

JPA Designer

Condensation Risk Analysis

Version 6.02a1 and above

ISSUE MAY 2015

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1 JPA Designer basics

1.1 Introducing JPA Designer

Welcome to JPA Designer, the design and calculation program from JPA TL Ltd. This manual describes how to use the JPA Designer to carry out R-value calculations and interstitial condensation risk analysis for Australia and New Zealand[1].

JPA Designer includes many features to make the calculation process easier:

- a project-based file system which enables you to keep all the calculations for one development in same project file;
- calculation results can be produced as PDF files for emailing;
- a comprehensive database of common materials;

We hope you find JPA Designer a useful calculation tool. We are always happy to receive comments, suggestions for improvements or proposals for enhancements to suit your specific needs.

Conventions for the manual

The manual uses the following conventions:

- <angled brackets> for keys on the computer keyboard, e.g. the <Enter> key.
- the **+** sign indicates you should hold down one key while pressing another, e.g. <Alt+F> means 'hold down the <Alt> key while pressing the <F> key'.
- **Bold type** indicates parts of JPA Designer's screen displays, e.g. the **Ventilation rate** dialogue.
- **Menu**>**option** indicates an option in a menu on the program's menu bar, e.g. Select **Edit**>**Primary heating system** means *click on the* ***Edit*** *menu and select* ***Primary heating system*** *from the list*.

This manual uses the following special terms:

[1] JPA Designer includes a number of different program modules, some –notably the SAP modules – are intended only for use in the UK. We have a separate manual for the UK on our web site.

- **Dialogue (dialogue box)**: a small window which displays text boxes or buttons for entering data.
- **Radio button**: a set of two or more related buttons - you can only select one at a time.
- **Tick box**: a box which lets you turn a setting on (ticked) or off (not ticked).
- **Text box**: an area on a dialogue in which you can type words or numbers.
- **List**: a box on a dialogue which can be expanded to show a number of pre-set options, usually by clicking an arrow on the right-hand side of the box.

Many functions of JPA Designer can be accessed using either the menus or the toolbars: also, some may also have keyboard shortcuts. To avoid repetition this manual refers only to the menus.

Getting help

If you have a problem with the *functioning* of the software please follow these steps:

- Download and install the latest version of JPA Designer from our web site (see section 1.2 for instructions) and see if that resolves the problem.
- Check the forum and FAQ on our web site (http://forum.techlit.co.uk) to see if the problem is addressed there.
- If the problem persists, email details of the problem to *support@techlit.co.uk*. Please include details of your computer system and attach sample files or PDF outputs where possible. We will respond as soon as we can.

If you have difficulty *using* the program (for example, you are uncertain how to enter a layer in a condensation risk calculation) please follow these steps:

- Consult the program manual or on-line help system;
- Check the forum and FAQ on our web site (http://forum.techlit.co.uk) to see if the query is addressed there;

If you are new to condensation risk calculations we offer distance learning and on-line training training courses, which provide a thorough introduction to the software and its use. You can find more details at http://www.techlit.co.uk/training.

1.2 Getting started

This section of the manual describes how to install JPA Designer on your PC and explains how the user registration and on-line licence checking systems work. It also includes instructions on adding your company details and logo to reports.

System requirements

JPA Designer runs on Windows XP, Vista, 7 and 8 (see Technical Note 2012/04). Apple Macintosh users can run JPA Designer on a Windows virtual machine under Parallels Desktop or VMWare Fusion, or on a Windows installation using Boot Camp (we do not offer technical support for installing JPA Designer on such systems).

Whatever computer you are using it will require an internet connection to check the validity of the licence.

Installation

To install JPA Designer on your PC:

1. Go to our web site at www.techlit.co.uk and *right click* on the link labelled *download JPA Designer*: select **Save link as** or **Save target as** (the exact wording will depend on which the browser you are using).

2. Save the installer file **jsetup990.exe** to your PC (we recommend downloading the file to the Desktop). The download is about 13 MB.

3. When the download is complete double click on the file **jsetup990.exe**. The InstallShield Wizard configures itself and, after a few moments opens.

   *You may see a security warning that the publisher of the file could not be identified. If you do, click **Run** to continue the installation process.*

4. Click **Next** to continue with installation. The installer displays the **Licence Agreement**. To continue with the installation click *I accept the terms of the licence agreement*, then click **Next**.

5. At the **Customer information** screen enter your name and company name and, using the radio buttons, select whether you want JPA Designer to be available to all user accounts on the computer, or just one. (We recommend you select *all*.) Click **Next**.

6. At the **Choose Destination Location** screen we recommend you accept the default settings and install JPA Designer into the folder **c:\program files\jpatl\jpa designer 981**. Click **Next**. The installer will now copy the JPA Designer files onto your computer.

7. When installation has finished the **Setup Complete** screen is displayed. Tick the box labelled **Launch the program** and click **Finish**. The installer will close and **JPA Designer** will open, showing you the **Project Manager** window.

User registration

In order to use JPA Designer you must enter valid user registration details and the program must be able to check the status of your licence against our licensing database. We supply the user name and key code when you buy a licence for a module. If you do not enter your details JPA Designer runs in *demonstration mode* and will not display the results of calculations.

To enter license details for a module:

1. At the **Project Manager** window (Figure 1.1) select **Edit**>**User and Security Codes** from the menu bar. The **User Registration** dialogue opens (section 1.2).
2. In the section for the module (e.g. the U-value module) enter the company name – exactly as supplied in the registration email – in the box **Your company name**.

   *The company name is case sensitive and should be entered exactly as shown in the email: so if, for example, you enter **Limited**, when the company name with the key code contained **Ltd** the program will not accept the key code.*
3. Copy the key code from the registration email and paste it into the bottom box on the **User Registration** dialogue.
4. Click the **Apply … code** button for the module. The program copies the code into the **Key code** boxes for the module.

If you have bought several modules repeat the steps for each one.

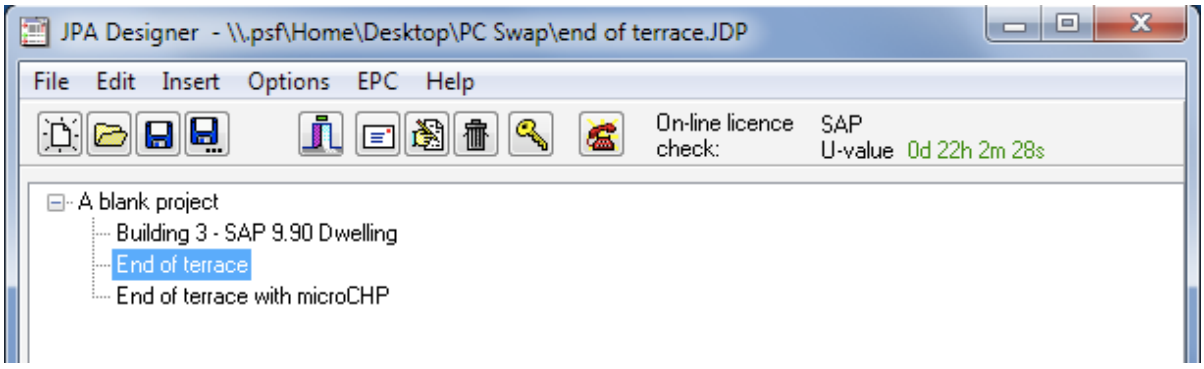


Figure 1.1: The Project Manager window

On-line licence checking

JPA Designer checks the validity of your licence for a module the first time you open a calculation after the the program has started. It does this by contacting our on-line licensing database and checking the expiry date for module[2].

- If the check is successful and the licence is valid the module will open. (The program will record the date and time of that successful check).

[2]The process only looks for the company name and checks the licence status and expiry date on the database.

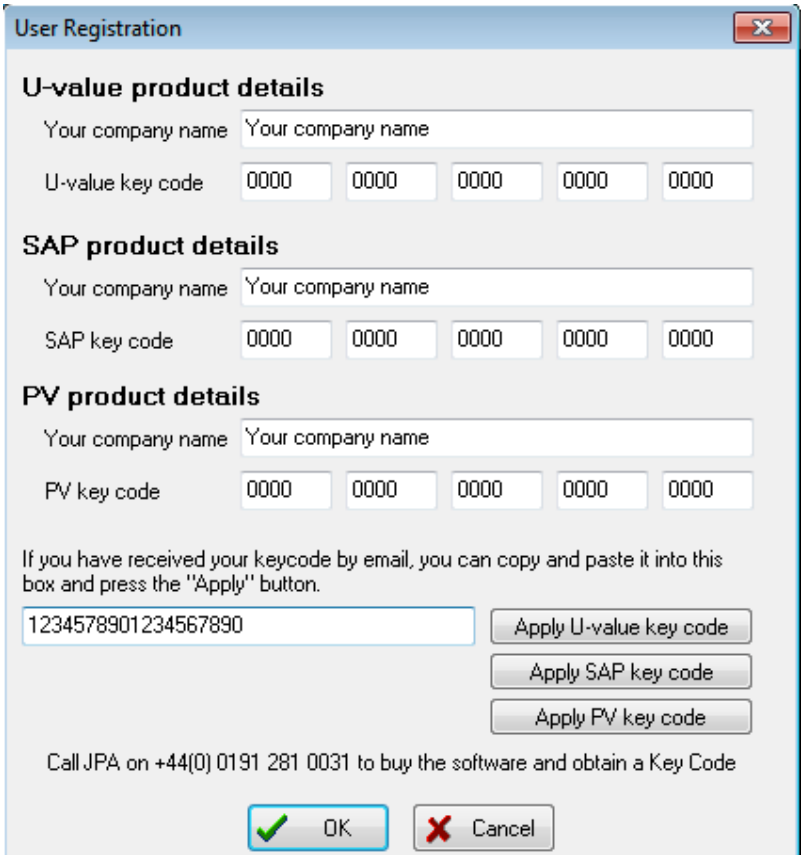


Figure 1.2: The User Registration dialogue

- If the program is unable to connect with the database (for example, because you are using your lap-top away from your office) it will look at the date of the last successful check: if that is less than seven days ago then the module will open.
- If the program is unable to connect with the database and the last successful check is more than seven days ago then it will **not** open the module.
- If the check is successful and the licence is not valid the calculation will not open.

If you often use JPA Designer away from the office there are two features you can use to prevent problems with the licence check:

- The **Project Manager** tool bar displays the length of time since the last successful licence check: provided the values shown are *green* the module will open.
- The **Check licence on-line** button on the tool bar will force a licence check and re-set the time since the last check to zero. You should force a check if you expect not to have an internet connection for a few days.

Updates

JPA Designer is continually being developed to introduce new features: to get the best from the program it is worth making sure you are using the latest version. You can find

the version number by selecting **Help**>**About** from the menu bar in JPA Designer and compare that with the version number shown on our web site[3] (www.techlit.co.uk).

Higher numbers and letters indicate later releases, with characters coming earlier in the name being more important that later ones: so 4.05a1 will be more recent than 4.04c2, and 4.05b1 more recent than 4.04a4. The three digit *Build* number indicates a minor change in a version. Figure 1.3 shows the **About** dialogue for JPA Designer together with the version number on the web site: in this case the software is up to date, as both version numbers are the same.

The process for updating the software is identical to that of originally installing it[4] (see section 1.2).

You can find details of the changes in each version on the announcements section of our web forum[5].



Figure 1.3: The About dialogue showing the version number

Opening and closing JPA Designer

To open JPA Designer:

- Select **Programs**>**JPA Designer**>**JPA Designer** from the Windows **Start** menu.

A splash screen (Figure 1.4) appears when you open JPA Designer. This allows you to add new calculations to a blank project, or to open an existing project. There is an option not to display the screen when the program starts-up.

To close JPA Designer:

- Select **File**>**Exit** from the JPA Designer menu bar. The program will prompt you to close any files which have not been saved.

[3] www.techlit.co.uk

[4] If you are using a version earlier than 5.02a3 you will have to uninstall the program using the Windows **Add/remove programs** or **Uninstall programs** control panel.

[5] http://forum.techlit.co.uk/viewforum.php?f=13

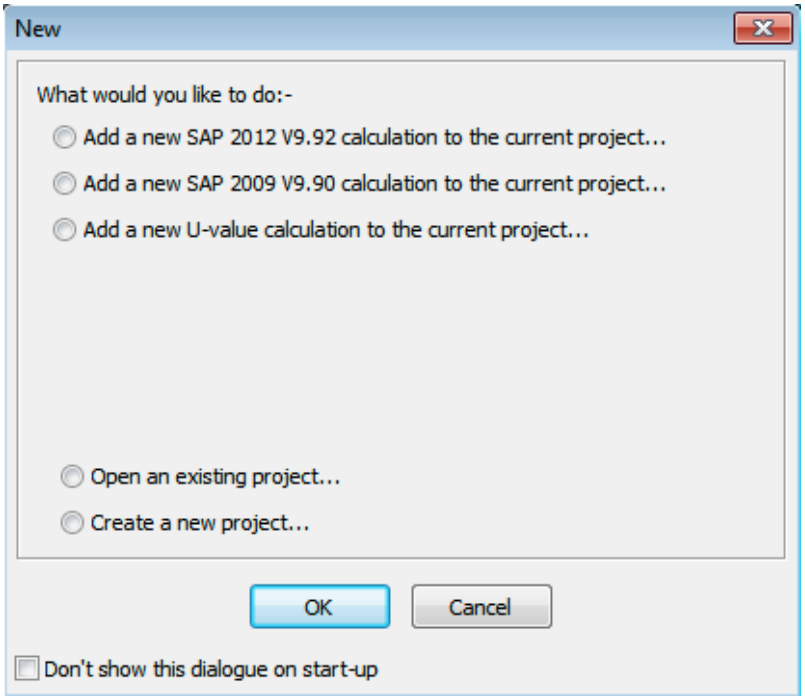


Figure 1.4: The new splash screen for JPA Designer

Uninstalling JPA Designer

To uninstall JPA Designer:

1. Open the Windows **Add/Remove programs** control panel (to access Control Panels select **Settings**>**Control Panels** from the **Start** menu).
2. Select JPA Designer in the **Add/Remove Programs Properties** dialogue and click **Add/Remove**. Windows will uninstall the program files and remove its icons.

