

DBM – GEO.COIL DLL

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BRIEF DESCRIPTION/LICENSE AGREEMENT

In order to use the coil selection software CALC98 as a step in a more general design process, calcdll.dll is available for use with any programming language that supports standard Windows DLL: the user can insert the required input data and obtaining results supplying proper parameters to the exported function StartJob. Please note that only a minimal check is performed on the validity of the values supplied; this could lead to unpredictable results if wrong data are specified. It is left to the user to assure data consistency. The batch version of Calc98 is distributed under the following conditions:

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The software belongs to D.B.M S.p.a. / GEO.COIL S.r.l. and it has to be considered a tool to improve business relationship with their customers.

It is forbidden to use the software to facilitate in any way any of D.B.M. S.p.a. / GEO.COIL S.r.l. competitors. It is forbidden to distribute it to any third party unless written request is sent to D.B.M. S.p.a. / GEO.COIL S.r.l. and a written confirmation is received.

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If it will be discovered that this DLL has been used to order products to D.B.M. S.p.a. / GEO.COIL S.r.l. competitors we reserve the right to ask for damages.

The use or the installation of the program automatically implies the acceptance of all these conditions as well as our standard sales terms unless a different agreement is signed.

The software might be distributed with time operating limit. After that time expires, the DLL might not work anymore.

Please contact DBM sales office for any further information.



INSTALLATION

The files needed for a correct use of the DLL are:

File name	Description
CALCDLL.DLL	Simple wrapper against CALC98 MFC DLL extensions.
HHSD.DLL	Monophase engine
LIQUIDI.DLL	Fluids database
GAS.DLL	Gases database
EVAP.DLL	Evaporator engine
COND.DLL	Condenser engine
CMPDLL.DLL	Calc98 common library
LIQUIDI.DLL	Liquid library
Przinfo.dlt	Price file, from version 1.6

WARNING

DLLs are written with Visual C++ 2010, and the user needs to distribute the VC++ runtime also. The runtime can be downloaded from Altec site:

www.altecsoftware.com

login as

USER:ALTEC

PWD:ALTEC

The correct file to download is :VCRedist_x86_2010.exe

The DLL is compiled as UNICODE.

UPDATE 01-03-2018 : DLLs are written with Visual C++ 2017, and the user needs to distribute the VC++ runtime also. The runtime can be downloaded from ALTEC site:

USER:ALTEC

PWD:ALTEC

The correct file to download is :VCRedist2015-x86.exe

PRICE FILE

Starting from version 1.6, the price information are stored in a separate file for easier update. This version of the DLL uses standard Windows cryptoAPI features. Be sure to place the file in the same folder as Calcdll.dll



DLL USAGE

Calcdll.dll exports two functions.

1. **StartJob**, that accepts three parameters

double alnputData[NINPUTDATA], specifies input data

VARIANT aResData[NRESDATA], contains calculation results

VARIANT aOptions[NOPTIONSDATA], specifies optional flags (for future use)

NINPUTDATA: **100**

NRESDATA: **100**

NOPTIONSDATA **1**

2. **SetPricePath**(char path[255])

To set the path where przinfo.dlt file is located.

3. **EndCalculation**()

A new method is exported for users that have trouble deallocating BSTR string from the result array.

Call this method after the call to Startjob and after copying in local variable the string results in the result array (coils tring and manifold dimensions, mainly)

After the call will not be safe to access the results array string

To avoid DLL location problems, check that Calcdll.dll, hhsd.dll, liquidi.dll, cmpdll.dll, gas.dll, evap.dll, cond.dll are placed in the same directory of your executable file.

endcalculation

Usage from VB-VBA

Function declaration

Declare Function StartJob Lib "c:\calcsoft\calcdll\debug\calcdll.dll" (ByRef p1 As Double, ByRef p2 As Variant, ByRef p3 as Double) As Boolean

Declare Function SetPricePath Lib "c:\calcsoft\calcdll\debug\calcdll.dll" (ByRef p1 As String)

Const NINPUTDATA = **100**

Const NRESDATA = 100

Const NOPTIONSDATA = 1



Const P60 = 1

where "c:\calcsoft\calcdll\debug\calcdll.dll" is the absolute path of calcdll.dll

Usage

Function StartCalc_Clicked()

Dim bErr As Boolean

Dim aInputData(NINPUTDATA) As Double

Dim aResult(NRESDATA) As Variant

Dim aOptions(NOPTIONS) As Variant

On Error GoTo StartCalc_exit

' Collect data from input mask

aInputData(0) = 1 ' coil type P60

aInputData(1) = 32 ' inlet temperature 32°C

aInputData(2) = 50 ' 50% R.H.

aInputData(5) = 2000 ' air volume 2000 Sm³/h

aInputData(14) = 4 ' 4 Rows

aInputData(15) = 10 ' 10 tubes per row

aInputData(16) = 2 ' fin pitch 2.0 mm

aInputData(17) = 4 ' 4 circuits

aInputData(18) = 500 ' coil length 500 mm

aInputData(26) = 7 ' water inlet temp 7 °C

aInputData(27) = 12 ' water outlet temp 12 °C

' DLL DBM

SetPricePath(".\\");

a = StartJob(aInputData(0), aResult(0), aOptions(0))

' show data results

' ShowResult(aResult)

Msgbox("Selected coil" & aResult(29))' Simple result processing

exit sub

StartCalc_exit:

MsgBox("Errors during calculation")



Resume next

End function

Note: Please remember that the first array position is 0, so you find the coil description in aResult.

Usage from C++

// Calcdll.h is located in the installation directory together // with calcwin.dll and calcwin.lib

```
#include "calcdll.h"
```

```
void CCalcdllsvrView::OnCalcolo()
```

```
{  
    // TODO: Add your control notification handler code here  
    VARIANT aRis[NRESDATA];  
    double aInp[NINPUTDATA];  
    double aOpt[NOPTIONSDATA];  
  
    // Collect data from input mask  
    GetData(vInp);  
    // Check for errors  
    if (!StartJob(aInp, aRis, aOpt))  
        return;  
    // Show results  
    ShowResults(aRis);  
}
```

Link Calcdll.lib together with your files.

Warning: positions 14,15 and 30 of the output array contain BSTR values, so in order to convert them to CString (in Visual C++) is possible to create an instance of the class CString passing *aRis[n].bstrVal* to the constructor (see VARIANT structure declaration):

```
CString coilDescription (aRis[29].bstrVal);  
AfxMessageBox(CString("Coil type: ") + coilDescription);
```

Contents of calcdll.h

```
#define NINPUTDATA      100  
#define NOPTIONSDATA   1  
#define NRESDATA      100
```



```
extern "C" BOOL FAR PASCAL EXPORT StartJob(double vInp[NINPUTDATA], VARIANT vRis[NRESDATA], double  
vOpt[NOPTIONSDATA]);
```

Note: Arrays in C/C++ are 0-based (first position is position number 0), so you find the coil description in aRis[29].



INPUT ARRAY DESCRIPTION

Each position of the input array specified as the first parameter in StartJob contains a value related to a variable used by the software according to the following table:

Cell	Meaning	Measure unit/values
1	Coil type ¹	
2	air inlet temperature	°C
3	air inlet humidity	A value between 0 and 100
4	air inlet absolute humidity	g/kg
5	air inlet wet bulb	°C
6	Air volume (standard conditions)	Sm ³ /h
7	Air volume (normal conditions)	Nm ³ /h
8	Air volume (actual conditions)	Em ³ /h
9	Header material ²	
10	Air volume (standard conditions)	Sm ³ /s
11	Air volume (normal conditions)	Nm ³ /s
12	Air volume (actual conditions)	Em ³ /s
13	Air weight	kg/h
14	Air weight	kg/s
15	Number of rows	
16	Number of tubes	
17	Fin pitch ³	mm (0: auto select)
18	Number of circuits	
19	Coil width	mm
20	Coil height	mm
21	Capacity	kCal/h
22	Capacity	kW
23	Air outlet temperature	°C
24	Air inlet velocity	Sm/s
25	Air inlet velocity	Nm/s
26	Air inlet velocity	Em/s

¹ P60: 1, P3012: 2, P25:.,P40:94. See table 6

² See table 10

³ See table 8



27	Fluid inlet temperature	°C
28	Fluid outlet temperature	°C
29	Fluid volume	dm ³ /s
30	Fluid volume	dm ³ /h
31	Fluid weight	kg/s
32	Fluid weight	kg/h
33	Max allowed fluid side pressure drop	kPa
34	Working pressure	bar
35	Working pressure	atm
36	Working pressure	kpa
37	Working pressure	kg/m ²
38	Working pressure	mmHg
39	Working pressure	mmH ₂ O
40	Tube-side fouling factor	m ² °C/W
41	Glycol type	1 – Ethylenglycol 2 – Propilenglycol 4 - Ethilen Alcohol
42	Glycol percentage - by volume	a number between 0 and 100
43	Glycol percentage - by weight	a number between 0 and 100
44	Safety factor on surface	a number between 0 and 100
45	Safety factor on capacity	
46	Fluid type ⁴	
47	Fluid density ⁵	kg/m ³
48	Fluid viscosity	mPa.s
49	Fluid specific heat	J/kg°C
50	Fluid conductivity	W/m°C
51	Frame code ⁶	
52	Price multiplier	
53	Fouling factor – fins side	m ² °C/W
54	Condensing pressure	bar
55	Condensing temperature	°C

