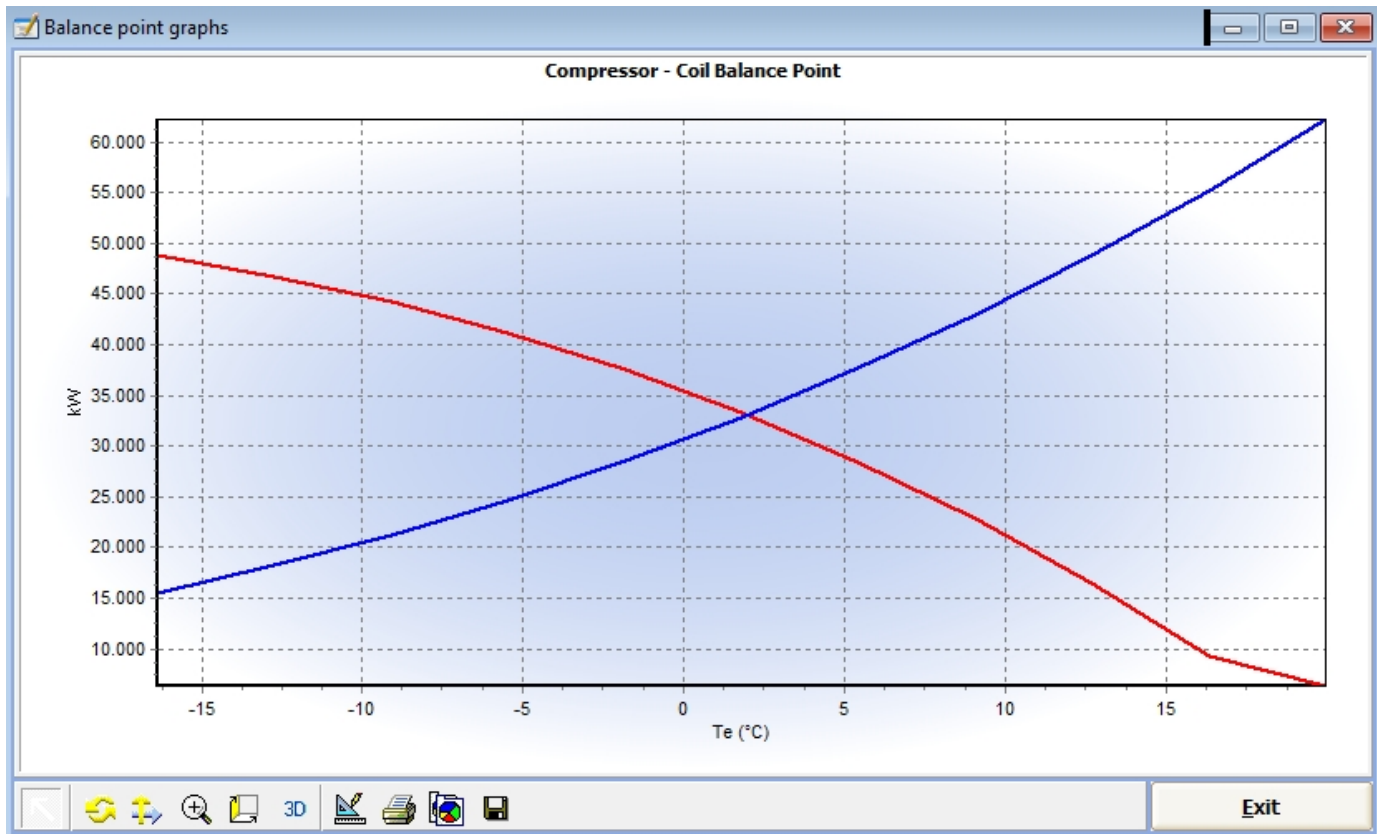
TUBE SIDE	
Fluid	R407C
Flow	kg/h
Compressor	1 x ZR11M3E-TW7
Condensing Temp.	°C Middle 28,9
Overheating	K 0
Subcooling	K 0
Pressure Drop	kPa 82,78
Fouling factor	(m² K)/W 0
Fluid Velocity [Gas phase]	m/s 31,31

N° tubes for row	40	Finned Length	mm 1100
Rows	4	Circuits	20
Fin Pitch	mm (2) 2,50		
Nr of Skipped Tubes	0	Baffles n°	0

Thus we have balanced fan and compressor.

- If we want to see the balance point by graph, we can click the on **Charts and tables** of the menu bar

○ Clicking on **Compressor balance point**, we obtain the following graph.



Coils 3D Visualization

Coils 3D Visualization

For this option please refer to the software [UNILAB EASY](http://www.unilab.eu/prodotto/easy/) or visit

<http://www.unilab.eu/prodotto/easy/>

Considerations on Calculations that do not converge

Considerations on Calculations that do not converge

In the calculation of heat exchangers, although there are rules of general trends related to the construction of the heat exchanger configuration and thermophysical properties, it is necessary to analyze each situation individually.

In the particular case of heat exchangers with phase change, such as direct expansion, condensation and pump evaporator, the program COILS makes a correction of the benefits related to pressure drops of the refrigerant.

In this mode, the iterative calculation can, in some situations, lead to a stall situation in the process of convergence due precisely to the application of this fix.