   Uninstalling the program will not remove any JPA Designer project files.

Adding your company details to reports

Most of the reports produced by JPA Designer can be customised to include your company name, address and logo. The details are added using **Options** dialogue from the main **Project Manager** window (see section 1.2). The logo must be a 256 colour BMP format file[6].

It is also possible to set up details for several different companies within JPA Designer: these sets of address details and logos are referred to as identities (see section 1.2). You can switch between identities to produce calculation reports with different addresses and logos.

Setting up address details

To set up your company details and logo for reports:

[6]If you have the company logo in a different format, such as a jpeg, tiff or png, you can use the free Paint program which comes with most versions of MS Windows™ to convert it to the right format and to set the correct colour depth.

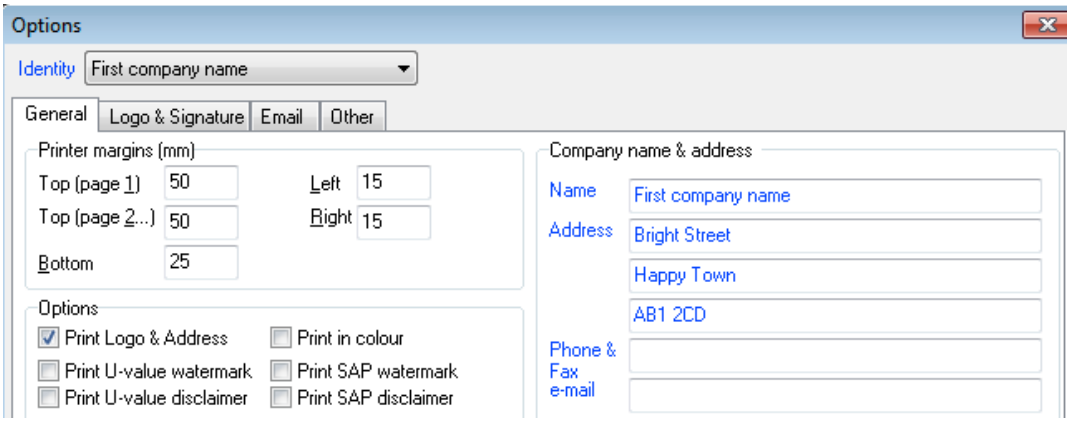


Figure 1.5: The Options dialogue - General tab

1. In the Project Manager window, select **Options** from the menu bar. The **Options** dialogue opens.
2. In the **General** tab enter your company name, address, phone and email details in the *Company name & address* section (see Figure 1.5).
3. Tick the **Print Logo & Address** box.
4. Enter the wording of any disclaimers which you want to appear at the bottom of U-value and SAP reports in the **U-value disclaimer** and **SAP** boxes.
5. If you have entered wording for the U-value and/or SAP disclaimers tick the **Print U-value disclaimer** and/or the **Print SAP disclaimer** boxes.
6. Click the **Logo & Signature** tab.
7. In the *Logo position* section enter the location of the **Top** and **Left** sides of the logo, relative to the page, and enter the **Width** of the logo. All dimensions should be in millimetres. *It will probably take some experimentation to get the logo position and size correct.*
8. Enter the name of the **Logo file**, including the *.bmp* extension, then click **OK** to close the dialogue.
9. Copy or move the logo file to the folder containing the user data. On Windows 7 this will be **c:\ProgramData\JPA\JPA Designer**.

   *Note: The **Certificate signature position** and associated settings are no longer in use.*

Setting up identities

The procedure for setting up identities is similar to that for setting address details:

1. Enter the details for the first company as described in section 1.2.
2. Re-open the **Options** dialogue.

3. In the **Identity** list select the first blank identity (usually labelled *Blank 1*). The *Company name & address* and disclaimer information will be cleared.

4. Enter the details for the second company, including the data in **Logo and signature** tab. Click **OK** to close the dialogue and save the data.

5. Repeat steps 2–4 for any further identities.

As you add identities they will be added to the **Identities** list, using the **Name** of the company in the list. If you need to edit the data for any one of the identities, select it from the **Identities** list, make the changes and click **OK**.

When you come to create a PDF of a report or to print it you will be able to select one of the identities to use the associated details in the header. Note that whichever identity you select when producing a report, the report footer will always show the name of the company or individual holding the licence.

1.3 Managing projects and calculations

This chapter explains how JPA Designer stores calculations and describes how to work with project files and calculations. It describes how to use calculation templates to speed up the calculation process.

The project file

JPA Designer organises and saves calculations in project files, which have the extension **JDP**. You can save multiple calculations in the same file.

Calculations are created, saved and managed in the JPA Designer **Project Manager** window (Figure 1.1), which lists all the calculations in the current project.

Starting a new project

Whenever you start JPA Designer the program creates a new blank project which you can use straight away. You can also create a new project at any time by selecting **File**>**New Project** from the main menu, or clicking the **New Project** button on the toolbar.

You can change the default project name **A blank project** to something more useful:

1. Click once on the project name and select **Edit**>**Rename selected item**. The **Project name** dialogue opens (Figure 1.6).

2. Enter the new name for your project, then click OK.

3. The project is renamed

   The project name does not affect the calculations in any way.

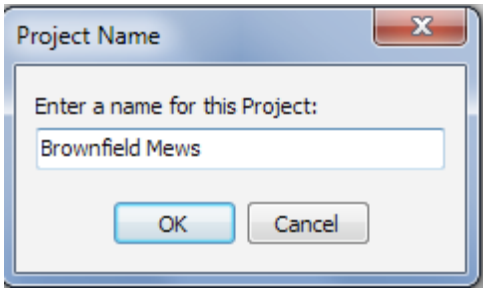


Figure 1.6: Changing the name of a project

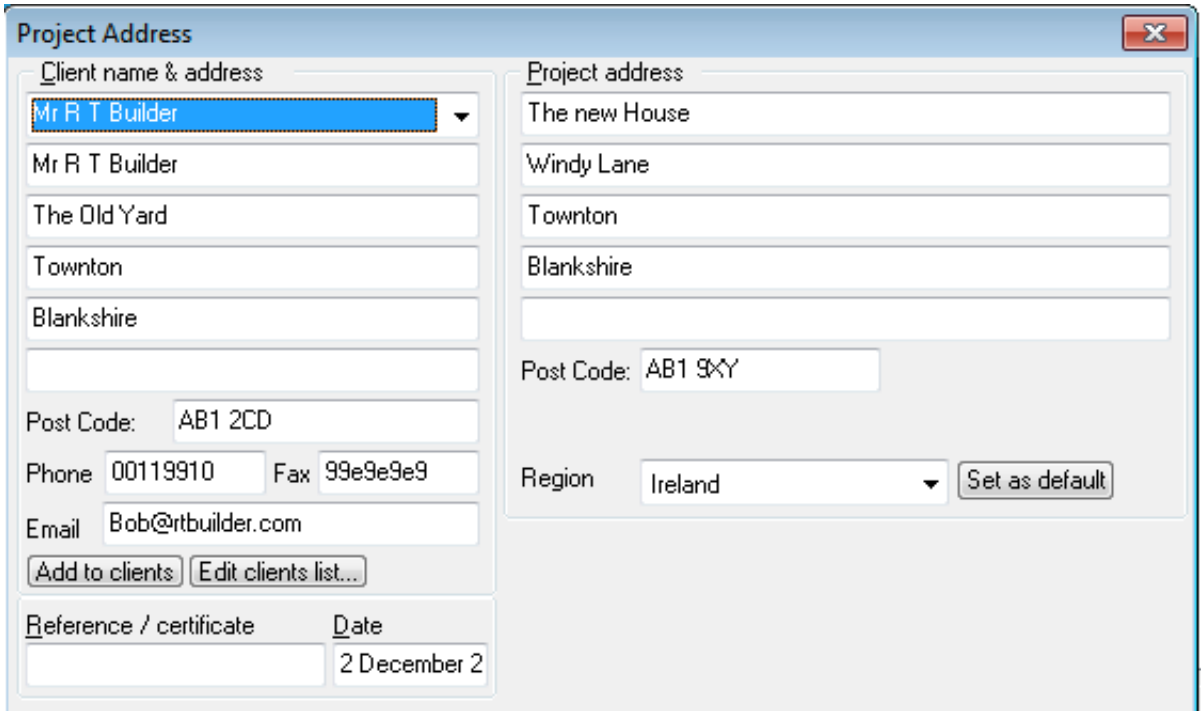


Figure 1.7: The Project Address dialogue

Adding project address details

You can enter client address and site details for a project, which you can then copy to all the individual calculations within that project. You can enter and edit that information using the **Project Address** dialogue (Figure 1.7). You can also store client address information to reuse in other projects.

To add client and project details:

1. From the menu bar select **Edit**>**Project Address**. The **Project Address** dialogue opens.
2. Enter the data by typing it into the appropriate boxes. Use the <Tab> key to move between boxes.

   Do not try to enter data in the top left hand box: this box is used for retrieving details you have previously stored.
3. If you want to store the client details to re-use later click **Add to clients**.

4. Click **OK** when you have entered all the data you need.

To copy the project address details to all the calculations in a project:

1. Enter the address details in the **Project Address** dialogue.
2. Click **Pass down**.
3. Click **Yes** at the confirmation dialogue.
4. Once the copying is done click **OK**.

You can also copy project address details to individual calculations once you have opened the calculations (see section 2.1).

To re-use existing client data simply click on the list at the top of the **Project information** dialogue and select a client name (Figure 1.8).

If you need to edit the details held for clients click **Edit clients list** then make the changes in the **Edit Clients** dialogue.

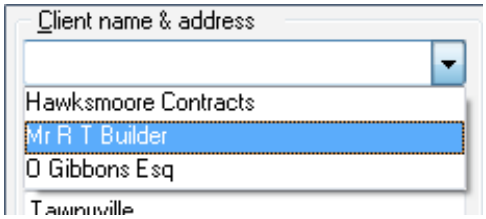


Figure 1.8: The client name and address list

Setting the calculation region

JPA Designer is designed to carry out the thermal calculations required in different regions of the world. Some regions require U-value calculations, while others require R-value calculations: some regions only consider one-way heat flow while others require two-directional heat flow (see Table 1.1. The region settings also determine the climate data available for condensation risk analysis.

Table 1.1: Regional calculation settings

Region	Calculation type	Heat flow
Asia	U-value	Heat-out
Australia	R-value	Heat-in/ heat-out
Ireland	U-value	Heat-out
Middle East	U-value	Heat-in/ heat-out
New Zealand	R-value	Heat in/heat-out
UK	U-value	Heat-out

The calculation region can be set in the **Project Address** dialogue (see Figure 1.7):

1. Select the **Region** in the list.
2. Click **Set as default**.
3. All new calculations will use that region.

You can override the region setting for individual calculations in the **Project Information & Options** dialogue.
*The multi-regional nature of JPA Designer is the reason some menu items for R-value calculations refer to **U-value**, rather than **R-value**.*

Saving projects

JPA Designer project are saved in the same way as any other file:

1. From the menu bar select **File**>**Save Project**. The **Save As** dialogue opens.
2. Select the folder into which the project should be saved, enter a name for the project file.

   *By default JPA Designer will add the extension **JDP** to all file names.*
3. Click **Save**. JPA Designer saves the project and displays the file name on the program title bar.

By default JPA Designer will save files into the JPA Designer user data folder (on Windows 7 usually **c:\ProgramData\JPATL\JPA Designer 981**). You can specify a different default folder by specifying the *startup* folder using the **Options** dialogue).

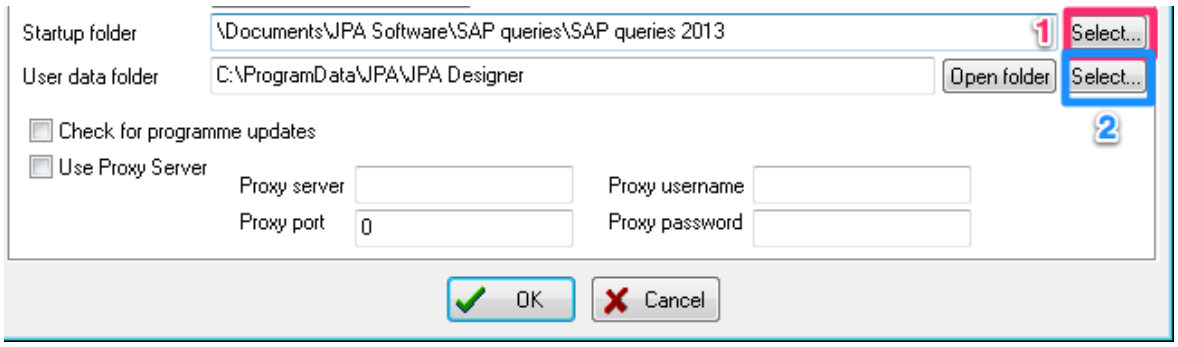


Figure 1.9: Startup folder controls in the Options dialogue

To specify the *startup* folder:

1. From the menu bar select **Options**.
2. On the **General** tab click the **Select** button for the **Startup folder** (item 1 in Figure 1.9).
3. In the **Browse For Folder** dialogue select a folder and click **OK**.
4. The folder will now be the default location for saving JPA Designer files and PDF files of calculation reports.

We recommend you have a regular back-up schedule for your data.

Opening projects

To open an existing project:

1. From the menu bar select **File**>**Open project**. The **Open** dialogue opens.
2. Select the file you want to work with, then click **Open**. The project opens in the **Project Manager** window.

Adding calculations to a project

You can add new calculations to a project in the **Project Manager** window. To add a new R-value calculation or condensation risk assessment to a project:

1. From the menu bar select **Insert**>**U-value calculation**. The **Description** dialogue opens (Figure 1.10).
2. Type a name for the calculation in the **Description** dialogue, e.g. *warm roof,* and click **OK**. The new calculation is added to the project.