4 See Table 5. **FRAME THICKNESS IS AUTOMATICALLY SET WITH DBM STANDARD RULES**

5 Specify lines from 47 - 50 only when line 46 contains 3 (USER-DEFINED FLUID)

6 See Table 11



56	Evaporating pressure	bar
57	Evaporating temperature	°C
58	Subcooling	°C
59	Superheating	°C
60	Type of calculation	1: Monophase 2: Direct expansion 3: Condenser
61	Fins material ⁷	
62	Fins thickness ⁸	mm
63	Tube thickness	mm (P60&P40: 0.4, 0.75, 1.00; P3012 0.35, 0.6; P25 0.30,0.50)
64	Flanges	0: No , other options not available
65	Tube material	0: CU – 1: CuSn – 2: INOX304 – 3 INOX316 – 4 FE 5 – CUNI9010
66	Customer field1	
67	Customer field2	
68	Customer field3	
69	Connection side	0:same side 1: opposite side. ED Coils always same side
70	Overall dimension – width ⁹	mm. Specify overall height also, or finned height
71	AHRI Version	0: Std calculation 1: AHRI calcul.
72	Type of fins	0: finned coils – 1: coil without fins
73	Automatic coil selection	0: std coil: 1 cheapest geometry selection
74	Number of gas circuits	1,2,3,4,6. Only for condenser and evaporator coil. (0 = auto selection)
75	Overall dimension – height	mm.
76	Steam coil: execution type	1-3-6 ¹⁰
77	Electro tinned after manufacturing	0: No 1: yes. Available only if CuSn tubes and fins are selected. Not all frame materials are suitable for electro tinning. We recommend Cu if coil weight is < 300 Kg

⁷ See Table 7

⁸ See Table 12

⁹ Alternative option for coil width. See row 19

¹⁰ 1: Sloped tubes – 3:Vertical tubes - 6 Headers on same side. Default value 1



78	Calculation mode	0:standard tolerance 1: reduced tolerance 2 certified performance 3: compatibility mode (performance as previous DLL version)
79	Inlet manifold diameter ¹¹	0: Auto else See table 13
80	Outlet manifold diameter ¹²	0: Auto else See table 13
81	Type, material and thickness of basin ¹³	See table 15.
82	Drop eliminator	See table 14
83	Packing type	0: None 1: crate 2: pallet 3: wooden box
84	Minimum height of bottom frame plate ¹⁴	mm. Standard value = 0
85	Minimum height of top frame plate ¹⁵	mm. Standard value = 0 Position 84 and 85 must be both 0 or greater than 0. These values are used only for selection with overall dimensions
86	Type of flow	0: Counter flow; 1:Parallel flow
87	Always single manifold	0: automatic manifold number calculation, 1: always a single manifold for inlet and outlet connection
88	Coil application, for PED calculation	0: HVAC application (default) 1: Industrial application 2: steam coil 3: superheated steam coil
89	Coil frame depth (mm)	Standard value =0 -> DBM standard rule

¹¹ Enter the input value specified in Table13. If the user wants to specify more than one manifold, add to the value the number of manifold multiplied by 100, so 110 is the correct value for 1 manifold DN150, 210 is the correct value for 2 manifolds DN150. Values less than 100 are treated as a single manifold. The maximum number of manifolds is 3

¹² Same as note 11

¹³ Thickness of intermediate tray is automatically calculated, based on material and coil length. Thickness of flat tray and sloped tray can be specified with the correct input value

¹⁴ WARNING: if a value is entered DBM minimum requirements will be ignored. This means that DBM cannot guarantee that frame will be strong enough and a safety handling will be possible. Customer will be solely responsible of risks and damages. For additional information about minimum suggested sizes refer to Table 16.

¹⁵ WARNING: if a value is entered DBM minimum requirements will be ignored. This means that DBM cannot guarantee that frame will be strong enough and a safety handling will be possible. Customer will be solely responsible of risks and damages. For additional information about minimum suggested sizes refer to Table 16.



Table 1: Input values

It is possible to set the value for some parameters in several ways or with different measure units. So, there are groups of lines for which only one value is required. If more than one value is supplied (as a mistake), the default value (if specified) or the first valid value is used: if you specify, for example, values for rows **6,7,9** in table 1, the data in the row **6** is assumed as valid; if you specify values for rows **9,10,14**, the value in row 9 is used. The default row numbers used when multiple choices are available are listed in Table 2.

Lines	Meaning	Default value
6,7,8,9,10,11,12,13,14,24,25,26	Air volume/weight/velocity	6
16, 20	N° tubes/Coil height	16
21,22	Capacity required	21
21,15	Capacity/N° Rows	21
28,29,30,31,32	Fluid outlet temp/Fluid volume/weight	28
34,35,36,37,38,39	Working pressure	34
42,43	Glycol percentage	43
54,55	Condensing pressure/temperature	54
56,57	Evaporating pressure/temperature	56

Table 2. Default values

AUTOMATIC COIL SELECTION

This feature, when enabled, selects the cheapest coil between P60, P40 and P3012 for the specified duty required. The following assumptions on input values are made:

- The coil height is specified (the number of tubes, if specified, is converted to a height value)
- A selection calculation is required: this option is not available when the user specifies the number of rows in position 15 of the input array.
- The fins pitch is always automatically selected, starting from the value entered in position 17 of the input array. The DLL considers this as the minimum fin pitch for the selection, while the maximum value is 5. The tube thickness is automatically selected. The comparison is between P3012 -0.35 mm and P60 0.4 mm or P3012 0.6 mm – P60 0.75 mm (specify 0.75 in position 63 of the input array). The tube thickness selected is available in the results array.
- The fins thickness is the same for both geometries. The value is specified in position 62. The DLL doesn't check for validity of the specified value.



RESULTS ARRAY DESCRIPTION

The second parameter specified in StartJob call contains the results related to the data specified in the input array. The meaning of each position in the array is given in Table 3.

Cell	Meaning	Measure unit
1	Capacity	kW
2	Capacity	kcal/h
3	Air outlet temperature	°C
4	Air outlet relative humidity	%
5	Air outlet absolute humidity	g/Kg
6	Fluid outlet temperature	°C
7	Fluid volume	dm ³ /h
8	Fluid volume	dm ³ /s
9	Fluid weight	kg/h
10	Fluid weight	kg/s
11	Air side pressure drop	Pa
12	Fluid side pressure drop	kPa
13	Capacity Reserve	%
14	Coil height	mm
15	Coil depth	mm
16	D dimension	mm
17	Gas velocity	m/s
18	Fluid velocity	m/s
19	Fluid density	kg/m ³
20	Fluid viscosity	mPas
21	Fluid specific heat	J/Kg°C
22	Fluid conductivity	W/m°C
23	Sensible Heat/Total heat ratio	
24	Condensed water	kg/h
25	Error code ¹⁶	
26	Number of rows	
27	Number of circuits	
28	Coil price	
29	Coil weight	kg
30	Complete coil denomination	
31	Subcooling	°C
32	Superheating	°C
33	Vapour fraction	
34	Inlet connection diameter	DN or ”

¹⁶ See Paragraph 7



35	Outlet connection diameter	DN or “
36	Vapour velocity inside inlet manifold	m/s
37	Vapour velocity inside tubes	m/s
38	Liquid velocity inside tubes	m/s
39	Liquid velocity inside outlet manifold	m/s
40	Number of distributors	
41	Distributors denomination	
42	Capillars outside diameter	mm
43	Capillars inside diameter	mm
44	Capillars length	mm
45	Distributor header diameter	mm
46	Condensing temperature	°C
47	Condensing pressure	bar
48	Evaporating temperature	°C
49	Evaporating pressure	bar
50	Total exchange surface	m ²
51	Freon pressure drop	°C
52	Inlet air relative humidity	%
53	Internal volume	m ³
54	Fins pitch	mm
55	Customer code	
56	Coil finned length	mm
57	Tubes number	
58	Tube thickness	mm
59	Coil overall length (standard DBM)	mm
60	Coil overall height (standard DBM)	mm
61	Drop eliminator pressure drop	pa
62	Drain tray price	€
63	Drop eliminator price	mm
64	Not used	
65	Number of coils	
66	Distance between manifolds (X) for water coils and single manifold	mm
67	Distance between manifolds (Y) for water coils and single manifold	mm
68	Number of gas circuit	
69	Coil needs drawing confirmation	
70	Frame thickness: is always computed according with DBM standard	mm
71	Warning code	See error table



72	Fins thickness	mm
73	Connection side	1 same side, 2 opposite side
74	Air side pressure drop, dry mode	Pa
75	Frame length on bends side (standard DBM)	mm
76	Capillars pressure drop (ED coils only)	Bar
77	Height of bottom and top frame plates (DBM standard)	Mm
78	DLL Version	
79	PED Class	0: Art 4.3 1: Class 1 2: Class 2 3: Class 3
80	PED: max pressure	
81	PED: max temperature	
82	PED: min temperature	
83	Liquid Reynolds number, at inlet liquid conditions	
84	Liquid Reynolds number, at outlet liquid conditions	

Table 3. Results array description.

DEFAULT VALUES

It is possible to specify only a minimum set of values in order to perform a selection.