The only way to remedy this situation is to vary the number of circuits of the coil set in the calculation.

HOW COILS CALCULATES CIRCUITS DURING A DESIGN ELABORATION

The “Design” functionality of Coils lets the user choose from a list of coils the best solution for a certain heat transfer and pressure drop requirement. But how does Coils generate the list of possible solutions? This will be discussed in the following document.

How does it work

Basically the software performs an automated calculation with all possible combinations of these three parameters:

1. Number of rows
2. Fin pitch
3. Number of passes (or nr of tubes in series)

The first two parameters changes between the minimum and maximum values set by the user in the “Design profile” form. The third parameter instead changes between 1 and 14 (*) and it’s used to calculate the number of circuits with the following formula:

$$\text{Nr of circuits} = (\text{Nr of tubes per row} * \text{Nr of rows}) / \text{Nr of passes}$$

Where the Nr of tubes per row is set by the user in the input parameters.

Examples

A few practical example of these values are:

Nr of Rows: 2

Fin Pitch: 2.1 mm

Nr of Tubes per Row: 32

In this situation, the number of circuits will vary from:

Nr of Passes: 1

$$\text{Nr of Circuits} = (32 * 2) / 1 = 64$$

To:

Nr of Passes: 14

$$\text{Nr of Circuits} = (32 * 2) / 14 = 4,57 = 5$$

Another example:

Nr of Rows: 3

Fin Pitch: 2.1 mm

Nr of Tubes per Row: 32

In this situation, the number of circuits will vary from:

Nr of Passes: 1

$$\text{Nr of Circuits} = (32 * 3) / 1 = 96$$

To:

Nr of Passes: 14

Nr of Circuits = $(32 * 3) / 14 = 6,85 = 7$

Another example:

Nr of Rows: 4

Fin Pitch: 2.1 mm

Nr of Tubes per Row: 32

In this situation, the number of circuits will vary from:

Nr of Passes: 1

Nr of Circuits = $(32 * 4) / 1 = 128$

To:

Nr of Passes: 14

Nr of Circuits = $(32 * 4) / 14 = 9,14 = 9$

Considerations on the thickness of the ice of the heat transfer coils

Considerations on the thickness of the ice of the heat transfer coils

This question on the effects of the thickness of the ice in the heat transfer coils and why sometimes the duty/ capacity increases instead of decreasing ?

When we use the thickness of the ice we get two effects:

the ice introduces a thermal resistance that decreases the heat exchange coefficient .

the ice decreases the passage area of the air, therefore having the same flow , the cross velocity increases, thus the heat exchange coefficient air side increases. This (coefficient) usually in the heat transfer coils is the binding factor.

The addition of these two effects give an increase or a decrease of the duty.

If the flow instead is determined by adding a fan, the ice presence will give an increase of the pressure drops air side, thus bringing the balance point to a lower point, so decreasing the duty.

Considerations about grooved tubes

Considerations about grooved tubes

The corrugation of the tubes can both affect dramatically the coil performances or not, dependently on the typology of the fluid inside the tubes. For example, if the fluid is an oil with high viscosity, or it is an ethylene/propylene glycol, a grooved tube can increase the coil performances, otherwise the difference will not be even visible. If in the project we are using refrigerants, the difference may not be so high. Why it happens like this?

The equation to calculate the heat exchange coefficient of a finned pack heat exchanger is the following

$$K = 1 / (\text{Air Resistance} + \text{Tubes Resistance} + U)$$

Air Resistance is the air side resistance equals to $\text{Air Resistance} = 1 / (\text{Air H} * \text{Coil Eff})$

Tubes Resistance is the tubes side resistance equals to $\text{Tubes Resistance} = S_i / \text{Tubes H}$

Where:

- Air H is the partial exchange coefficient air side
- Coil Eff is the finned surface efficiency
- $S_i = (\text{Partial primary surface} + \text{Secondary Surface}) / \text{Primary Surface}$
- Tubes H is the partial exchange coefficient tubes side
- U are other resistances usually ignored like the thermal resistance due to the tubes material and the fouling factors both sides.

The primary surface is the thermak exchange surface of the tubes, and the secondary is the total surface of the fins.

Suppose that we set the Air Resistance to = 0,018

When increasing the surface of the tube, using a grooved tube, you get a double effect: it increases the exchange coefficient tube side and it increases the ratio "Si". If because of the type of fluid used we exchange fluid side of the coefficients of very high, for example 4000 (equal to water at 2.8 m/s), this effect will be negligible. Assuming a value for "Si" of 20 and a coefficient of 4000, the resulting Tubes Resistance will be equals to $20/4000 = 0.005$. Consequently, the tube side resistance will be negligible.

If the fluid is very viscous, such as a thermal oil, the coefficient side tube will be much lower, such as 800. Therefore $\text{Tubes R} = 20/800 = 0.25$. Consequently the tube side resistance is dominant in the calculation of the overall coefficient, and therefore in this case is more useful to use a grooved tube to increase both the coefficient of exchange that the ratio between the surfaces, increasing therefore the coil performance significantly.

In this situation it is very important to set the parameter "**Tube internal surface ratio**" of the geometry, which specifies the increment of the surface of the grooved tube. This ratio is calculated as: $(\text{Tubes Internal Grooved Surface} / \text{Surface of the corresponding smooth tube})$.

Support