   *When naming a calculation avoid using the Windows restricted characters ' /\ : * ? < > |, otherwise you will have problems creating PDFs of calculation reports (see section 2.6 for a more detailed explanation.*

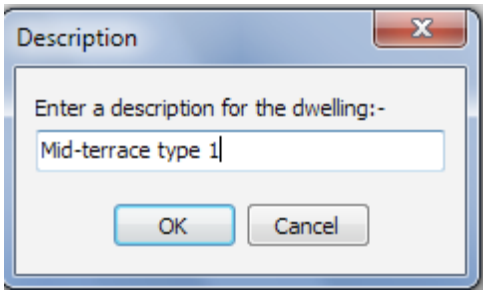


Figure 1.10: The Description dialogue

Using R-value calculation templates

JPA Designer offers a range of standard R-value calculations, which you can use to speed up the calculation process and minimise repetitive work. We refer these standard calculations as R-value templates. Each template contains the same information as a normal R-value calculation including element definitions and layers.

You can either use the template 'as is' without modifying it, or use it as a starting point to produce your own calculation, but whichever route you chose, the calculation process will be quicker.

There are three types of R-value template:

- *standard templates for roofs, walls and floors*. These are generic calculations which can be adapted by changing materials and thicknesses. They are supplied with the program.

- *manufacturers' templates*. A number of construction product manufacturers have supplied R-value templates for typical constructions featuring their products. The templates are supplied with the program[7].
- *user-defined templates*. These are calculations which you have previously performed and then saved as a template, enabling you to build up a library of commonly used calculations. See section 1.3 for instructions.

Inserting a U-value calculation from a template

The controls for inserting R-value calculations based on templates are at the bottom of the **Project Manager** window (Figure 1.11). To insert a new R-value calculation based on a template:

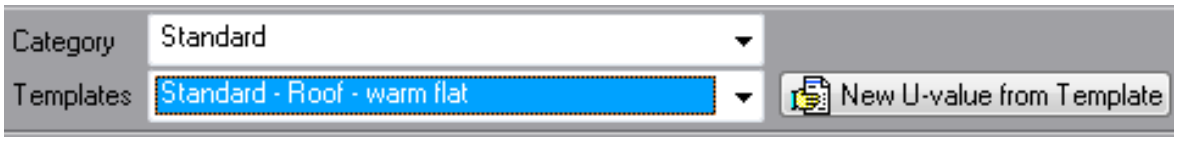


Figure 1.11: The template selection controls

1. In the **Categories** list select the *type* of template you want. That may be a manufacturer's category, one of the default categories, or a template group you have created previously.
2. In the **Templates** drop-down list pick the template you wish to use.
3. Click **New U-value from Template**. The **Description** dialogue opens.
4. Edit the name of the template to suit your project, or accept the default name. Once you are ready, click **OK**.
5. A new R-value calculation is added to the project.
6. You can now open and edit the calculation by double-clicking on its name in the **Project Manager** list.

Creating user defined templates

You can create templates from your own R-value calculations by saving them in JPA Designer template files, which have the file extension JTF. You can have several different template files which allows you to sort the calculations into groups: you might have one for wall calculations and one for floor calculations, alternatively, you might divide them into masonry or timber framed calculations.
The simplest way to create a template file is to use the **Import U-value** feature to collect all the existing R-value calculations you want available into one project then save the project as a template file.
To import an existing R-value calculation to a project:

[7] If you are a manufacturers of construction materials you can add R-value calculations which include your materials into the set of templates which is distributed with JPA Designer. Offering R-value calculations with your materials makes it easier for designers to include them in R-value calculations and specifications and helps to ensure the materials are included in calculations correctly. Please contact JPA TL Ltd for information and current pricing.

1. Start a new project in JPA Designer: on the **File** menu click **New**.
2. On the **File** menu click **Import U-value from another JPA Designer project**.
3. In the **Open** window select the file which contains the calculation.
4. At the **Import U-value from Project** dialogue (Figure 1.12) select the U-value calculation from the list and click **OK**.
5. The R-value calculation is added to the open project.
6. Repeat the process to import all calculations you want into the project.

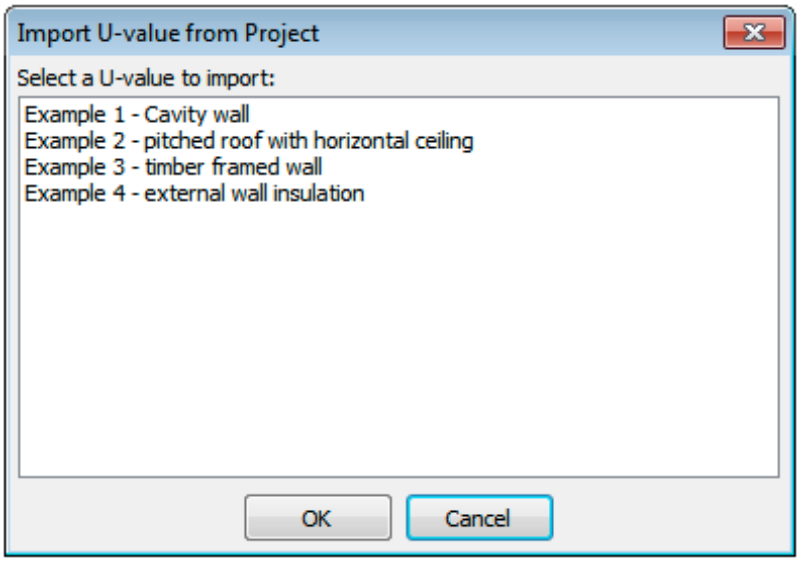


Figure 1.12: The Import U-value dialogue

You can, of course, create new calculations for the template if you want to.

The name which appears in the **Categories** list is taken from the *project name* in the Project Manager window. So before you save a template file you should change the *project name* to something which will help you identify the calculations from the list (Figure 1.13)[8].

To set the *project name*:

1. In the **Project Manager** window double click on the *project name* – the default value is *A blank project*.
2. In the **Project Name** dialogue type a new name for the project.

The template file must be saved in the same folder as the other JPA Designer user data files and in the JTF format. To save a project as a template:

1. On the **File** menu click **Save Project as Template**.

[8]The default *A Blank Project* will be no help at all a few weeks after you have created the template.

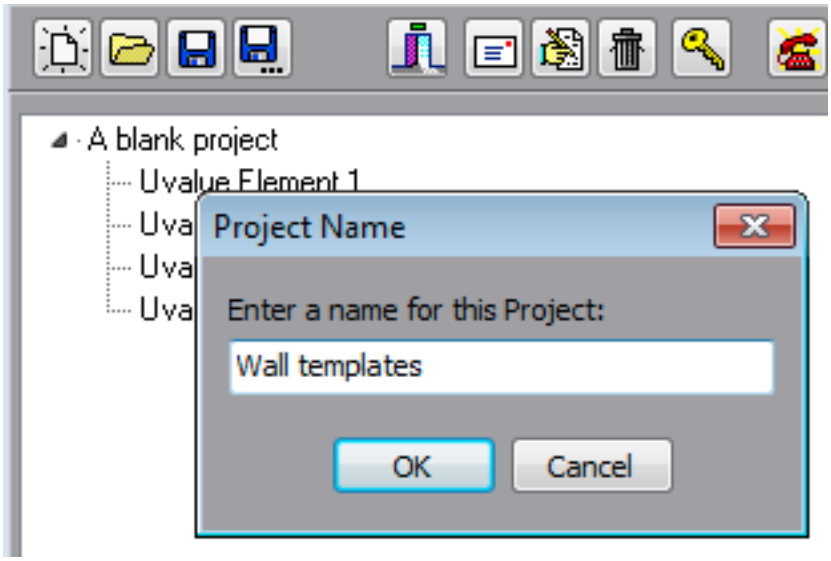


Figure 1.13: Changing the *project name*

2. Enter a *File name*.
3. Set the folder to the user data folder (in Windows 7: **c:\ProgramData\JPA\JPA Designer**).
4. Make sure **Save as type** is set to *JPA Designer U-value Template (JTF)* and click **OK**.
5. Your template project is now included in the **Categories** list.

Opening and closing calculations

To open a calculation from the **Project Manager** window, either:

- double click on the calculation name; or,
- click once on the calculation name, then from the menu bar select **Edit**>**Selected item**.

To close a calculation and return to the **Project manager** window click the **Project manager** button on the tool bar.

Duplicating calculations

If you want to carry out a calculation which is very similar to an existing calculation in a project you can duplicate the calculation and then change the copy, leaving the original calculation untouched. To duplicate a calculation:

1. In the **Project Manager** window click once on the calculation to select it.
2. From the menu bar select **Edit**>**Duplicate item**. The **Description** dialogue opens.

3. Type a name for the duplicate calculation and click **OK**. A copy of the original calculation is added to the project.

   *When naming a calculation avoid using the Windows restricted characters ' /\ : * ? < > |, otherwise you will have problems creating PDFs of calculation reports (see section 2.6) for a more detailed explanation.*

You can now work with the duplicate calculation in the usual way.

Importing R-value calculations

When you need to re-use an existing R-value calculation in a new project you can import a copy of the calculation from its original project into a new one.
To import a calculation into the current project:

1. On the **Program Manager File** menu select **Import U-value from another JPA Designer project**.
2. In the **Open** dialogue select the project containing the original R-value calculation. Click **OK**.
3. In the **Import U-value from Project** dialogue click on the calculation to select it, then click **OK**. The R-value calculation is copied into the current project.

Importing existing R-value calculations into a new project is a quick way of building a set of R-value templates (see section 1.3)

Renaming calculations

To change the name of a calculation:

1. In the **Project Manager** window click once on the calculation to select it.
2. From the menu bar select **Edit**>**Rename selected item**. The **Name** dialogue opens.
3. Enter a new name for the calculation and click **OK**. The **Project Manager** window shows the new name.

   *When naming a calculation avoid using the Windows restricted characters ' /\ : * ? < > |, otherwise you will have problems creating PDFs of calculation reports (see section 2.6 for a more detailed explanation.*

Changing the name of the calculation will not affect the calculation results.

Deleting calculations

Calculations can be deleted from JPA Designer projects.
WARNING: there is no way of recovering a deleted calculation.
To delete a calculation:

1. In the **Project Manager** window click once on the calculation to select it.
2. From the menu bar select **Edit**>**Delete selected item**. JPA Designer asks you to confirm the deletion.
3. Click **Yes** to delete the calculation or **No** to abandon the deletion. If you click **Yes** the calculation is removed from the project.

Merging projects

Using the **Merge projects** function you can copy all the calculations in an existing project into the currently open project. This can be useful if you have a number of standard calculations stored in different projects which you need to bring together for a particular job. Merging does not change the project you are copying *from*.

To merge calculations from one project into another:

1. In **Project Manager** open or create the project you want to *receive* the calculations.
2. From the menu bar select **File**>**Merge a project from disk into this Project**. The **Open** dialogue appears.
3. Select the file which *contains* the calculations and click **Open**. JPA Designer adds the calculations to the current project and lists them in the **Project Manager** window. You can now edit them without affecting the original project.

2 R-value calculations

2.1 The JPA Designer R-value modules

JPA Designer offers two R-value modules:

- **R-value 2014** calculates R-values for walls, roofs and intermediate and suspended ground floors.
- **R-value 2014 Professional** has the functionality of R-value 2014 and also performs condensation risk analysis using the methods set out in ISO 13788:2012.

The program carries out two R-value calculations for each construction: a heat-in calculation and a heat-out calculation[1].
R-value calculations are carried out in the R-value module by:

1. Entering project information (section 2.1).
2. Entering data about the construction as a whole, including the element type (e.g. wall, floor, roof) (section 2.2);
3. Defining the different layers which make up the element (section 2.4);
4. Printing calculation results, or creating PDF files of the results for emailing (section 2.6).

R-value project information

JPA Designer can store client and project details for each calculation and then add them to calculation reports. You can either copy the client and project details which you entered in the **Project Information** dialogue in the **Project Manager** window, or you can enter new data in the R-value modules. You can also save and re-use client data (section 1.3). In either case you can select the **Region** for the calculation (see section 1.3 for an explanation of how region settings affect calculations).
To copy project details from Project Manager:

1. In the R-value module select **Edit**>**Project Information** from the menu bar. The **Project Information** dialogue opens.
2. Click the **Inherit** button.
3. At the prompt choose whether you want the calculation to inherit the region settings for the project or not[2].

[1] These are sometimes referred to as summer and winter calculations.
[2] In most cases you will want to inherit the project region settings.

4. Any information you entered in Project Manager is copied to the **Project Information** dialogue here.
5. Click **OK**.

To enter new project details:

1. In the R-value module select **Edit**>**Project Information** from the menu bar. The **Project Information** dialogue opens.
2. Enter project information by typing it into the appropriate fields. Use the <Tab> key to move between fields.
3. If you need to use a region other than the default, select the new **Region** in the list.
4. Click **OK** when you have entered all the data you need.

To copy project details from the current calculation to all other calculations in project:

1. Enter the address details in the **Project Information and Options** dialogue.
2. Click **Pass down**.
3. At the **Information** dialogue click **Yes**.

2.2 Construction details

The thermal performance of building element will be affected by the type of element and its position within a building. These conditions are set in the **U-value Construction** dialogue[3] (Figure 2.1), which accepts details of:

- The type of element (e.g. roof, wall, floor), together with additional information for some elements (section 2.2).
- The conditions at the internal and externals surfaces (see section 2.2).

To enter data:

1. From the menu bar select **Edit**>**Construction type**. The **U-value Construction** dialogue opens.
2. Enter your data and click **OK**.

For some constructions, such as those with mechanical fasteners, you may find it easier to enter some of the data in the construction dialogue *after* you have entered the layers of the element.

[3]Note that the U-value Construction dialogue shows a number of options which are not required for R-value calculations including light steel frame construction, twin-skin metal roofing and cladding, and the mechanical fixings corrections.