For the parameters without value (that is, with value 0) default values will be assumed, according to the following table:

Row	Meaning	Default value
34	Working pressure	1.013 bar
40	Tube side fouling factor	0 m ² C/W
42	Glycol percentage	0
44	Safety factor on surface	0
45	Safety factor on capacity	0
46	Fluid type	1 (water)
53	Gas side fouling factor	0 m ² C/W

Table 4: default values for empty rows.



TABLES

Fluid type	Value
Water	1
ESSOTHERM 500	2
R134a	4
R22	5
Steam	9
Therminol 66	11
R407c	12
R404a	13
R410a	16
Sea water (100g/kg)	10
R407F	72
R448A	78
R449A	79
R32	82

Table 5: Fluid types

Coil type	Value
P60	4
P3012	2
P40	94
P25	113

Table 6: Coil types

P60	P3012	P40	P25
2	2	2	2
2,5	2,5	2,5	2,5
3	3	3	3
4	4	4	4
5		5	5
6		6	6
8		7	
10		8	
		10	
		12	

Table 8: Available fins pitches (mm)

Fin materials	Value
AL	1
ALPR	2
CU	3
CUSN	4
ALMG 2.5	9

Table 7: Fin material

NOTE: AIMg2.5 not available for P25



Header material	Value
Steel	6
Copper	1

Table 10: Header material

For INOX tubes, manifolds material is INOX

For Fe tubes, manifolds material is Fe

N.B.: Starting from version 1.7.0.0 manifolds material is ALWAYS equal to tubes materials.

Frame	Value
Al 2 mm	15
Al 3 mm	40
FeZn 1,5 mm	11
FeZn 2,0 mm	12
FeZn 2,5 mm	13
FeZn 3 mm	14
FeZn 4 mm	43
Inox 304 1,5 mm	16
Inox 304 2 mm	17
Inox 304 2,5 mm	18
Inox 304 3 mm	39
Inox 304 4 mm	41
Inox 316 1,5 mm	25
Inox 316 2,0 mm	36
Inox 316 2,5 mm	37
Inox 316 3 mm	38
Inox 316 4 mm	42
Fe 1,5 mm	45
Fe 2,0 mm	46
Fe 2,5 mm	47
Fe 3 mm	48
Fe 4 mm	49
Cu 2 mm	19
Cu 3 mm	44

Table 11: Frame codes



Fin thickness P60	Value
	(mm)
Al	0,11
Al	0,20
AlPR	0,11
Cu	0,10
CuSn	0,10
AlMg2.5	0,15

Table 12: Valid fins thick.(P60)

Fin thickness P3012	Value
	(mm)
Al	0,11
Al	0,20
AlPR	0,11
Cu	0,10
Cu	0,20
CuSn	0,10
CuSn	0,20
AlMg2.5	0,15

Table 12: Valid fins thickness (P3012)

Fin thickness P40	Value
	(mm)
Al	0,11
Al	0,20
Al	0,25
Al	0,40
AlPR	0,11
AlPR	0,25
Cu	0,10
Cu	0,20
CuSn	0,10
CuSn	0,20
AlMg2.5	0,15
AlMg2.5	0,20

Table 12: Valid fins thickness (P40)

Fin thickness P25	Value
	(mm)
Al	0,11
Al	0,20
AlPr	0,10
Cu	0,10

Table 12: Valid fins thickness (P25)



Input value	Manifolds diameter	Manifolds diameter
2	DN 20	¾"
3	DN 25	1"
4	DN 32	1" ¼
5	DN 40	1" ½
6	DN 50	2"
7	DN 65	2" ½
8	DN 80	3"
9	DN 100	4"
10	DN 125	5"

Table 13: Manifolds diameter

Input value	Drop Eliminator type	Frame material
50	Plastic 33 mm pitch	Integrated into coil
51	Plastic 33 mm pitch	Separate – Galvanized steel
52	Plastic 33 mm pitch	Separate – Aluminum
53	Plastic 33 mm pitch	Separate – INOX 304
54	Plastic 33 mm pitch	Separate – INOX 316

Table 14: Drop eliminator type

Input value	Flange type	Flange material
203	EN 1092 Type 13 PN16	Inox 304
206	EN 1092 Type 13 PN16	Steel
217	EN 1092 Type 13 PN 16	Inox 316
303	EN 1092 Type 01 PN 16	Inox 304
306	EN 1092 Type 01 PN 16	Steel
317	EN 1092 Type 01 PN 16	Inox 316
403	EN 1092 Type 11 PN 16	Inox 304
406	EN 1092 Type 11 PN 16	Steel
417	EN 1092 Type 11 PN 16	Inox 316
503	EN 1092 Type 02 PN 16	Inox 304
506	EN 1092 Type 02 PN 16	Steel
517	EN 1092 Type 02 PN 16	Inox 316

Table 16: Flanges type and material

**NB: TO CALCULATE THE PRICE FOR COUNTERFLANGES ADD
400 TO THE ABOVE CODE: i.e.906 = EN 1092 Type 02 PN 16 Steel
+ counterflanges**



Min value	Max weight	Max finned length
[mm]	[kg]	[mm]
15	100	1500
20	300	2500
40	800	4000
50	2000	5000

Table 16: Minimum recommended heights for top and bottom frame plates



Input value	Basin type	Material
1011	Flat	Galvanized steel 1.5 mm
1012	Flat	Galvanized steel 2.0 mm
1013	Flat	Galvanized steel 2.5 mm
1014	Flat	Galvanized steel 3.0 mm
1015	Flat	Aluminum 2.0 mm
1016	Flat	Inox 304 1.5 mm
1017	Flat	Inox 304 2.0 mm
1018	Flat	Inox 304 2.5 mm
1025	Flat	Inox 316 1.5 mm
1036	Flat	Inox 316 2.0 mm
1037	Flat	Inox 316 2.5 mm
1038	Flat	Inox 304 3.0 mm
1040	Flat	Inox 316 3.0 mm
2011	Sloped	Galvanized steel 1.5 mm
2012	Sloped	Galvanized steel 2.0 mm
2013	Sloped	Galvanized steel 2.5 mm
2014	Sloped	Galvanized steel 3.0 mm
2015	Sloped	Aluminum 2.0 mm
2016	Sloped	Inox 304 1.5 mm
2017	Sloped	Inox 304 2.0 mm
2018	Sloped	Inox 304 2.5 mm
2025	Sloped	Inox 316 1.5 mm
2036	Sloped	Inox 316 2.0 mm
2037	Sloped	Inox 316 2.5 mm
2038	Sloped	Inox 316 3.0 mm
2039	Sloped	Inox 304 3.0 mm
2040	Sloped	Aluminum 3.0 mm
3007	Intermediate	Galvanized steel
3002	Intermediate	Aluminum
3003	Intermediate	Inox 304
3017	Intermediate	Inox 316

Table 15: Basin type and material

NB: TO CALCULATE THE PRICE FOR BOTH INTERMEDIATE TRAY AND FLAT/SLOPED TRAY, ADD 3000 TO THE ABOVE CODE: i.e.5038 = SLOPED TRAY INOX316 3mm + INTERMEDIATE TRAY INOX316



ERROR CODES

If you specify wrong input data, error codes are returned according to the following table:

Error code	Error description
-99	Unknown error
130	Maximum number of connected rows exceeded.(steam coil)
131	Steam velocity too high. Please contact DBM
150	License expired
151	Unable to load standard coils. Be sure to call InitLib() before StartJob()
10100	Fin pitch not allowed
10200	Wrong circuits number or wrong max liquid side pressure drop
10300	Calculation type not specified
10305	Invalid gas or liquid temperatures
10306	Wrong liquid temperature. Minimum temperature difference is 1°C between air and liquid, suggested value is 3C°
10310	Invalid fin pitch for ratings mode
10400	Wrong liquid type
10500	Wrong user specified liquid properties
10600	Liquid outlet temp. and liquid volume not specified
10700	Incorrect tubes number or coil height
10750	Incorrect coil length
10800	Incorrect inlet air condition
10900	Incorrect gas side volume or weight
11000	Wrong coil type
11010	Wrong frame code
11020	Invalid fin thickness or fins pitch
11030	Invalid tube thickness
11040	Invalid header material
11050	Invalid tube material
11070	Overall length or height not specified correctly
11080	Steam coils dimensions invalid.
11090	Invalid steam coil execution: valid values for input[46] are 1,3,6
11100	Invalid temperature or pressure for evaporator or condenser
11200	Invalid inlet refrigerant conditions (error in computing vapour fraction)
11300	Condenser or evaporator module not found
11310	Evaporating temperature is too low (minimum value -20°C)
11320	Minimum fins pitch is 3.0 (see direct expansion coil selection note)
11330	ETAM is available only for CuSn tubes and fins
11340	Invalid basin type or material



11350	Invalid drop eliminator
11360	Invalid packing code
11370	Invalid flange material
11380	Invalid flange type
11390	Flanges must be selected for this temperature conditions
11400	Error in price calculation. Check for przinfo.dlt file
11401	Error with tubes price
11402	Error with fins price
11403	Error with frame price
11404	Error with inlet manifold price
11405	Error with outlet manifold price
11410	Invalid number of rows or circuits
11420	Maximum fin pitch for AlMg is 3.0 mm
11430	Tube temperature is too high for the selected material and thickness
11440	Minimum temperature is -45°
11450	Maximum copper manifold temperature is 160°C. Select Steel manifold
11460	Minimum temperature is -10° for steel tubes and manifolds
11470	Wrong package code
19000	Invalid tube thickness. Check the minimum tube thickness based on selection type and geometry type. Especially for R410 selection, due to working limits, is often necessary to set 1.0 mm tube thickness
40000	Number of circuit not valid. Decrease number of circuit, increase max pressure drop or increase liquid volume
41000	The difference between input temperature must be at least 3°C
41110	It is suggested to use ARI calculation mode
41120	It is suggested to use ARI mode and a fin pitch of 3.0 mm or wider
41140	It is suggested a fin pitch of 2.5 minimum
41150	The results cannot be guaranteed in this working conditions
41160	The results need DBM check
41170	It is suggested to use glycol
41180	It is not possible to select air velocity and overall length
41190	Steam velocity too high. Please contact DBM

Table 17: wrong input error codes.

If the calculation engine fails during iterations, the error code returned is listed in table 9.



Error code	Error description
10xx	Unknown error
20xx	General error
30xx	Liquid velocity out of allowable range
40xx	Out of temperature difference in iteration
50xx	Required capacity is too high
60xx	Endless loop
70xx	Liquid quantity is too high

Table 18: calculation engine error codes.



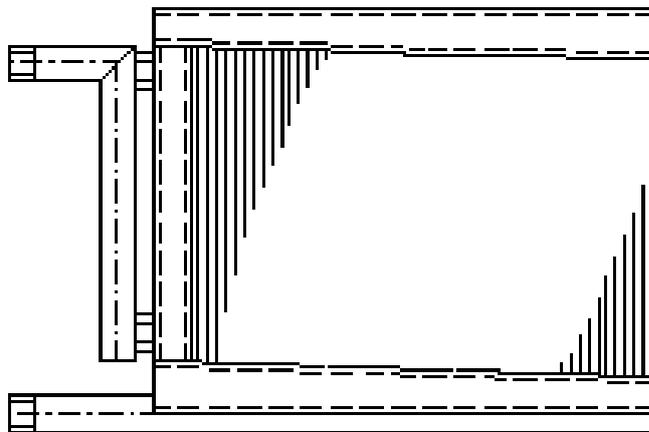
NOTES ON DLL USAGE

In the next pages there will be some suggestions to set up DLL correctly for specific applications like steam coils, direct expansion coils, condensers and other applications.

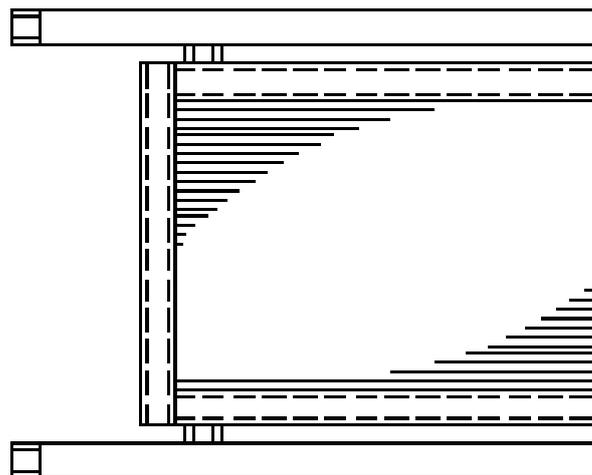
Steam coils

Standard configurations:

VAPORE 1



VAPORE 3



We always suggest to use configuration VAPORE 1 or VAPORE 3 with tubes in Stainless Steel (Inox304,



Inox316, thickness 1.00mm) or Carbon Steel (Fe, thickness 1.5mm). Configuration VAPORE 6 is possible but not recommended. Talking about Cu as tubes material: in most of the cases its use is possible however a technical evaluation is necessary case by case.

Geometry: compulsory to use P60 or P40. Geometries P0312 and P25 should not to be used for steam applications.

Here how to set up DLL correctly according to above comments:

Cell	Meaning	Measure unit/values
1	Coil type	1 or 94
46	Fluid type	9
60	Type of calculation	3
61	Fins materials	1-3-4-9 *
62	Fins thickness	0.20**
63	Tube thickness	0: default value=1.5 for Fe tubes, 1.0 for Inox tubes
65	Tube material	4 or 2 or 3
76	Steam coil: execution type ***	1 – 3

*

Pre-painted aluminium fins are not ok for steam applications because of too high temperature. Do not list them as available material.

**

With Fe or Stainless Steel tubes we suggest to use reinforced fins (minimum thickness 0.20 mm) Standard fins thickness is possible but with very bad aesthetical results

1 = Configuration "VAPORE 1"

3 = Configuration "VAPORE 3"

The connection side(input values cell 69) is automatically selected by the DLL for steam coils according with steam coil execution

Important note: for execution VAPORE 3 height and length (both overall and finned) have to be inverted.



Selection notes and physical limits for steam coils

Maximum steam velocity inside tubes: 20 m/s

Execution	Min. Steam pressure [bar(a)]	Max finned length [mm]	Max finned height [mm]
Vapore 1	0	4000	2400
Vapore 3	0	2400	3000
Vapore 6	3	1500	2400

If bigger dimensions are needed, it is recommended to split the coil in order to not to exceed suggested measures.

Minimum headers/connections diameters according to number of supplied lines of tubes

Tubes material	N° of tubes lines supplied	Minimum headers diameter
Cu	1	1"
	2	2"
	3	3"
	4	4"
Fe	1	1"
	2	2"
	3	4"
Inox304-316	1	1"
	2	2"
	3	4"
CuNi9010	1	1"
	2	2"
	3	4"

Steam related error codes

Error code	Error description
41190	Steam velocity too high. Please contact DBM
131	Steam velocity too high. Please contact DBM
11090	Invalid steam coil execution: valid values for input[46] are 1,3,6
11080	Steam coils dimensions invalid.
130	Maximum number of connected rows exceeded.



Direct expansion coils

Inputs values limits and default parameters

Evaporating temperature: minimum allowable value is -20°C

If evaporating temperature is $\leq 1^{\circ}\text{C}$ fins pitch must be $\geq 3.0\text{mm}$ (only for heat pumps systems lower fins pitch can be allowed).

Default values for superheating: 5 K - Subcooling: 2 K. If zero is specified for these values in input[58] and input[59] then the default values is used..

IMPORTANT: Evaporating temperature or pressure (Inputs 57 and 56). This is the temperature/pressure at the outlet of the coil at the suction header. Please note that this temperature is different from the temperature at the coil tubes inlet. For particular refrigerants with high temperature glide (e.g. r407c) there can be up to 6K between inlet and outlet. Calc selecting such type of coils consider the mean temperature corrected by refrigerant title at distributor inlet and tubes pressure drop. However the nominal evaporating temperature is the one you can measure at the suction (this means that real average evaporating temperature will be lower with some refrigerants).

Direct expansion coils with stainless steel tubes

Do not use DLL to select direct expansion coils with stainless steel tubes. Thermal results are correct however following restrictions apply:

- Refrigerant circuits can only be stacked (not interlaced)
- Capillars are only available in diameters 6 and 8mm.
- Distributors are available only up to 20 circuits
- Overall sizes and frame depth are not correct
- Prices are not correct

Capillars pressure drop – ratio between capillars pressure drop and coil pressure drop

A very important parameter to consider in the desing of direct expansion coils is the pressure drop through the capillars. This value is the position 76 in the result array.

DBM recommends a minimum value for the pressure drop of 0.5 Bar and a maximum value of 1.5 Bar.

However it is very important to consider how the coil will work. If coil will have to provide a big swing of capacity between maximum and minimum load it is better to use a high value of pressure drop (e.g. DX coils for marine applications with a desing air inlet temp. of 35°C 70% which have to work also with much lower inlet temperatures and humidities) and stay around 1.0/1.5 Bar. If coil will work at a constant load also low values are ok. To increase the pressure drop you have to decrease number of circuits. The opposite to



increase it.

Another important value to consider is the ratio between capillars pressure drop and the refrigerant pressure drop inside the coil (output position 12): in order to have a correct refrigerant distribution such ratio must be at least 3 (considering worst operating condition).

Example:

Refrigerant pressure drop inside the coil = 19.2 Kpa = 0.192 Bar

Capillars pressure drop = 0.64 Bar

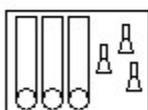
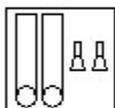
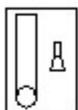
Ratio = $0.64 / 0.192 = 3.33$ --> OK ! Coil will work properly.

In case ratio value is lower than 3 correct refrigerant distribution cannot be guaranteed.

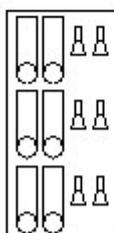
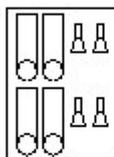
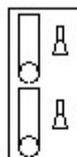
IMPORTANT: direct expansion coils must be selected considering the application. This because some selection parameters are related to the application (e.g. capillars pressure drop). It means that we cannot guarantee they will be suitable for the application.