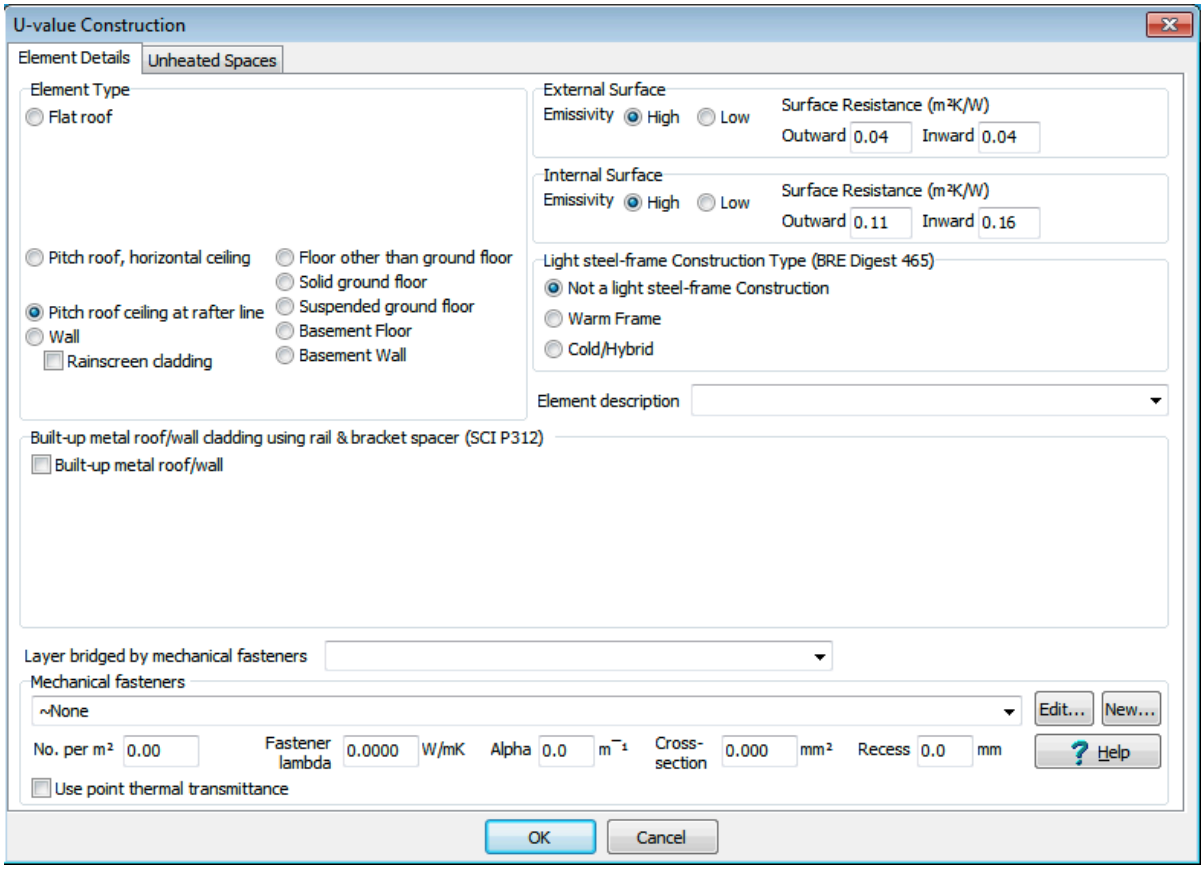


Figure 2.1: The U-value Construction dialogue

Element type

JPA Designer recognises several types of element which have to be treated differently in the calculation process. Use the radio buttons in the **Element type** section to select the type of floor, wall or roof. For some elements there are options for entering additional information.

The element types relevant for R-value calculations are:

- Flat roof. A roof with typically less than 10° pitch[4].

[+ Pitched roof with horizontal ceiling. Typically a 'cold roof' with the insulation applied between and over the ceiling joists. You must enter the pitch (angle) of the roof, measured from the horizontal.]

- Pitched roof with ceiling at rafter line. A 'warm roof' with the insulation in the plane of the rafters. This element type can also be used for pitched roofs with a horizontal ceiling, where the resistance of the attic space is known.
- Wall. Any construction at an angle of more than 70° to the horizontal. [5]

[4] The options for inverted roofs are not relevant.
[5] The option to enter data for the fixings in rainscreen cladding is not relevant.

- Floor other than ground floor. A floor over an open space (e.g. a parking bay) or an unheated space (e.g. an enclosed garage).
- Solid ground floor. A floor which is contact with the ground across its whole area, such as groundbearing concrete slab.
- Suspended ground floor. A floor with a ventilated space below the floor deck, such as a beam and block floor or timber joist floor.

  Note: the Solid ground floor, Basement floor *and* Basement wall *elements are not suitable or R-value calculations.*

You may also enter a description for the element in the **Description** box, or select one from the drop-down list. The description does not affect the calculation

Internal and external surfaces

R-value calculations take account of the heat flow at the internal and external surfaces of an element by means of the internal and external *surface resistances*. Those resistances are affected by the direction of heat flow through the construction and the emissivity of the exposed surfaces.
The surface resistances used in the calculation are shown in the two pairs of **Surface Resistance** boxes, with each pair having a resistance for outward and inward heat flow. The program automatically adjusts the surface resistances according to the type of element being considered (section 2.2) and the emissivity of the surfaces, using the values from the AIRAH Handbook shown in Table 2.1.
The default emissivity setting is *high emissivity*. Virtually every commonly specified surface material has a high emissivity so there is rarely any need to change the default. You can, of course, replace default resistances with your own values.

Table 2.1: Air film resistances

			Resistance (m^2K/W)	
Wind speed m/s	Heat flow	Element	High emittance	Low emittance
Still air	Horizontal	Up	0.11	0.23
		Down	0.16	0.80
	45° slope	Up	0.11	0.24
		Down	0.13	0.39
	22.5° slope	Up	0.11	0.24
		Down	0.15	0.30
	Vertical	Horizontal	0.12	0.30
6.00 (winter)	Any	Any	0.03	
3.00 (summer)	Any	Any	0.04	
0.5 (internal)	Any	Any	0.08	

2.3 Working with layers

Each R-value calculation is built up by inserting layers which correspond to the different materials in the construction. For example, a R-value calculation for a cavity clay masonry wall could have a layer to represent each of:

- the outside surface resistance;
- the outer leaf of brickwork;
- the cavity;
- a reflective foil;
- the inner leaf of masonry;
- the plaster finish;
- the internal surface resistance.

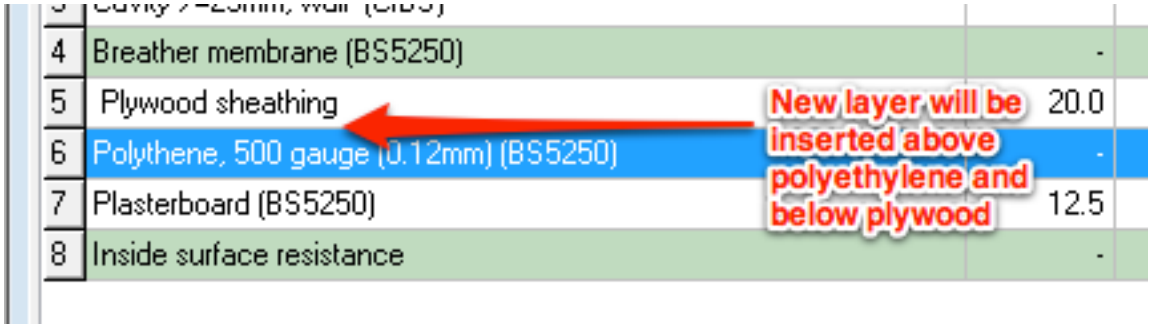


Figure 2.2: The new layer will be inserted *above* the selected layer

You can add layers to the calculation by inserting materials from the program's extensive database, which includes data for generic materials and cavities, as well as branded products from a number of manufacturers. For many common constructions it is possible to insert all the layers from the database. If you cannot find a material in the database then you can insert a blank layer and edit the information yourself.

The program always adds a new layer directly *above* **the currently selected layer, so in Figure 2.2 the new layer would be inserted above the polyethylene and below the plywood sheathing.**

When you start a calculation you should select the lowest layer (which will be the inside surface resistance for walls and roofs, and the outside surface resistance for floors) before beginning to add layers. Because layers are of this it is quicker to work from outside to inside for wall and roof calculations and from inside to outside for floor calculations.

Inserting layers from the Products database

The Products database contains a wide range of materials and cavities for use in R-value calculations and is accessed using the **Products Database** window (Figure 2.3).

The **Products Database** window has three main parts:

- The **Categories** box, which is used to select the type of material you want to use. Categories of branded materials are shown in **bold**, categories of generic materials in normal text and user categories in *italics* (see section 2.7 for information on adding your own materials).

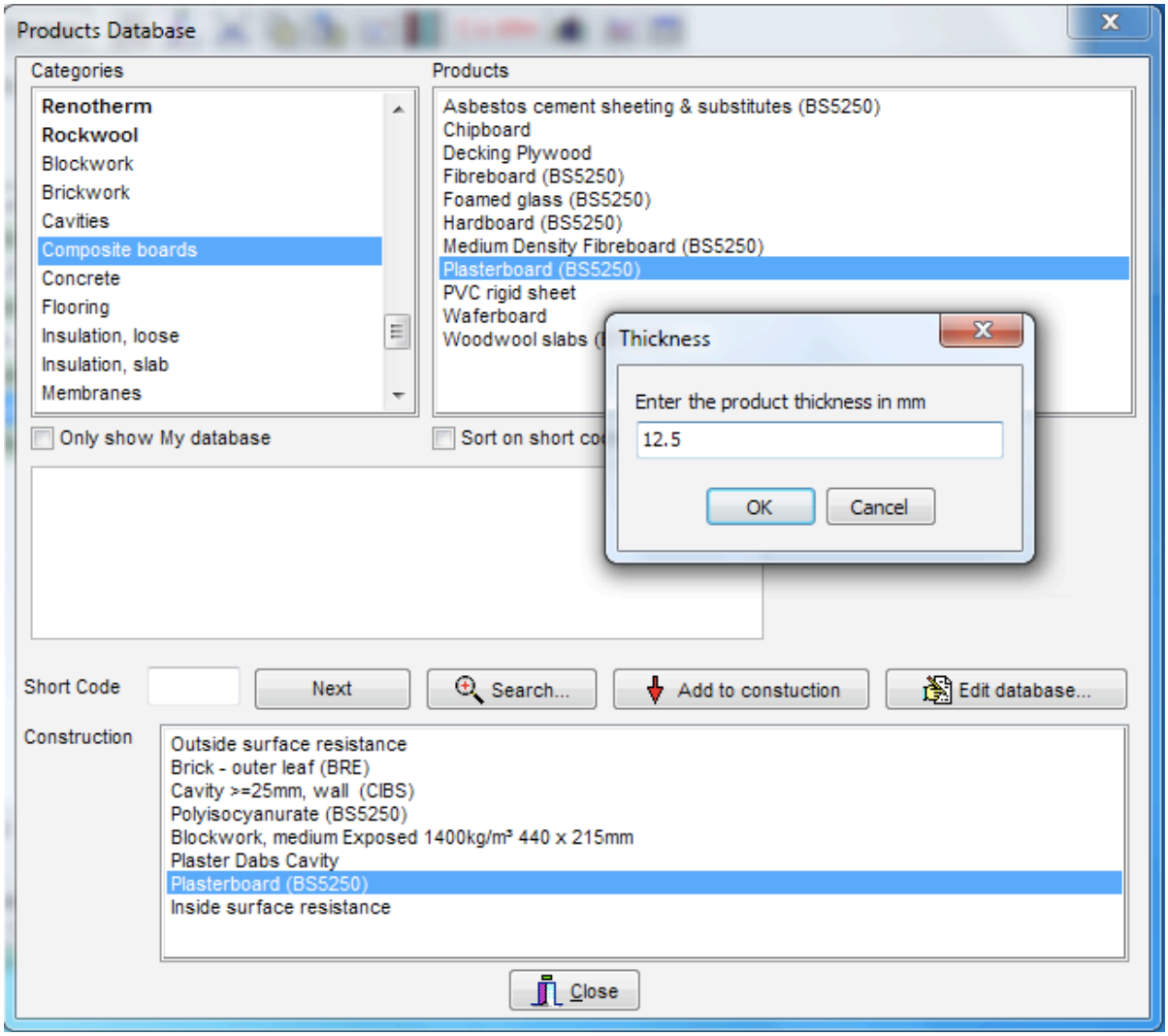


Figure 2.3: The Products Database window

- The **Products** box, which you use to select a material from a particular category.
- The **Construction** box which shows the order of layers in the construction.

To insert layers using the Products Database:

1. Select the existing layer which will be *below* the new layer.
2. On the **Insert** menu click **Layer from database** (or click the **Database** button on the toolbar). The **Products Database** dialogue opens.
3. Use the scroll bar on the **Categories** box to find the manufacturer or type of material you need, then click once on that category. The **Products** box shows the material in that category.
4. Click on a material to select it, then click **Add to construction** (alternatively you can double click on the material in the **Products box**). The **Thickness** dialogue opens.

   *If the material has a set thickness the layer will be added without the **Thickness** dialogue opening.*

5. Enter the thickness of the layer then click **OK**. The **Construction** box now shows the new layer.
6. You can now add more layers from the database, using the **Construction** box to control the position of the new layers.
7. When you have finished adding layers click the **Close** button. The main **R-value** window now shows the calculation with the new layers added.



Product database hints

Product categories are sorted with branded materials first, followed by generic and user categories sorted in alphabetical order.
If you are not sure which category a particular material belongs to you can click **Search** to find it.
You can use the **Only show My database** box to make the software only show categories which you have added.

Inserting blank layers in a calculation

To insert a new blank layer:

1. Select the existing layer which will be *below* the new layer.
2. From the menu bar select **Insert**>**Blank layer** (alternatively you can press <Insert>). The new blank layer is added to the calculation *above* the existing layer.
3. Double click on the layer to open it for editing.

Managing layers

Once you have added layers to your calculation you change their order, cut, copy and paste them, or delete them.

- **Moving a layer**:
  - Click and hold the right-hand mouse button on the layer number at the left-hand side of the window.
  - Drag the layer to a new position.
  - Release the mouse button
- **Cutting a layer**: removes a layer from the calculation but keeps it available on the clipboard.
  - Click on the layer to select it.
  - Click the *Cut* button on the toolbar.
  - The layer is deleted from the calculation but remains on the clipboard for pasting.