Standard configurations

Interlaced



Separate / Partly interlaced





STANDARD CONFIGURATIONS

DEFINITIONS:

- A = 1 Refrigerant circuit
- B = 2 Interlaced refrigerant circuits
- C = 3 Interlaced refrigerant circuits
- D = 2 Stacked refrigerant circuits
- E = 4 Stacked and interlaced refrigerant circuits
- F = 6 Stacked and interlaced refrigerant circuits

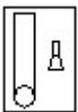
DEFINITIONS AND DESIGN LIMIT FOR ED COILS

Refrigerant circuits configurations can be specified or not. In the second case the DLL will use our standard configurations according to the number of circuits.

Cell	Meaning	Measure unit/values
74	Number of gas circuits	1 or 2 or 4. Only for condenser and evaporator coil.

If no value is specified for cell 74, the DLL will work with automatic selection mode and will choose refrigerant circuits according to DBM standard rules.

A (Number of gas circuit: 1)



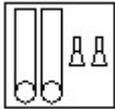
Maximum number of circuits for each distributor:

	Capillars Ø [mm]		
	5	6	8
Maximum number of circuits (stock distributors)	30	30	30

- Maximum number of distributors connected together: 2
- Maximum number of circuits 60 (2 * 30)



B (Number of gas circuit: 2)

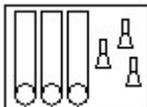


Maximum number of circuits for each distributor:

	Capillars Ø [mm]		
	5	6	8
Maximum number of circuits (stock distributors)	30	30	30

- Maximum number of distributors connected together: 2
- Maximum number of circuits 120 (2 * 2 * 30)

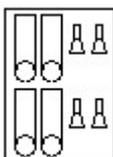
C (Number of gas circuit: 3)



	Capillars Ø [mm]		
	5	6	8
Max number of circuits for each distributor in stock	30	30	30

- Maximum number of distributors assembled together: 1
- Maximum number of circuits for the configuration: 3 x 30 = 90

E (Number of gas circuit: 4)



Maximum number of circuits for each distributor:

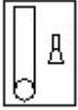
	Capillars Ø [mm]		
	5	6	8
Maximum number of circuits (stock distributors)	30	30	30

- Maximum number of distributors connected together: 1
- Maximum number of circuits 120 (4 * 1 * 30)



AUTOMATIC REFRIGERANT CIRCUITS SELECTION

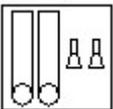
A (Number of gas circuits: 1)



Maximum number of circuits for each distributor:

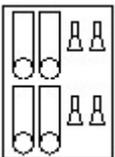
	Capillars Ø [mm]		
	5	6	8
Maximum number of circuits	34	34	30

B (Number of gas circuits: 2)



	Capillars Ø [mm]		
	5	6	8
Maximum number of circuits	34	34	30

E (Number of gas circuits: 4)

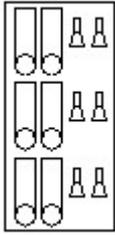


Maximum number of circuits for each distributor:

	Capillars Ø [mm]		
	5	6	8
Maximum number of circuits	34	34	30



F (Number of gas circuits: 6)



Maximum number of circuits for each distributor:

	Capillars Ø [mm]		
	5	6	8
Maximum number of circuits	34	34	30

Default values for headers diameter according to single gas circuit capacity

Headers (suction) diameters are automatically selected according to coils capacity listed on the following table

Refrigerant	Kcal/h						
R404A	7500	17000	29000	46000	94000	230000	360000
R507A	7500	17000	29000	46000	94000	230000	360000
R12	5000	10000	18000	30000	60000	140000	220000
R134A	5000	10000	18000	30000	60000	140000	220000
R22	9000	20000	35000	55000	110000	270000	420000
R407C	8100	18000	31500	49000	99000	240000	378000
R410A	8100	18000	31500	49000	99000	240000	378000
Diameter [mm]	22	28	35	42	54	80	90

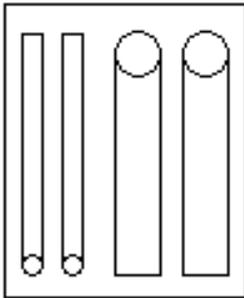


DEFINITIONS AND DESIGN LIMITS FOR REFRIGERANT CONDENSER COILS

A



B



STANDARD CONFIGURATIONS

DEFINITIONS:

A = 1 Refrigerant circuit

B = 2 Interlaced refrigerant circuits

C = 3 Interlaced refrigerant circuits

D = 2 Stacked refrigerant circuits

E = 4 Stacked and interlaced refrigerant circuits



WATER COILS' SIGN FOR DOUBLE MANIFOLD OR CONNECTION

Within a finned height limit, a single manifold with double connection will be proposed; further on, the double manifolds will be proposed.

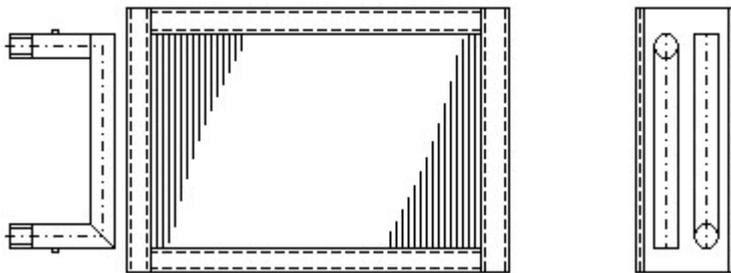
The limit is:

- 2500 finned height for AC and AR
- 2100 height finned for AS

In the coil's code, the following wording appears that makes this configuration evident. In particular:

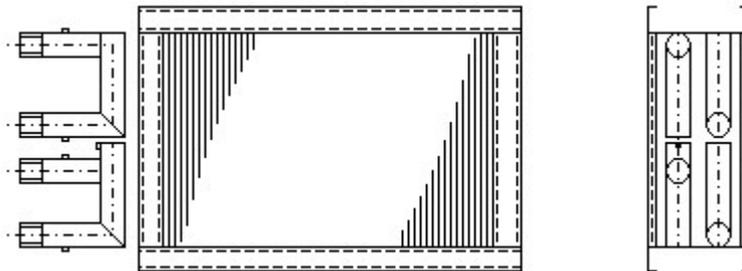
1) NORMAL CONFIGURATION

Cu-Al-FeZn P40AR 6R-62T-1350A-2.0pa 20C 3 "



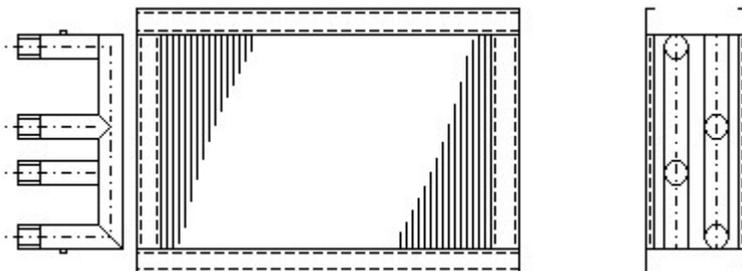
2) DOUBLE MANIFOLD

Cu-Al-FeZn P40AR 6R-62T-1350A-2.0pa 20C 2x3 "



3) SINGLE MANIFOLD WITH DOUBLE CONNECTION

Cu-Al-FeZn P40AR 6R-62T-1350A-2.0pa 20C 3 "(x2)





REFRIGERANT CIRCUITS - MANUAL AND AUTOMATIC SELECTIONS

User can choose number of refrigerant circuits (it is possible to specify configurations A, B, E only) using Cell 74.

Cell	Meaning	Measure unit/values
74	Number of gas circuits	1, 2, 3 or 4. Only for condenser and evaporator coil.

If no value is specified for cell 74, the DLL will work with automatic selection mode and will choose refrigerant circuits according to DBM standard rules.

If the number of gas circuit specified is zero, the DLL computes the number and type of refrigerant circuits automatically according to total coil capacity (one circuit will be added every time maximum capacity for bigger possible diameter is reached, refer to following table) following this order:

A = 1 Refrigerant circuit

B = 2 Interlaced refrigerant circuits

C = 3 Interlaced refrigerant circuits

E = 4 Stacked and interlaced refrigerant circuits

INLET AND OUTLET HEADERS DIAMETERS ACCORDING TO EACH REFRIGERANT CIRCUIT CAPACITY

Refrigerant	Kcal/h						
R404A	9300	21000	38000	63000	135000	315000	485000
R507A	9300	21000	38000	63000	135000	315000	485000
R134A	6000	13000	24000	37000	80000	185000	285000
R22	11000	25000	45000	70000	150000	350000	540000
R407C	10000	22000	42750	66000	142000	332000	513000
R410A	10000	22000	42750	66000	142000	332000	513000
Ø Inlet	22	28	35	42	54	80	90
Ø Outlet	22	22	22	28	35	54	54



INPUTS VALUES LIMITS AND DEFAULT PARAMETERS

Maximum circuit length is 20 m

Maximum refrigerant velocity inside tubes is 4.2 m/s

If finned height is > 2.1m DLL will automatically switch to configurations E and D (stacked refrigerant circuits)

CERTIFICATIONS, TOLERANCES ON CAPACITY, AIR SIDE AND WATER SIDE PRESSURE DROPS

Selection mode and tolerances on declared data can be defined through Cells 71 and 78.

CELL 71 is used to define if a coil needs to be certified according to AHRI or according to DBM Standard.

If value is 0 selection mode is standard. If value is 1 selection mode is AHRI.

AHRI is a North American certification program on coils performances.