- **Copying a layer**: puts a copy of the layer on the clipboard.
  - Click on the layer to select it.
  - Click the *Copy* button on the toolbar.
  - The layer remains in place but is copied to the clipboard.
- **Pasting a layer**: places the layer on the clipboard into the calculation.
  - Click on the layer which you want to be *below* the pasted layer.
  - Click the *Paste* button on the tool bar.
  - The layer on the clipboard is placed in the calculation *above* the selected layer.
- **Deleting a layer**: removes a layer permanently from the calculation.
  - Click on the layer to select it.
  - Click <Delete>.

2.4 Working with materials

The properties of layers are entered and edited in the **Edit Material** dialogue (Figure 2.4). The dialogue enables you to set:

- the basic characteristics of the material (section 2.4).
- the type of material (section 2.4).

To edit the properties of a layer:

1. Click on the layer to select.
2. From the menu bar select **Edit**>**Layer** (alternatively, double click the layer, or press <Enter>). The **Edit Material** dialogue opens.
3. Amend the data for the layer and click **OK**.

Note that there are part of the **Edit material** dialogue (such thermal bridging and air gap correction settings) which are not used in R-value calculations.

Basic characteristics

The **Material** section contains the basic data about the layer, including:

- **Description**: the name of the material or a description, which appears in the calculation.
- **Code** and **Category** : used with the database to sort or enter materials – but not in general use.
- **Thickness**: the cross-sectional thickness of the layer, measured in mm.

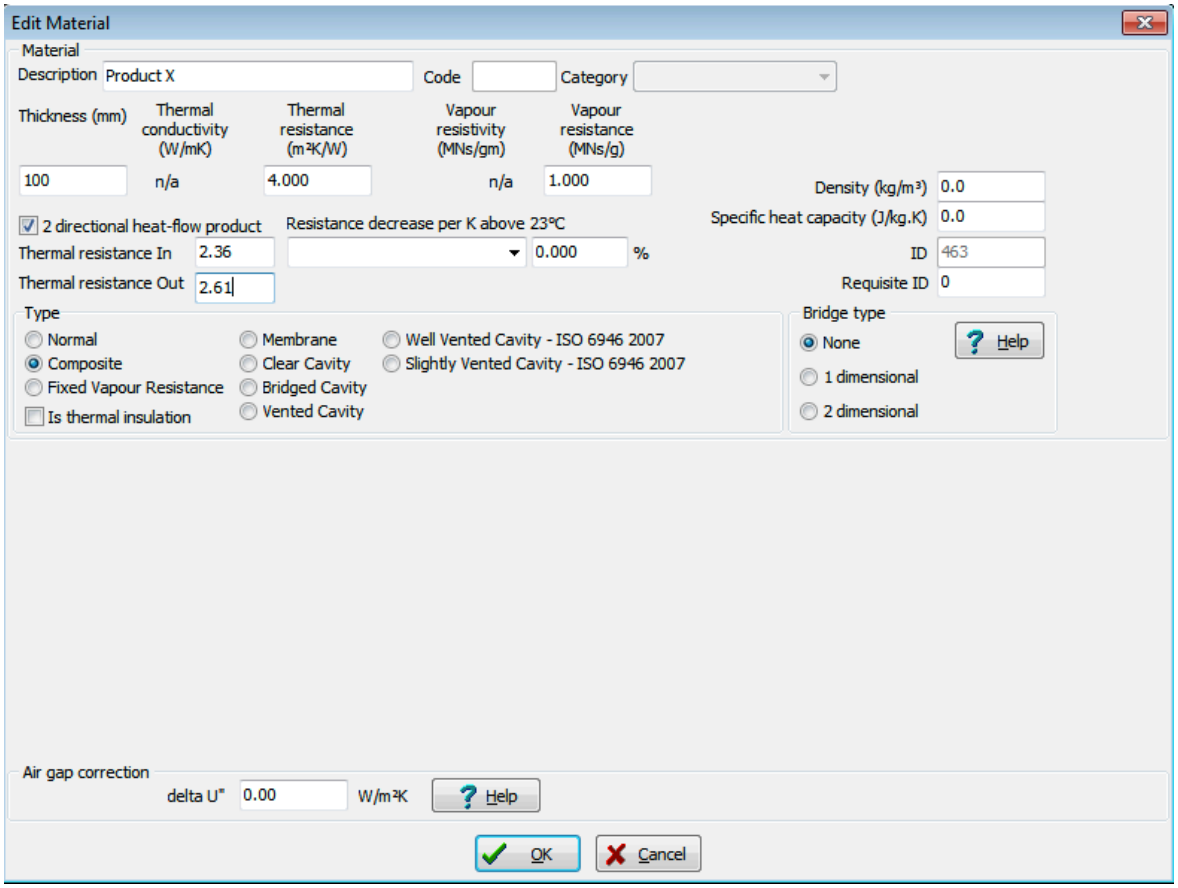


Figure 2.4: The Edit Material dialogue

- **Thermal conductivity**: the rate of conduction heat transfer through 1m of the material, measured in W/mK. Usually referred to as the lambda value.
- **Thermal resistance**: the resistance to heat transfer provided by the layer, measured in m^2K/W.
- **Vapour resistivity**: the rate of transfer of water vapour through 1 m of the material, measured in MNs/gm.
- **Vapour resistance**: the resistance to water vapour provided by the layer, measured in MNs/g.

The following two values are only required for κ-value calculations.

- **Density**: the mass per cubic metre of the material, measured in kg/m^3.
- **Specific heat capacity**: the amount of energy required to raise the temperature of one kilogram of the material by one Kelvin (equivalent to 1 degree Celcius). kJ/kg.

Two-directional heat-flow

Some layers, primarily thermal insulation and air spaces, have different thermal resistances depending on the direction in which heat is being transferred. There are two ways of addressing these *two-directional heat flow products*:

- by entering two thermal resistances; or,
- by adjusting the resistance of insulation for the ambient temperature using a correction coefficient.

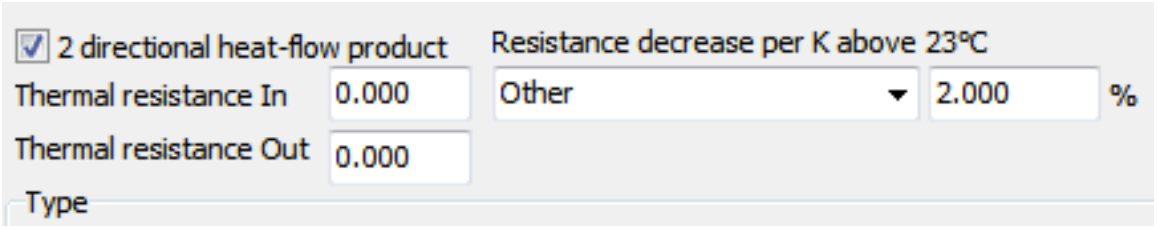


Figure 2.5: Two-directional heat transfer settings

Heat-in and heat-out resistances

Where you have been given separate heat-in and heat-out resistances for the material:

1. Tick **2 directional heat-flow product** (see Figure 2.5).
2. Enter the **Thermal resistance In**.
3. Enter the **Thermal resistance Out**.
4. Set the *Type* of layer, usually to **Composite** for a solid and **Clear cavity** for an airspace.

Adjusting resistances for temperature

For some insulation materials the measured thermal resistance can be adjusted according to the difference between the mean temperature across the R-value calculation and the temperature at which the thermal resistance was measured. The thermal resistance is increased or reduced by a given percentage for every kelvin of temperature difference between the two temperatures.

The thermal resistance of insulation is measured at 23°C, while Table 2.2 shows the mean temperatures used for Australia and New Zealand. JPA Designer determines appropriate mean temperature from the region of the calculation (section 1.3) and direction of heat flow. The standard percentage changes applied to different insulants are shown in Table 2.3.

Table 2.2: Temperature adjustments

Location	Heat flow	Mean temperature (°C)	Adjustment (°C)
Australia	Out	15	–8
	In	30	+7
New Zealand	Out	12	–11
	In	27	+4

To have the resistance of a layer adjusted for temperature:

Table 2.3: Temperature adjustment factors for insulants

Material	Change in resistance per kelvin (%)
Glass wool, polyester, sheep's wool	0.65
Rockwool	0.39
Cellulose	0.52

1. Enter the **Thermal resistance** of the material.
2. Tick **2 directional heat-flow product**.
3. In the **Decrease resistance** list select the insulation type (see Figure 2.5). The **percentage** box shows the adjustment being applied. *If the insulation type is not listed select* Other* and enter a value in the **Percentage** box.
4. Set the **Type** of material: this will usually be *Normal* or *Composite*.

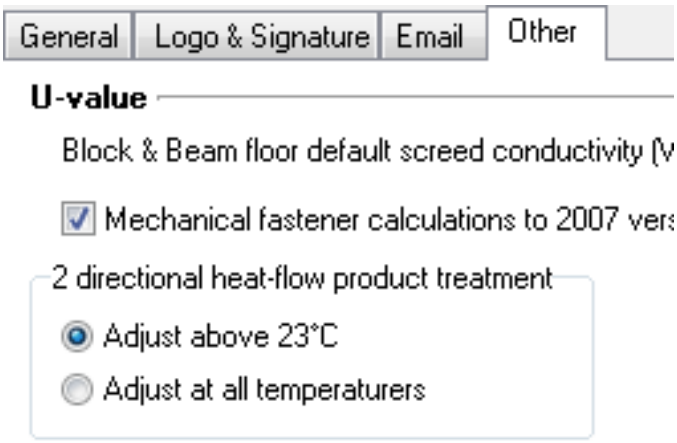


Figure 2.6: Temperature options for two directional heat flow products

Options for adjusting resistances

The thermal resistance of insulation is usually measured at 23ºC. AS NZS 4859.1 requires resistances to be adjusted for mean temperatures above that. However, it is common practice to adjust resistances at mean temperatures below 23ºC as well. You can specify whether JPA Designer adjusts only above 23ºC, or above and below 23ºC in the **Options** dialogue.
In the section *2 directional heat-flow product treatment* select either **Adjust above 23ºC** or **Adjust at all temperatures** (see Figure 2.6).

Types of materials and cavities

Layers within building elements have different combinations of properties: JPA Designer recognises four types of material layer and five types of cavity. However, for R-value calculations only the *Clear Cavity* is used.

The rest of this section describes the types of layer and the data required for each one.

Normal

Normal materials have the same composition all the way through, so the thermal resistance of a normal layer is calculated from the material's conductivity and thickness, and the vapour resistance is calculated from the thickness and vapour resistivity. A normal material requires the following information:

- **Type**: select *Normal*.
- **Description** : type a description of the layer – this will appear on the report.
- **Thickness**: enter in millimetres, mm.
- **Thermal conductivity**: enter in W/mK.
- The program calculates the **Thermal resistance** in m^2K/W.
- **Vapour resistivity**: (only required if you will be carrying out condensation risk analysis) enter in MNs/gm.
- The program calculates the **Vapour resistance** in MNs/g.

  Where appropriate a normal material can be configured as a two directional heat-flow product (section 2.4).

Composite materials

For composite materials, for example insulation-backed plasterboard, there is no direct link between the conductivity, thickness and thermal resistance. You must therefore use the thermal resistance for the specific configuration of the material (this will usually be supplied by the manufacturer of the product). The same principle applies to the vapour resistance.

A composite material requires the following information:

- **Type**: select *Composite*.
- **Description** : type a description of the layer – this will appear on the report.
- **Thickness**: enter in millimetres, mm.
- **Thermal resistance**: enter in m^2K/W.
- **Vapour resistance**: (only required if you will be carrying out condensation risk analysis) enter in MNs/g.

  Where appropriate a composite material can be configured as a two-directional heat-flow product.

Fixed vapour resistance materials

Some materials – such as glass and metals – have vapour resistances which are effectively infinite, even if they are used in very thin layers. The *fixed vapour resistance* material type allows the thermal performance of these materials to behave in the same way as normal materials (changing according to the thickness), but allows their vapour resistances to be set as very high fixed values (typically 100.000 MNs/g.

As materials with fixed vapour resistances behave the same way as normal materials in thermal calculations you need only use the type in condensation risk calculations. A fixed vapour resistance material requires the following information:

- **Type**: select *Fixed vapour resistance*.
- **Description**: type a description of the layer – this will appear on the report.
- **Thickness**: enter in millimetres, mm.
- **Thermal conductivity**: enter in W/mK.
- The program calculates the **Thermal resistance** in m^2K/W.
- **Vapour resistance**: enter in MNs/g.

Membranes

Membranes, such as vapour control layers or vapour open roofing underlays, are treated as having no thermal resistance. The only property they have is their vapour resistance. Membranes require the following information:

- **Type**: select *Membrane*.
- **Description** : type a description of the layer – this will appear on the report.
- **Vapour resistance**: enter in MNs/g.



Membranes with low emissivity surfaces

Membranes have no direct effect on thermal calculations. However, a membrane which has one or two low emissivity faces may improve the thermal performance of a construction by increasing the resistance of adjacent cavities; that is addressed in the calculation by changing the resistance of the cavities, not the membrane.

Clear cavities

The thermal resistance of a cavity is not calculated directly from its thickness, but is usually entered as a default value, selected on the direction of heat flow and the thickness range. The Product Database contains standard resistances. Clear cavities, such as those in cavity walls, require the following information.

- **Type**: select *Clear cavity*.
- **Description** : type a description of the layer – this will appear on the report.

- **Thickness**: enter in millimetres, mm.
- **Thermal resistance**: enter in m^2K/W.

  Where the cavity has two directional heat-flow follow section 2.4 when setting the thermal resistance.
- **Vapour resistance**: cavities have a vapour resistance of 0.00 MNs/g.

The cavity resistance calculator (found to the right of the thermal resistance box - see Figure 2.4) uses the method in ISO 6946:2007 which is not employed in Australia and New Zealand.

2.5 Ground floor R-values

The standard method of calculating R-values has to be modified for suspended ground floors to take account of the underfloor void and the ground.

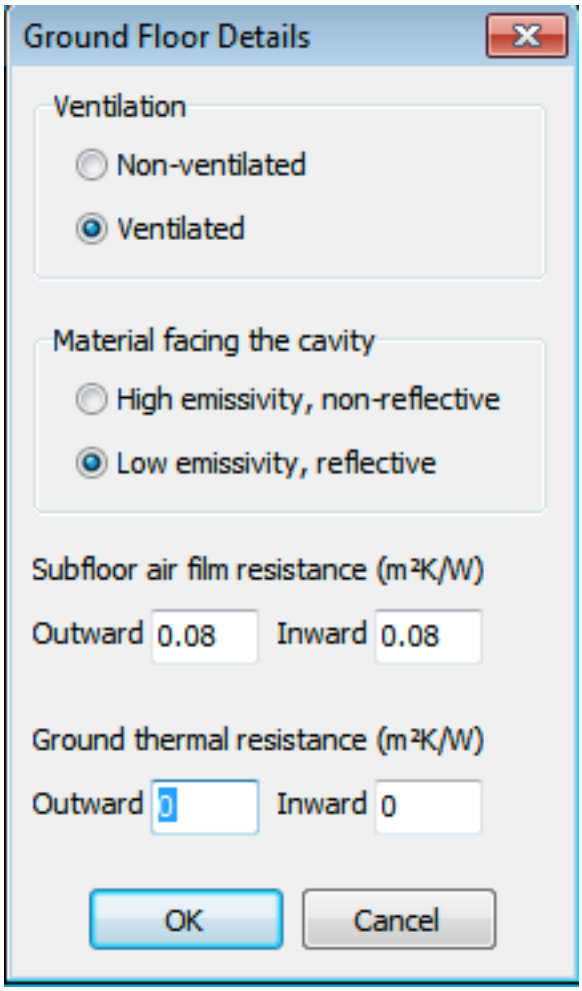


Figure 2.7: The Ground Floor Details dialogue for suspended ground floors

To calculate an R-value for a suspended ground floor:

1. Create a new U-value calculation in the **Project Manager** window and open it for editing (section 1.3).

2. Enter any project information in the **Project Information** dialogue (section 2.1).
3. In the **U-value Construction** dialogue set the *Element Type* to **Suspended ground floor**.
4. Click **OK**. The **Ground Floor Details** dialogue opens.
5. Enter the data for the ground (Figure 2.7).
    - Set the *Ventilation* of the sub-floor void as either **Non-ventilated** or **Ventilated**.
    - Set the characteristics of the *Material facing the cavity* as **High emissivity** or **Low emissivity**.
    - The program will display a set of default *sub-floor air film resistances* based on the ventilation and material selections. You can edit the default values if you need to.
    - Click **OK**.
6. Add the remaining layers of the floor construction.

Do not use this method to calculate R-values of floors over open or unheated spaces such as car parks or garages; instead select **Floor other than ground floor** in the Construction dialogue box and proceed as usual.

2.6 Creating reports

You can print R-value calculation reports or produce a PDF file which can be opened on any computer with the free Adobe Reader software installed. PDF files are ideal for emailing to people who need to see the results of the calculation but do not have JPA Designer. For both print and PDF the report includes:

- Project information;
- Details of the construction;
- A heat-out R-value calculation.
- A heat-in R-value calculation.

To print a report:

1. On the **File** menu click **Print** (or click the **Print** button on the tool bar).
2. The **Sections To Print** dialogue opens (Figure 2.8). If you have several user identities (see section 1.2) select the one you want to use in the report in the **Identities** list.

   *The **TIMSA** logo option is not relevant for Australia and New Zealand.*
3. If you want to include a watermark over the calculation tick **Print watermark text**. You can also modify the wording, angle and font size of the default text.
4. Click **OK**. The **Print preview** window opens.

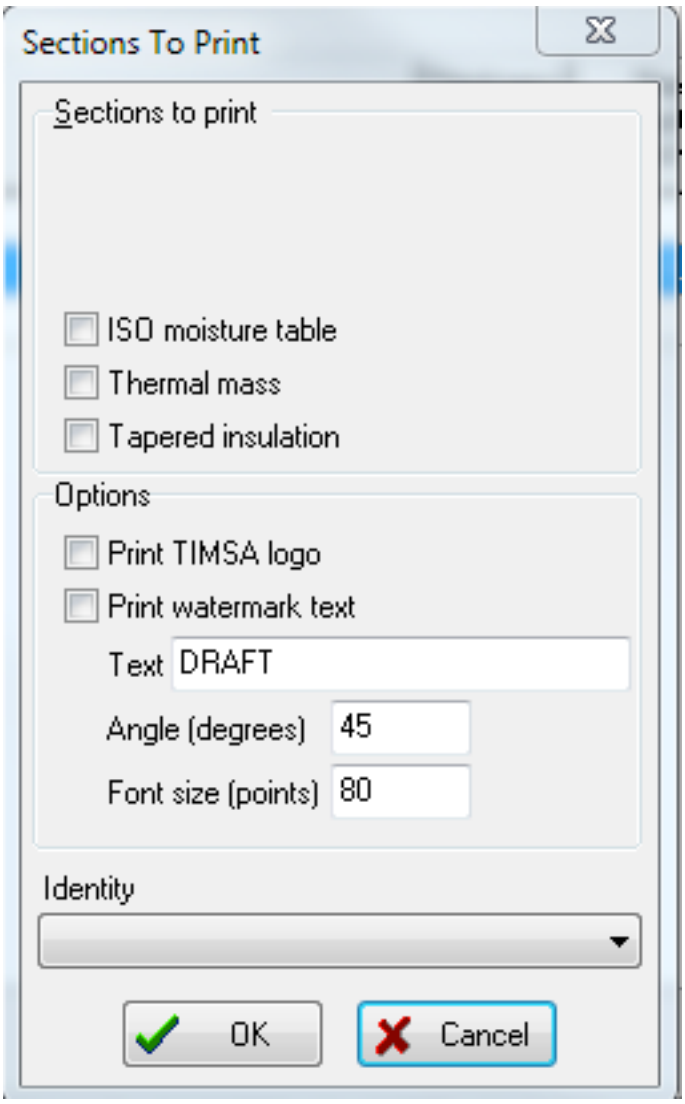


Figure 2.8: The Sections To Print dialogue



Figure 2.9: Print preview controls

5. Use the buttons on the tool bar to view successive pages of the report, then click the **Print** button to print the pages (Figure 2.9).

To create a PDF report:

1. On the **File** click **Create PDF**. A dialogue asks if you want to open the PDF when it is created.
2. Select **Yes** or **No**. The **Sections To Print** dialogue opens (Figure 2.8).
3. If you have several user identities (see section 1.2) select the one you want to use in the **Identities** list.

   *The **TIMSA** logo option is not relevant for Australia and New Zealand.*
4. If you want to include a watermark over the calculation tick **Print watermark text**. You can also modify the wording, angle and font size of the default text.
5. Click **OK**. The **Print preview** window opens.
6. Use the buttons on the tool bar to view successive pages of the report, then click the **Print** button to print the pages (Figure 2.9). The program will then create a PDF file of the calculation.

   *The name of the PDF file will include the JPA Designer file name and the calculation name, so the calculation **tile hung wall** in a project **The Meadows** will be called **The Meadows.JDPtile hung wall.PDF**.
7. The file will be saved into the JPA Designer program data folder or in the start-up folder you have specified (see section 1.3).

   Note: as Windows does not allow certain characters to be used in file names you should ensure the calculation names in JPA Designer do not contain those characters, otherwise PDF creation will fail. The restricted characters are: ' /\ : * ? < > |.

You can change the printer settings by selecting **File**>**Printer setup** from the menu bar.

It is also possible to produce PDF reports of all the R-value calculations at once. In the **Project Manager** window on the **File** menu click **Print all U-value calculations in this project to PDFs**. The program will then offer the **Sections to Print** dialogue before creating the PDFs.

Adding notes to reports

You can add notes to the report of a calculation, which can be used to explain particular features of the calculation or to highlight assumptions made within it.

To add notes open the **U-value construction** dialogue and click on the **Print Report Notes** tab. You can then enter your wording (Figure 2.10). The notes text will appear between the layers list and the final result.

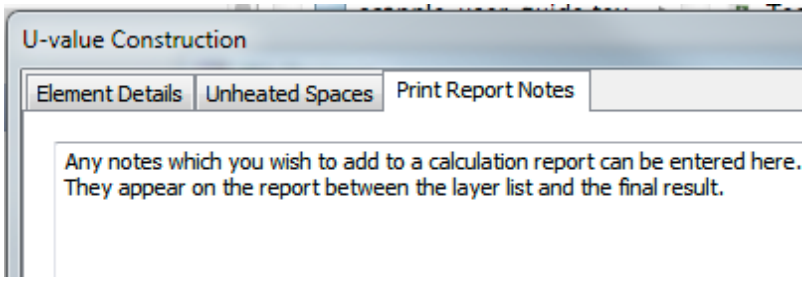


Figure 2.10: The Print Report Notes tab in the U-value Construction dialogue

Customising reports

You can control many aspects of the appearance of JPA Designer's calculation reports:

- Selecting the printer: In the U-value module select **File**>**Printer setup**. You can select the printer and paper source. It is possible to set the page orientation to landscape rather than portrait, but the reports are not designed for landscape format.
- Changing the font used in reports: In the U-value module select **File**>**Font**. Then in the **Font** dialogue. set the typeface, style and size. The default is Arial regular, 10 pt. Larger sizes may cause problems on the page with columns overflowing. Note also, that some fonts are wider than others, even at the same point size, so it worth testing font settings.
- Page margins: These are set in the **General** tab of the **Options** menu. There are two *Top* settings, one for the first page and one for the second page. This is to allow you to print calculations onto headed paper, with printing on the first sheet starting lower down the page.
- Adding your logo and address: You can add your logo and contact details to calculation reports: see section 1.2.
- Adding a disclaimer to be shown at the bottom of calculation reports: Enter the disclaimer text in the **U-value disclaimer** box on the **Options** dialogue **General** tab.
- Including the total construction thickness in the calculation report: In the **Other** tab of the **Options** dialogue tick **Print total thickness on U-value report**. The total thickness will then appear on calculation reports below the layer list.

2.7 Editing the Products database

To make U-value calculations easier all JPA Designer U-value modules include the **Products database**, which provides key data on generic construction materials and cavities,as well as data on branded products from a number of manufacturers. This section explains how you can add frequently used products to the database.

The materials within the database are organised into three categories:

- Branded products from manufacturers, shown in **bold** in the categories list;

- Generic materials, shown in normal type in the categories list;
- User-defined materials, shown in *italics* in the categories list.

Whilst you can create, edit and delete user-defined categories and materials, you can not edit or delete branded or generic categories or materials. However, you can clone a generic or branded material and make changes to the cone, leaving the original untouched.

To make changes to the **Products database** you must first open the **Edit database** dialogue (Figure 2.11) by selecting **Edit**>**Database** from the main menu.

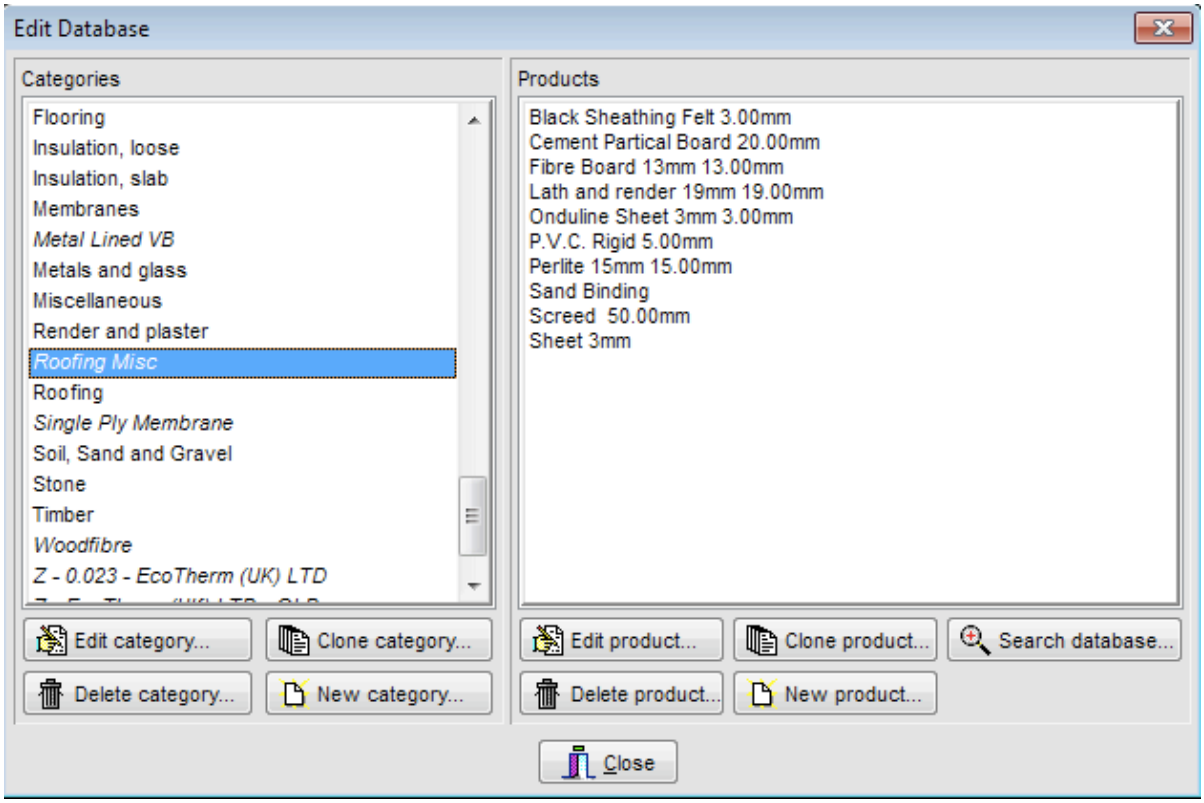


Figure 2.11: The Edit Database dialogue

To add a user defined category:

1. Click the **New category** button.
2. Enter the name of the category in the **New category** dialogue.
3. Click **OK**. The new category is created.

To rename an existing user defined category:

1. Select a category by clicking on it.
2. Click the **Edit category** button. The **Edit category** dialogue opens.
3. Enter a new name then click **OK**. The category is renamed.

To clone a category:

1. Select the category to clone by clicking on it.
2. Click the **Clone category** button. The **Clone category** dialogue opens.
3. Enter a name for the new category and click **OK**.
4. A new category will be created, containing copies of the original materials.