Important note: setting Cell 71 to AHRI mode does not imply that coil can be AHRI certified. There are some certification limits the DLL does not check. However coil is selected according to AHRI standard.

AHRI selection mode can only applied to water coils. DX, COND and STEAM coils are not currently certified..

AHRI mode can be used only if Cell 78 value is 2 (Certified mode).

Cell	Meaning	Measure unit/values
71	AHRI Version	0: Std calculation 1: AHRI calculation



CELL 78 is used to set the selection tolerances on declared capacity, air and water pressure drops. DLL can work with 3 pre-defined levels of accuracy referring to following parameters: capacity, air pressure drop, water pressure drop. Tolerances are the following:

Default calculation type	Nominal tolerance on capacity	Nominal tolerance on air side pressure drop	Nominal tolerance on water pressure drop
Standard tolerance	15%	15% or 10 Pa	15% or 5 Kpa
Reduced tolerance	10%	10% or 10 Pa	10% or 5 Kpa
Certified performance	05%	05% or 10 Pa	05% or 5 Kpa

Here available values for Cell 78:

0: standard tolerance
1: reduced tolerance
2 certified performance
3: compatibility mode (performance as previous DLL version)

IMPORTANT NOTES:

- For other thermodynamic declared data tolerances are not defined.
- Indicated tolerances are valid only for air conditioning applications with air velocity between 0.5 – 4.5 m/s and water velocity between 0.5 – 2.5 m/s. For special applications we always recommend to contact our sales office.
- Certified performance selection mode complies with AHRI-410 Standard technical requirements. However not all the materials, geometries, fluids have been certified.
- Indicated tolerances refer to a coil tested in a tunnel, with perfectly clean fins, without any fouling factor on the tubes side and with perfect air distribution across all coil surface (air flow perpendicular to coil face area). Reference standard is ASHRAE 33.
- Bare tubes coils are not tested
- Tolerances on capacity for heat recovery selections (twin coils): we do not guarantee tolerances on such type of selections. Reason is that often water and air temperatures are too close. We recommend to always select such systems in certified mode

Why different tolerances are necessary

We decided to introduce three levels of tolerances moving from following considerations:

- At the moment in Europe tolerances on declared performances are in the range of 10 – 20 % depending on the market, application and manufacturer. This is commonly called “Commercial factor”
- An increasing number of coils users is working to achieve performances certifications on their products. This means that they need a reliable instrument to size their equipment in order to avoid to oversize components.



In summary there are two main streams in the market moving towards different directions. In this way our customers can decide how to use our program but being aware of accuracy of the data they are using.

FINS THICKNESS FOR COILS WITH INOX, FE, CUNI AND CU 1.00 TUBES

For coils with Inox304, Inox316, Fe, CuNi9010 or CU 1.00mm thk we recommend to use at least 0.20mm thickness fins (if available in the desired material).

This mainly to have better aesthetical results. Thinner fins can be easily damaged during tubes expansion.

ELECTRO TINNED FINS

By CuSn fins and tubes we mean fins and tubes electro tinned after manufacturing. This means that fins and tubes are cut and then sent to a tinnery where Sn layer is applied.

Such method guarantees a complete Sn coverage on all cutting edges while pre-tinned materials have no protection on them.

The disadvantage is that fins will not look so good after the process. There will be scratches, small damages and their color will not be uniform. This is something we cannot avoid and it is related to the process.

STANDARD THREADED CONNECTIONS MATERIAL

For threaded connections standard materials please refer to following table;

Connections Ø	FRAME MATERIAL				
	Fe	FeZn	Inox304/316	Cu	Al
1/2" – 5"	Fe	Fe	Inox304/Inox316	Inox316	Inox316

NOTES:

- Valid for coils with copper headers. For coils with stainless or carbon steel headers connections will be of the same headers alloy.
- Refrigerant condensers and direct expansion coils will be supplied with plain copper connections.

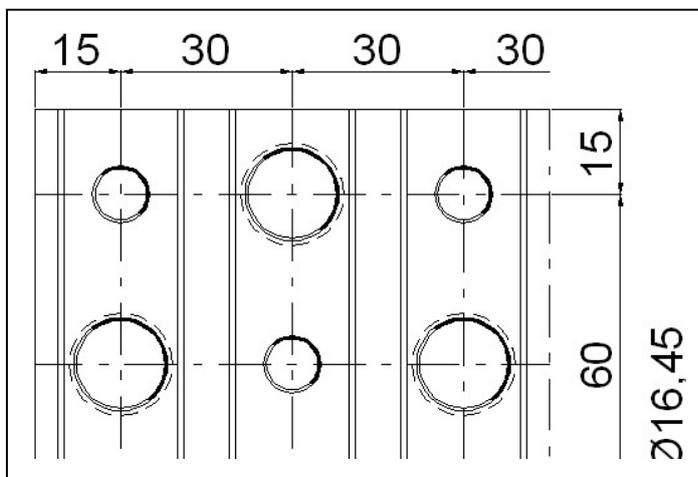


AVAILABLE MATERIALS FOR TUBES, FINS AND POSSIBLE FINS PITCHES

P60 - deprecated

FINS											
FINS MATERIAL	Thickness [mm]	AVAILABLE FIN PITCHES [mm]									
		2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0
Al	0.110										
	0.200										
AlPr	0.110										
AlMg2.5	0.150										
Cu	0.100										
CuSn	0.100										

TUBES					
Material	Thickness [mm]				
	0.40	0.60	0.75	1.00	1.50
<i>Cu</i>					
<i>CuSn</i>					
<i>CuNi9010</i>					
<i>Fe</i>					
<i>Inox304</i>					
<i>Inox316</i>					

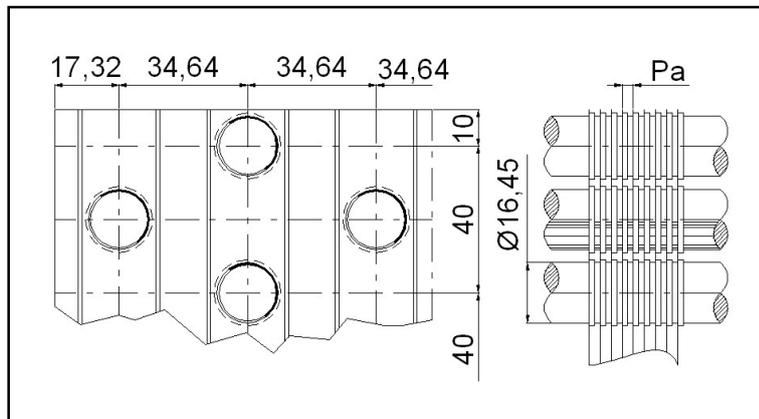




P40

FINS											
FINS MATERIAL	Thickness [mm]	AVAILABLE FIN PITCHES [mm]									
		2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0
Al	0.110										
	0.200										
	0.250										
	0.400										
AlPr	0.110										
	0.250										
AlMg2.5	0.150										
	0.200										
Cu	0.100										
	0.200										
CuSn	0.100										
	0.200										

TUBES					
Material	Thickness [mm]				
	0.40	0.60	0.75	1.00	1.50
Cu					
CuSn					
CuNi9010					
Fe					
Inox304					
Inox316					

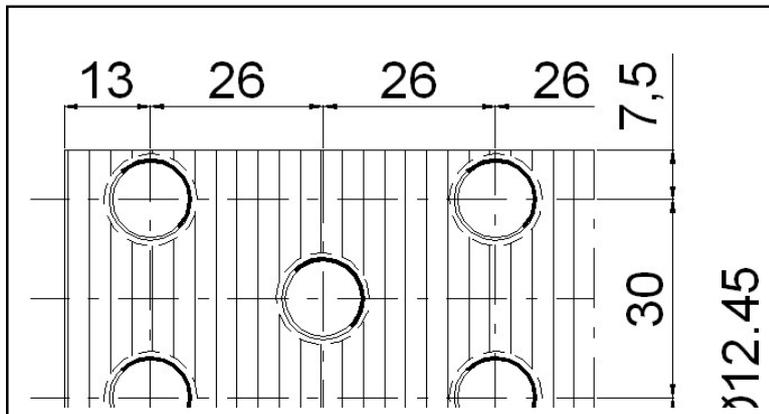




P3012

FINS											
FINS MATERIAL	Thickness [mm]	AVAILABLE FIN PITCHES [mm]									
		2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0
<i>Al</i>	0.110										
	0.200										
<i>AlPr</i>	0.110										
<i>AlMg2.5</i>	0.150										
<i>Cu</i>	0.100										
	0.200										
<i>CuSn</i>	0.100										
	0.200										

TUBES			
Material	Thickness [mm]		
	0.35	0.40	0.60
<i>Cu</i>			
<i>CuSn</i>			





P25

FINS											
FINS MATERIAL	Thickness [mm]	AVAILABLE FIN PITCHES [mm]									
		2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0
<i>Al</i>	0.110										
	0.200										
<i>AlPr</i>	0.100										
<i>Cu</i>	0.100										
<i>CuSn</i>	0.100										

TUBES		
Material	Thickness [mm]	
	0.30	0.50
<i>Cu</i>		
<i>CuSn</i>		

	= Available
	= Available with stellar collar
	= Available
	= Not available



PED AND MAXIMUM COILS WORKING CONDITIONS

Current DLL implementation does not have a complete check on maximum allowable working conditions and PED classification.