To delete a user defined category:

1. Select the category to delete.
2. Click the **Delete category** button. An **Information** dialogue asks you to confirm the deletion.
3. Click **Yes** to delete the category, **No** to keep it.

To insert a new material in a user-defined category:

1. Select the category in which you want to create the new material.
2. Click the **New product** button. The **Edit material** dialogue opens.
3. Complete the **Edit material** dialogue (section 2.4).
4. Click **OK**. The new product is added to the category.

To edit an existing user defined material:

1. Select the product you wish to edit.
2. Click the **Edit product** button. The **Edit material** dialogue opens.
3. Make the changes in the **Edit material** dialogue (section 2.4).
4. Click **OK**. The product information is updated.

To clone an existing product in a user defined category:

1. Select the product and click the **Clone product** button. A copy of the product will be inserted in the category.
2. Click on the clone to edit it.

To delete a product from a user-defined category:

1. Select the product you wish to delete.
2. Click the **Delete product** button. The product is deleted.

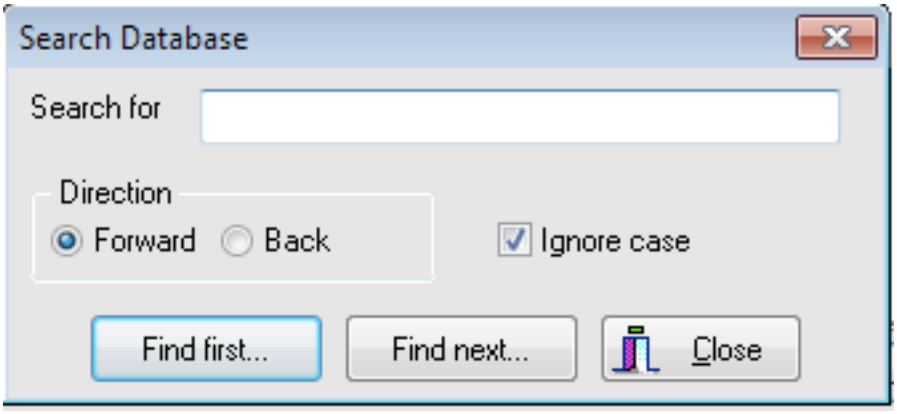


Figure 2.12: The Search Database dialogue

You can search the database to find specific products:

1. Click the **Search** button. The **Search Database** dialogue opens (Figure 2.12).
2. In the **Search Database** dialogue enter the text you want to search for and the direction the program should search through the database (*forwards* or *backwards*).
3. Tick the **Ignore case** box if you want the search to ignore capitals and lower-case letters.
4. Click **Find first** to start the search. The program will display the first matching product in the **Products** pane.
5. Click **Find next** to go on to the next matching product.
6. When you have found the product you want click **Close** to close the Search dialogue.

When you have finished working on the database, click the **Close** button to return to the main U-value window.

Short codes

You can assign codes to user defined materials as you enter them in the database. The short codes can then be used for rapid data entry using the Products database. You can also use short codes to determine the order in which products and materials are presented within categories, to speed up data entry for common constructions.

To sort the database by short codes you must first assign short codes to the materials; use a numbering system which matches the order in which you want the materials to appear. Once you have assigned short codes you should click on the **Sort on short code** tick box in the **Products database** dialogue (Figure 2.3).

3 Condensation risk

3.1 The problem of interstitial condensation

Condensation occurring within building elements – interstitial condensation – can cause substantial damage to the building fabric and reduce the effectiveness of thermal insulation[1]. By carrying out condensation risk analysis (CRA) you can identify constructions which are likely to be at risk of condensation and, where necessary, make modifications to the design.

JPA Designer assesses the risk of interstitial condensation using the steady-state method defined in ISO 13788:2012[2], which uses mean monthly temperatures and relative humidities to assess the risk of interstitial condensation over a twelve month period. The method provides a general assessment of suitability of the construction, but does not address air movement within the construction, nor does it take account of the effects of capillary moisture transfer.

[1] For further information on the causes and effects of condensation, and guidance on reducing problems see the ABCB handbook Condensation in Buildings, available here: http://www.abcb.gov.au/education-events-resources/publications/abcb-handbooks

[2] ISO 13788:2012 Hygrothermal performance of building components and building elements – Internal surface temperature to avoid critical surface humidity and interstitial condensation – Calculation methods.

3.2 Condensation risk analysis in JPA Designer

Condensation risk analysis determines whether condensation is likely to occur at the interfaces between the layers of material which make up the construction[3]. Using the hygrothermal properties of the materials (section 3.2) and the environmental conditions (section 3.2) the program looks at each interface in the construction and calculates:

- the amount of condensate deposited or evaporated during each month of a year;
- the maximum amount of moisture deposited;
- the accumulated mass of water compared to total evaporation during the year;
- the annual moisture balance.

You can then use the results to assess the suitability of the construction for that environment.

To carry out condensation risk analysis:

1. Define the element in the same way as you would for a thermal calculation (section 3.2).
2. Set the environmental conditions (section 3.2);
3. View the results (section 3.3).

For Australia and New Zealand, where cavities and insulants have different properties according to the direction of heat transfer, the condensation risk module has to select whether to use the heat-out or heat-in properties for analysis.

For each month the program compares the internal and external temperatures:

- where a month has a higher inside temperature the analysis uses the heat-out values of materials;
- where a month has a higher external temperature the analysis uses the heat-in values of materials.

Defining the construction

To carry out condensation risk analysis you must set the thermal resistance and vapour resistance of each layer which makes up the element, using the appropriate methods for each type of layer:

- *Normal* materials: Enter the **thickness**, **thermal conductivity** and **vapour resistivity**. JPA Designer will calculate the **thermal resistance** and the **vapour resistance**.

[3] The module can not carry out condensation risk analysis for ground floors, basements nor constructions containing variable layers; neither will it calculate the risk of surface condensation.

- *Composite* materials: Enter the **thermal resistance** and **vapour resistance**. Although the **thickness** is not required for the calculation, setting the **thickness** ensures the Dewpoint graph (Figure 3.4) looks right.
- *Fixed vapour resistance* materials: These are designed to be used in condensation risk analysis to represent materials such as metals which have very high resistances even when used in thin layers. Enter the **thickness**, **thermal conductivity** and the **vapour resistance**.
- *Membranes*: Enter the **vapour resistance**.
- *Cavities*: Enter the **thermal resistance**. The vapour resistance of a cavity is always zero. Enter the **thickness** to ensure the the appearance of the Dewpoint graph.

The data for each type of material and cavity is described in more detail in section 2.4. If you have already carried out thermal calculations on the same construction you need only check that the vapour resistivity or resistance figures are correct.

Units of vapour resistance and resistivity

JPA Designer uses the vapour resistivity with units of MNs/gm and vapour resistance with units of MNs/g. If material data is quoted as μ or s_d values, multiply by five to obtain the resistivity or resistance respectively. You can find guidance on converting from European units and from permeability and permeance figures in Annexes E.7 and E.8 of BS 5250:2011.

Environmental conditions

The condensation risk calculation requires mean monthly data for the external temperature and relative humidity and the internal temperature and relative humidity.

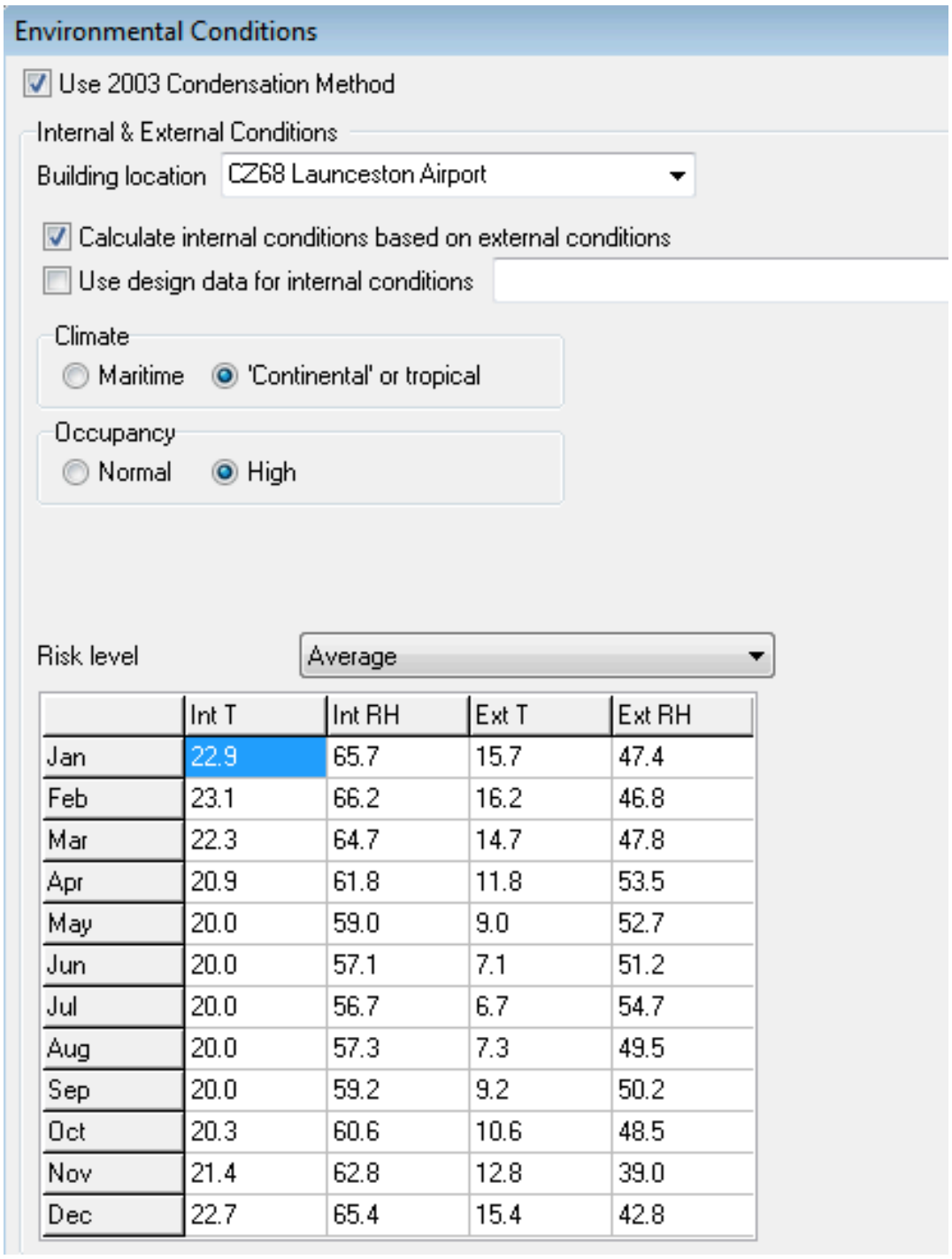
External temperature and humidity

The external conditions depend upon the building's location. JPA Designer includes external temperature and humidity data for each of the 69 climate regions in NatHERS as well as a number of weather stations., allowing you to select the nearest location to the project site. If you have environmental data for a location you can either enter that directly, or add it to the program's standard data sets.

Internal temperature and relative humidity

Internal environmental data can be:

- derived from the external conditions using the method in ISO 13788 Annex A.1. This is suitable for dwellings or offices with no air conditioning.
- entered as design conditions. This is intended for buildings with cooling and/or dehumidification systems. You can set design conditions for an individual calculation, or create and use a new data set (section 3.2).



	Int T	Int RH	Ext T	Ext RH
Jan	22.9	65.7	15.7	47.4
Feb	23.1	66.2	16.2	46.8
Mar	22.3	64.7	14.7	47.8
Apr	20.9	61.8	11.8	53.5
May	20.0	59.0	9.0	52.7
Jun	20.0	57.1	7.1	51.2
Jul	20.0	56.7	6.7	54.7
Aug	20.0	57.3	7.3	49.5
Sep	20.0	59.2	9.2	50.2
Oct	20.3	60.6	10.6	48.5
Nov	21.4	62.8	12.8	39.0
Dec	22.7	65.4	15.4	42.8

Figure 3.1: The Environmental Conditions dialogue

Setting environmental conditions

The environmental conditions for condensation risk analysis are set in the **Environmental Conditions** dialogue (Figure 3.1).

To set the environmental conditions:

1. On the **Edit** menu select **Edit environmental conditions**.
2. Select the **Building location** from the list. Once you have done that the external temperature and relative humidity columns are filled in.

   The list only shows locations for the selected region (section 1.3). The locations starting CZ are climate zones based on the NatHERS data set.
3. To derive the internal conditions from the external conditions:

   a) Tick **Calculate internal conditions based on external conditions,
   b) At *Climate* select **Continental or tropical**.
   c) At *Occupancy* select **Normal** or **High**.
   High occupancy will set a higher moisture load.
   d) The data in the internal temperature and relative humidity columns will be adjusted.
4. Alternatively, to select a data set for internal conditions:

   a) Tick **Use design data for internal conditions**.
   b) Select a set of conditions from the list.
   If the list does not have a suitable set of internal conditions you can create one: see section 3.2).
5. Ignore the **Risk level** list.

   a) The data in the internal temperature and relative humidity will be set.

Creating new data sets

You can build up and save sets of internal and external environmental conditions to use in condensation risk analysis. This is particularly useful when examining air-conditioned buildings which have design values for temperature and humidity.

User data is stored in a file **Env_user.txt** which is kept with the other user data files in **c:\ProgramData\JPA\JPA Designer** (file location correct for Windows 7 - see Technical note 2012/01 for other versions of Windows). Currently, the only way to add data sets is to edit **Env_user.txt** in a text editor, such as Notepad (Figure 3.2). Before editing **Env_user.txt** make sure JPA Designer is not running.

Within **Env_user.txt** the data for an external location or an internal design condition is on one line, with each line separated by a return. On each line, the different items of data are separated by the pipe character, |, with no spaces before or after the pipe. The final character on every line is also a pipe.