We recommend to warn the user to send selection to DBM for approval whenever working temperatures exceed 110°C . This to avoid the risk of entering in high PED Categories.

Following tables give general information about standard allowable working pressures and temperatures for standard copper tubes coils.

REMARKS:

Values are exclusively applicable to heat exchangers belonging to PED Art.4.3, Cat.I and Cat.II.

Test pressure will be pneumatic type. In some cases, because of personnel safety reason, the pressure test will only be 1.1 times the MAWP. This is in line with PED Annex 1 safety requirements. Whenever necessary pressure test is preceded by specific NDE or additional tests.

Listed minimum allowable temperatures will be the standard ones in absence of further information or thermal calculations. If latter are available it will be determined by choosing the minimum value between:

- A) -10°C
- B) Value indicated in the thermal selection

Similarly, the maximum allowable temperature, will be the lower value between:

- A) MaxT as indicated in the tables
- B) Value indicated in the thermal selection



HOT AND CHILLED WATER/WATER GLYCOL COILS

GEOMETRY	TUBES Thk [mm]	HEADERS OD and thk [mm]	MAWP [BarG]	TP [BarG]	MinT [°C]	MaxT [°C]
P25	All	All	15	24	-10	110
P3012	All	All	15	24	-10	110
P40	All	All	15	24	-10	110
P60	All	All	15	24	-10	110

SUPERHEATED WATER (>110°C) COILS

GEOMETRY	TUBES Thk [mm]	HEADERS OD and thk [mm]	MAWP [BarG]	TP [BarG]	MinT [°C]	MaxT [°C]
P25	0.50	All	10	24	-10	140
P3012	0.40	All	10	24	-10	120
	0.60	All	10	24	-10	140
P40, P60	0.75	All	10	24	-10	140
	1.00	All	10	24	-10	160

STEAM COILS

GEOMETRY	TUBES Thk [mm]	HEADERS OD and thk [mm]	MAWP [BarG]	TP [BarG]	MinT [°C]	MaxT [°C]
P40, P60	0.75	All	4	24	-10	140
	1.00	All	6	24	-10	160

DIRECT EXPANSION AND REFRIGERANT CONDENSERS COILS

P25 GEOMETRY - MAWP/TP [BarG]																
HEADERS Ø [mm] - MATERIAL Cu-DHP EN 12735-1																
Exc.Tubes thk [mm]	22x1.0	22x1.5	28x1.0	28x1.5	35x1.0	35x1.5	42x1.5	42x2.0	48x1.5	54x1.5	54x3.0	60x1.5	76x2.0	80x2	88.9x2	108x2.5
0.30	26/29	26/29	26/29	26/29	26/29	26/29	26/29	26/29	26/29	24/29	26/29	21/24	21/24	21/24	21/24	21/24
0.50	39/47	42/47	30/42	42/47	26/29	42/47	30/42	42/47	26/29	24/29	42/47	21/24	21/24	21/24	21/24	21/24

P3012 GEOMETRY - MAWP/TP [BarG]																
HEADERS Ø [mm] - MATERIAL Cu-DHP EN 12735-1																
Exc.Tubes thk [mm]	22x1.0	22x1.5	28x1.0	28x1.5	35x1.0	35x1.5	42x1.5	42x2.0	48x1.5	54x1.5	54x3.0	60x1.5	76x2.0	80x2	88.9x2	108x2.5
0.35	24/29	24/29	24/29	24/29	24/29	24/29	24/29	24/29	24/29	24/29	24/29	21/24	21/24	21/24	21/24	21/24
0.40	26/29	26/29	26/29	26/29	26/29	26/29	26/29	26/29	26/29	24/29	26/29	21/24	21/24	21/24	21/24	21/24
0.60	39/47	42/47	30/42	42/47	26/29	42/47	30/42	42/47	26/29	24/29	42/47	21/24	21/24	21/24	21/24	21/24



P40 AND P60 GEOMETRIES - MAWP/TP [BarG]																
HEADERS Ø [mm] - MATERIAL Cu-DHP EN 12735-1																
Exc. Tubes thk [mm]	22x1.0	22x1.5	28x1.0	28x1.5	35x1.0	35x1.5	42x1.5	42x2.0	48x1.5	54x1.5	54x3.0	60x1.5	76x2.0	80x2	88.9x2	108x2.5
0.40	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24	21/24
0.75	36/47	36/47	30/42	36/47	26/29	36/47	30/42	36/47	26/29	24/29	36/47	21/24	21/24	21/24	21/24	21/24
1.00	39/47	42/47	30/42	42/47	26/29	42/47	30/42	42/47	26/29	24/29	42/47	21/24	21/24	21/24	21/24	21/24

NOTES:

Maximum allowable temperature: 80°C or value stated in the thermal selection

Minimum allowable temperature: -10°C or value stated in the thermal selection

VERSIONS

Ver 1.2 04-08-2009

- Added P40 geometry
- Price update
- Update frame depth calculation
- Update X distance calculation between manifolds
- Update Y distance calculation between manifolds
- Update D Dimension calculation for ED and COND coils
- Added tolerance on calculation

Ver 1.3 10-11-2009

- Revision of P3012 performance

NINPUTDATA 100

- Added fixed manifold diameter selection (input array)
- Added option for basin (input array)
- Optimization of manifolds dimension
- Added frame dimension on bends side (result array)
- Added drop eliminator price option (input array)
- Added error nr 19000, 11340, 11350:
- Update of materials price

Ver 1.4 16-03-2010

- Fixed basin code
- Added packing code

Ver 1.5 20-04-2010

- Update of materials price
- D variable value changed for P40
- Improved selection algorithm for manifold dimensions
- Fixed correct manifold dimension for ED coils and CU material for 2" and 2"1/2
- Improved selection algorithm for monophasic coil
- Update AIPR conductivity
- Warning 40000 is now an error: two tubes per circuit coils with more than 8 rows are not selected by DLL.
- Changed max liquid velocity for condensers

Ver 1.6

- Updated standard material of intermediate tray for cost calculation
- Update selection algorithm for cooling coils in wet->dry conditions
- Added check for aluminum fins 0.25 with 6 mm fins pitch (not a valid combination)



Added calculation option with overall length and number of tubes

Added control for temperature limit on connection without flanges (for monophasic coils and temperature greater than 160°C flanges must be selected: a warning code is issued in vRis[70])

Added check for flanges. This option is not available in this version of the DLL

Bug fix for ED coils selection with R507a and overall dimensions

Price materials are stored in a separate, encrypted file. Future price update only needs a new **przinfo.dlt** file

Connection thickness updated as in Calc98

Fixed manifolds x distance for one row coil

Fixed selection with 5" manifolds

Ver 1.6.0.1

Added aluminum frame for Inox tubes

Added a check for CryptoAPI provider on some Windows XP machine

Ver 1.6.0.2

Fixed problem with outlet manifold diameter description in ris[34]

Ver 1.6.0.3

Added price calculation for multiplier lower than 1.95, added price calculation for reinforced manifolds, added new error codes for missing prices

Changed air side pressure drop for P60 fin pitch 2.5 wet mode

Set maximum number of rows to 25 for finned tubes coils

Changed D dimension calculation for coils with covered box and 1 circuit

Fixed connection material for 4" manifolds

Ver 1.6.0.4

Material prices update on 03.01.2011

Fixed auto fin pitch for P40

Auto fins pitch always starts from 2.0 mm

Ver 1.6.0.5

Review of calculation algorithm to solve additional coils selection for high temperature

Added P40 automatic fin pitch

Added drop eliminators pressure drop in position 61

Fixed pressure calculation for R22 and R134 with evaporating temperature = -1

Fin pitch for AlMg is limited to 3.0 mm

Updated temperature working limits and thickness for tubes (see error codes 11430-11460)

Added packaging price calculation

Improved selection for automatic fin pitch

Improved selection for coils specified with overall dimensions (ED and COND, R410A)

ED coils are always selected with connections on the same side

Added price checks for special brazing AG-H

Ver 1.6.0.6

Changed distance between manifold for 2" , P3012



Fixed selection with a desired outside manifold diameter

Added SetPricePath function

Fixed capacity margin on ED and COND coils with safety on capacity set

Fixed some convergence problem

Changed steam coils manifolds diameters

Added controls on ED max circuit length

Revised selection when overall dimensions are set

Changed frame length for coils with basin and ducted execution

Changed algorithm for selection with overall dimension and number of circuits set.

Added ethilen alcohol - water mixture. Valid percentage from 20% to 50 %. Temperature range -30°C to 30°C

Fixed glycol calculation with weight percentage specified

Fixed calculation with overall length and number of tubes specified.

Changed price calculation for drop eliminator + basin

Prices update with price of raw material dated 11-2011

Changed frame depth for ED and COND coils with minimum value

Changed steam velocity limit for manifolds selection

Ver 1.6.0.7 - Ver 1.6.0.8

Added check on P40 with fin pitch 6.0, which is not available

Revised coil prices

Added prices for CUNI9010 tubes

Revised calculation for INOX 316 tubes

Revised price calculation for INOX distributors

Changed capillars' length for P40 coils

Tube thickness is automatically set based on temperature and/or pressure inlet conditions

Ver 1.6.0.9

Fixed a bug in calculation with automatic fin pitch

Frame depth for P40 has changed

Ver 1.6.0.10

Steam coil description now has VAP instead of AS

Steam coil overall length is now correct for type 3

Steam coil volume calculation has changed

Selection with automatic fin pitch has been optimized and fixed in some cases

Additional check on user input validity



Ver 1.7.0.0

Additional frame codes are now available

Price update

Revision of manifold diameter selection

Revision of heat exchanger performance

Revision of fins pitch and fins thickness

P30 is not available anymore

Brass is not used anymore for headers

Coil weight now includes flanges, if selected, and intermediate plates

Performance laws revision based on last tested coils

P40 is added to automatic coil selection

Manifolds material is automatically assigned as the same as tube material

The capillars pressure drop is now available in the result array, position 76. See page 28 consideration for suggested selection. It's up to the user of the DLL decide to give warnings

Revision of max liquid velocity in manifolds

Added check for FE-INOX tubes: max two rows of connected circuits for every type of coils: Error 130

Added check for max difference between air and liquid fluid: 3°C Warning 41100

Added check for maximum coil size if electro tinned, error 11480

Steam coils: now DLL gives same result on VAP1 configuration for the overall dimensions. Frame thickness for Galvanized steel is 2.00 minimum, for aluminium fins minimum thickness is 2.00 mm. Price Calculation is now aligned with stand-alone software

Steam coils calculation with overall dimensions has been revised

Ver 1.7.0.1

Added input option for bottom and top frame plate height. The values, if custom, must be both greater than 0. Output array contains the value of bottom and top plate frame given by DBM standard. It is left to the user to check if the coil satisfy DBM manufacturing rules. This option in for testing purpose only.

Fixed a problem that affects some calculation where user input liquid volume in units different from dm³/h

Error 41100 is now a warning

Update P40 frame depth

Drop eliminator type has been changed to same type as stand alone version, pressured drop changed accordingly.

Calculation mode 3 (input position 81) is not supported anymore.

Ver 1.7.0.2

Some minor price calculation fixed in both stand alone and DLL version.

Due to incorrect DLL usage from final users, now DLL forces frame thickness to 2.0 mm minimum

for Steel and Stainless steel tube

Steam calculation now forces fins thickness to 0.2 mm as stand alone version



Ver 1.7.0.3

New revision of P40 frame depth

Ver 2.0.0.0

Addition of automatic tube thickness calculation for freon coils. Price correction for Freon coils with reinforced manifolds

DLL is now built with VC++ 2010

Ver 2.0.0.1

Revision of dimensions calculation for twin coils in heat recovery

Added P40 bare tubes coil calculation,

Reviewed bare tubes coil selection parameters

Added cost calculation for Stainless steel distributors

Ver 2.0.0.2

Added fin pitch 6 for P3012

Fixed cost calculation for recovery coils

Activated calculation with overall dimensions and number of rows

Added Dry efficiency calculation for recovery coil at 5/25 temperature and balanced air flow

Ver 2.0.0.3

Steam properties have been updated with latest formula in literature

Water properties have been updated with latest formula in literature

Added R407F

R404 properties for saturated vapour have been updated

Calculation for condensing coil has been updated

Frame thickness is now automatically calculated for recovery coils

Ver 2.1.0.0

Frame thickness is now automatically calculated for recovery coils

Recovery coils calculation contains selection algorithm to obtain performance in accordance with ECODesign regulation.

Price update

Ver 2.1.0.1

Added DLL Version in output array

Ver 2.1.0.2

Fixed a problem with P40 in heat recovery calculation

Ver 2.1.0.3

Price update, some fixes on manifolds cost calculation

Fixed some rare selection conditions that gives endless loop

Performance are updated according with latest available test results

Updated coil frame depth for all geometries

Fixed manifolds material in heat recovery coils calculation

Other minor bugs fixes



Ver 2.1.0.7

Released temporary objects

Fixed a bug in overall dimensions calculation for water and DX coils.

Fixed a bug in price calculation after a selection of a DX coil with R410

Added 6 gas circuits selection for DX coils

Added possibility to select coil in cocurrent flow (input position 86)

Ver 2.1.0.8 - Ver 2.1.1.0

Fixed height check for steam coil

Added drop eliminator option for heat recovery (run around) coils

Fixed a problem for water coil with overall dimension

Activated THERMINOL66

Changed folder for temporary files

Fixed minimum tubes thickness for DX coil and 0.75 mm tubes

DX coil now consider the drip tray in the selection with overall dimensions in height

Added drop eliminator price calculation for exhaust coil on run around coil selection, overall dimensions does not consider the drip tray if specified

Added R448A, R449A. Due to lack of published official data, the performance calculation can have higher tolerance

DLL has been updated to C++ 2017

Frame with Al 3.0 and Copper 3.0 is not available anymore

Ver 2.1.0.8 - Ver 2.1.1.0

Added 6 circuits for ED and COND coils

Fixed dimensions checks for steam coil selection, with VAP3 execution

Removed constraints check for steam coil calculation with overall dimensions set. It's up to the user verify the dimensions limits

Changed Stainless steel thermal conductivity

Fixed price error for heat recovery

Added price for flanges and counterflanges

Added option for single manifold only

Ver 2.1.1.1

Added 6 circuits for ED and COND coils

Ver 2.1.1.2

Fixed dimensions check for steam coil selection, with VAP3 execution

Removed constraints check for steam coil calculation with overall dimensions set. It's up to the user verify



the dimensions limits

Changed Stainless Steel conductivity

Ver 2.1.1.3 - 2.1.1.4

Update coil price

Added price calculation for flanges and counterflanges

Added option to have single manifold inlet always

Ver 2.1.1.5 - 2.1.2.0

Added P25 geometry

Fixed selection for recovery coils and overall dimensions set

Fixed price calculation for DX coil in some rare circumstances

Fixed DX coil performance calculation with dry desuperheating

Fixed R410 properties

Added PED class calculation

Ver 2.1.3.0-2.1.3.4

Fixed price with big Stainless steel manifold

Changed glycol properties with volume percentage

Changed Steel manifold dimensions and thickness

Fixed liquid coil calculation for heaters, with humidity and water-air temperature cross conditions

Fixed overall dimensions for DX coils and new refrigerants

Added possibility to specify coil bottom and top frame height in calculation with given finned length and height

Revision of capillars calculation for new refrigerants

Added PED class calculation

Revised price calculation with new rules

Revised type of brazing based on temperature

Ver 2.1.3.5

Added R32

Ver 2.1.3.6

Fixed DX coil weight selection in some rare case

Fixed weight for P25 coils with drip tray

Fixed capillars pressure drop for P25

Fixed capillars pressure drop for R407F



Ver 2.1.3.7-Ver 2.1.3.8

Removed fin pitch 5 and 6 for P3012 geometry

Documented EndCalculation new exported method to easy correct release of string resources.

Changed temperature selection margin for condensing coil, aligned to stand-alone software

Changed temperature and pressure information for PED classification in results array

Fixed some dimensions calculation for P25 coils

Fixed price for PED Class 2 coils

Minimum tube thickness changed for liquid coils with superheated water

Aligned P40 performance to stand alone software

Fixed price calculation when testing pressure is greater than 30 bar and the tube thickness is automatically increased due to working conditions (DX coil)

Ver 2.1.3.9

All coils with reinforced tubes have reinforced manifolds, if available

Ver 2.1.3.10

Fixed a rare bug in PED classification for DX coils

Ver 2.1.3.11

Added internal volume as output for P25

Fixed coil depth calculation for P25, configuration A

Ver 2.1.3.12

Fixed frame dimension for some P25 configuration

Changed Max pressure for P3012 0.40 mm tubes to 26 bar

Ver 2.1.4.0

Price update

Fixed cost calculation for recovery coil with low temperature

Fixed capacity calculation for condenser coil with parallel flow and superheating

Revision of coil performance for P3012

Geometry P60 is "deprecated"

Ver 2.1.4.1

Updated R1234ze properties

Ver 2.1.4.2

Price update for DX coil

Updated frame dimension, bend side

Ver 2.1.4.3

Fixed distributor calculation with AUTO specified for number of gas circuit

Ver 2.1.4.4



Price update

Fixed PED class for DX coil

Fixed selection with overall dimensions as input, in same rare case the selected coil may not respect the input value

Ver 2.1.4.5

Performance review for heat recovery coils

Ver 2.1.4.8

Price update

Bugs fixing in cost calculation for special materials

Ver 2.1.4.12

Fixed frame width for P40 6 rows 3" manifolds

Fixed PED classification for DX coil in some cases

Fixed PED classifications for R32

Review manifolds distance for P40

Fixed DX coil selection with overall dimensions set in some cases

Minor bugs fixed

Ver 2.1.4.13

Added 1 manifolds- 2 headers connection type

Fixed frame width for P40 6 rows 3" manifolds

Fixed PED classification for DX coil in some cases

Fixed PED classifications for R32

Review manifolds distance for P40

Fixed DX coil selection with overall dimensions set in some cases

Minor bugs fixed

Ver 2.1.4.14

Cost update

Revision of water pressure drop for coils with single manifolds and double header

Ver 2.1.4.15

Revision of Internal volume calculation for coil with double manifold

Addition of liquid Reynolds number for liquid coils at inlet and outlet temperature in results list

Added new input: custom coil frame depth