The data items are:

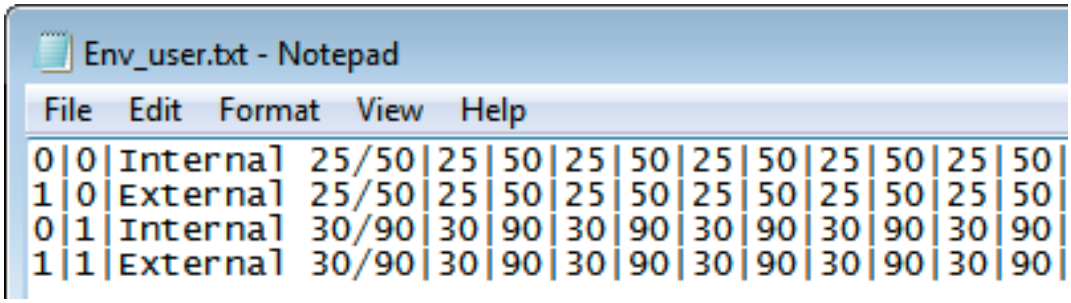


Figure 3.2: Editing the **Env_user.txt** file

- Item 1: whether the set is for internal conditions, 0, or external conditions, 1.
- Item 2: whether the set is system data, 0, or user data, 1.
- Item 3: a text description of the data set. This appears in the **Building location** or **internal conditions** lists, which are sorted alphabetically using the text description. This item can start with the tilde character (~), which does not appear on lists, but controls the way in which items 4–27 are interpreted.
- Items 4–27: these are the monthly temperature and relative humidity figures. Temperatures should be entered in degrees centigrade and relative humidity as a percentage. The order of the data depends on whether item 3 starts with a tilde (~).
  - If item 3 has a tilde the mean monthly temperatures should be entered in a sequence starting with January, followed by the relative humidity figures, starting with January (so: `Jan temp|Feb temp| … |December temp|Jan %rh|Feb %rh|` etc.)
  - If item 3 has no tilde the temperature and relative humidity values for each month should follow each other (so: `Jan temp|Jan rh|Feb temp|Feb %rh|` etc).
- Item 28: the country code. UK, 0. Republic of Ireland, 1. Australia, 2. New Zealand, 3. Asia, 4. Middle East, 5.
- Item 29: applies to external environmental sets and indicates whether internal conditions should be calculated on the basis of continental conditions, 1, or maritime conditions, any other value. This item is used only when internal conditions are to be derived from the external conditions: it is not used if fixed internal conditions are specified.

As an example:

`1|1|Newcastle Airport|3.4|92|…|4.2|89|0|0|`

This shows:

- External data (1).
- User data (1)
- Location, with no tilde.

- Paired monthly values for temperature (3.4 and 4.2) and relative humidity (92 and 89).
- UK (0)
- Maritime climate (0).

Once the environmental conditions have been entered and saved in **Env_user.txt** and JPA Designer started, the new data sets will show up in the **internal conditions** list. Note that the conditions will only show if their region matches the region selected for analysis.
If there are several users of JPA Designer within the same organisation the **Env_user.txt** file can be set up on one PC then copied to the others, ensuring everyone is using the same data sets.

3.3 Viewing results

You can view the results of condensation risk analysis in three formats:

- As month by month data, in the ISO Condensation Table (section 3.3).
- As a graph, in the Dewpoint graph (section 3.3).
- In summary form, in the Results table (section 3.3).

ISO Condensation Table

The **ISO Condensation Table** shows the amount of condensate predicted at each interface in the construction, and is the most accurate means of viewing the results of an analysis to ISO 13788.
To view the **ISO Condensation Table**: on the **View** menu select **ISO Condensation Table**r. The upper part of the window (Figure 3.3) shows the interfaces within the construction. When you select an interface by clicking on it, the lower half of the table shows the amount of condensation predicted at that interface. It shows the amount of condensate deposited or evaporated each month, **gc**, and the accumulated condensate at the end of each month, **Ma**, both measured in g/m^2. A negative amount of condensate indicates the amount of moisture predicted to evaporate in that month.
The results always start with the first month in which condensation is predicted: if no condensation is predicted in any month results start with January. Guidance on interpreting results is given in ISO 13788 and BS 5250.

The Dewpoint graph

In condensation risk analysis the *dew point* is the temperature at which air would be saturated with vapour. Condensation occurs when the temperature at a point with in the construction drops below dew point and the air cannot support all the water vapour, resulting in some of the excess being deposited as liquid water.
The **Dew point graph** is a visualisation of the relationship between the predicted temperature through an element and the dew point. The orientation of the **Dew point graph** is determined by the building element: walls are shown with layers running vertically and roofs with layers running horizontally.
The graph shows two lines:

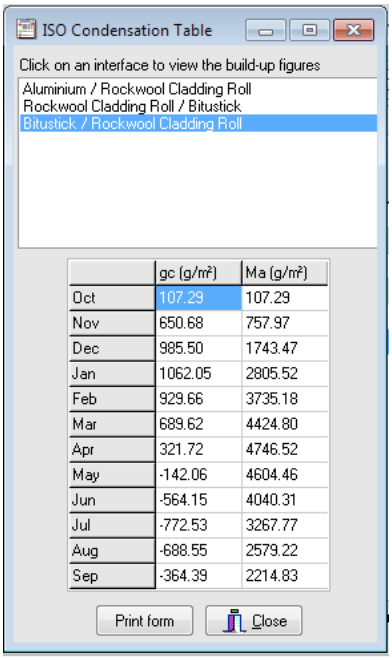


Figure 3.3: ISO 13788 Condensation table

- the temperature gradient through the construction, calculated for each interface, shown in red; and,
- the dew point at each interface, shown in blue.

The lines are plotted for the month with the worst condensation conditions.

Where the two lines do not touch the actual temperature is above dew point and no condensation is predicted at those interfaces. Condensation is predicted at any interface where the two lines touch (see Figure 3.4). Note that the actual temperature will never be lower than the dewpoint and the lines will never cross.

To open the **Dewpoint graph**:

- on the **View** menu select **Dewpoint graph**; or,
- click the Dewpoint graph button on the tool bar.

To view the results for the month with the greatest evaporation, click the *Summer* button in the **Results to show** section.

The Results table

The **Results Table** shows the headline results for each interface in the construction. To view the **Results table**: on the **View** menu click **Results Table**. When the table is open click the **Always on top** box to keep it visible on screen while you continue to work on the calculation. When you have finished, click **Close** to close the Results Table.

For calculations to ISO 13788 the significant columns are:

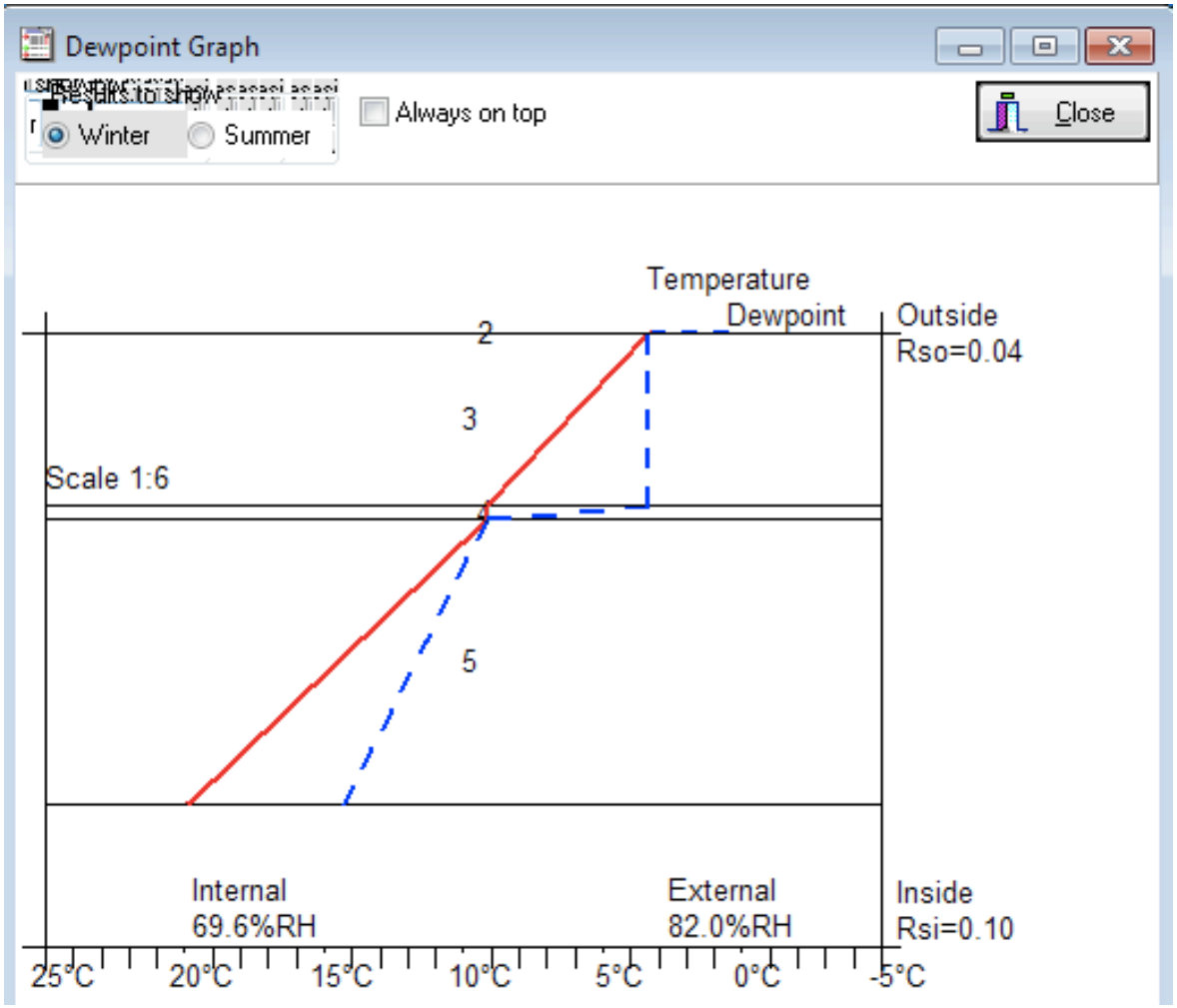


Figure 3.4: Dewpoint graph for a roof with condensation predicted at the interface between layers 4 and 5

- **ISO - Winter worst build up**: the month in which the highest amount of condensate is predicted to be deposited;
- **ISO - Winter peak build up**: the month which sees the highest cumulative amount of condensation.

For each column the amount of condensate is shown in grams per square metre g/m^2. The result *n/a* means no condensation is predicted at that interface. You can see more detailed results in the **ISO Condensation table.**

Producing reports

The results of condensation risk analysis can be printed or produced as PDF files in the same way as the results of thermal calculations (section 2.6).

The main differences are:

1. Before starting to print or create a PDF, tick the **Condensation risk** box on the status bar at the bottom of the main **U-value** window.

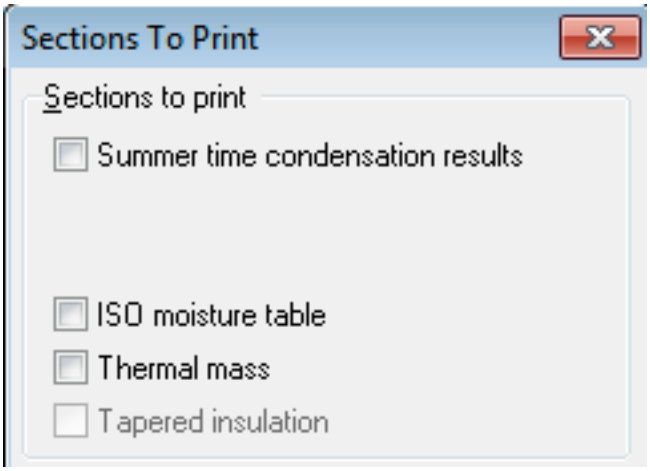


Figure 3.5: The Sections To Print dialogue for condensation risk reports

2. In the **Sections To Print** dialogue review whether you want to print the summer-time condensation results and the ISO moisture table and tick the appropriate boxes.

3.4 Using the BS 5250:1989 calculation method

The BS 5250:1989 Appendix D method is based on the same underlying principles as the method set out in ISO 13788, but analyses condensation risk for a 60 period rather than the whole year and reports results in a different way. The Appendix D method is no longer referred to by building regulations and standards, but is still available within JPA Designer.

To use the BS 5250: 1998 calculation method open the **Environmental conditions** dialogue and untick **Use 2003 condensation method**. The dialogue box will now show the environmental data for the BS 5250:1989 method.

External conditions

The program sets standard values for external environmental conditions, following BS 6229:1982 and BS 5250:1989, which are:

- summer temperature: 18ºC.
- winter temperature: 5ºC.
- summer relative humidity: 65%.
- winter relative humidity: 95%.

If you need to calculate condensation risk for other external environments you can change the standard values by typing new values into the text boxes. To return to the default values for external environmental conditions click the **Default** button.

Build-up of condensate is assessed over a standard 60 day winter period: that value can be changed using the **Condensation build up period** box.

Internal conditions

The internal temperature and relative humidity values will be determined largely by the building use. You can enter design data or measured values in the four boxes, or select one of the pre-defined building use groups listed in **Building Use**, which are taken from BS 5250 and BS 6229, Table 7.

BS 5250:1989 results

Once you have set the environmental conditions you can view the calculation results using the **Results table** (section 3.3) and the **Dewpoint graph** (section 3.3). On the results table the important columns are:

- **Winter buildup** which shows the build up of condensate over the 60 day winter period; and,
- **Annual buildup** the amount of condensate carried over into the next year. A negative figure indicates there is no condensation carried forward.

Both figures are given in g/m^2.

Calculation options

The BS 5250:1989 method does not allow for the removal of moisture by air movement, however, the standard suggests some indication of the effect of vented cavities can be obtained by assuming the air in the cavity is at outside conditions. This can done by setting to zero the vapour resistances of the materials to the outside of a cavity.

For an explanation of the limitations of this technique please refer to BS 5250: 1989 page 76.

To use this option in JPA Designer:

1. In the **Options** dialogue go to the **Other** tab.
2. Tick **Set vapour resistance of layers above vented cavity to zero**.
3. Open the condensation risk calculation.
4. Double click on the cavity layer.
5. In the **Edit material** dialogue set the cavity type to **vented cavity**.

The program will set the vapour resistance of the layers outside the cavity to zero.