

# Course Syllabus: Introduction to Using THERM to Model Thermal Bridges

Approximate time required to complete each section is given in brackets in the title.

## 1. How to Use This Course (60 Minutes)

An explanation of how the course works and how to set up THERM.

## 2. Learning Objectives (5 Minutes)

Thermal bridges are one of the key ways that buildings lose heat and understanding them is critical to designing low energy buildings. This course aims to explain:

- why they are significant
- how they vary
- the concepts of calculation
- how to calculate them using the THERM software

The course presumes that the student is a Passivhaus designer/consultant, or has a similar level of understanding of building physics.

## 3. Introduction (60 Minutes)

This topic gives an introduction to thermal bridging. It looks at:

- examples of significant thermal bridges
- problems associated with thermal bridges
- significance of thermal bridges in energy assessments
- thermal bridging as an additional heat loss - the difference between "simple" heat loss and "actual" heat loss

## 4. Heat Loss Calculations (20 Minutes)

This topic introduces the concept of thermal bridges as a correction to heat loss calculations.

The learning objectives are to understand:

- Thermal bridges are a component of a building heat loss calculation.
- Thermal bridges, together with simple heat loss ( $U$  value  $\times$  Area), make up the total fabric heat loss.
- The area used in simple heat loss can be measured internal or externally, giving different results for simple heat loss.
- As a result, thermal bridge correction values ( $\psi$  values) must be calculated to correct either internal or external measurements

## 5. Exercise 1 – Wall Corner Junction (60 Minutes)

This example guides you through modelling a basic thermal bridge in THERM and calculating the associated  $\psi$ -value. The learning objectives are:



- Start using THERM.
- Calculate a psi value for a basic thermal bridge.
- Review the concept of thermal bridges as a correction to simple heat loss.

## 6. Exercise 2 – Combined Thermal Bridge (60 Minutes)

This example explains how to change a material in a THERM model and calculate the new Psi-value. The learning objectives are to understand:

- how to change a material
- the effect of material choice on internal and external Psi-values
- that Psi-values correct errors in both the U-value and area component of simple heat loss. These are known as construction and geometric corrections, respectively.

We will also review exercises 1 and 2, as well as going through some examples of thermal bridges to see whether the resulting Psi-value will be a geometric or construction correction (or both).

## 7. Conventions and Software (30 Minutes)

The learning objectives of this topic are to understand the most useful conventions covered in EN ISO 10211, Linear Thermal Bridges:

- cut-off or adiabatic planes
- simplification
- quasi-homogeneous
- air cavities
- surface resistances
- input and output data requirements
- linear and point thermal bridge derivation equations
- error estimating

## 8. Exercise 3 – Gable Wall to Roof Junction (120 Minutes)

The exercise will guide delegates through:

- Modelling and calculating the Psi-value for a more realistic construction junction - a gable cavity wall to loft insulated roof join.
- Using the THERM Report function to export the results to the WARM "Psi from THERM.xls" spreadsheet.
- Completing the spreadsheet to calculate the Psi-value and document the results.

## 9. Exercise 4 – Ground Floor to Wall Junction (120 Minutes)

This exercise is designed to introduce how we include the insulating effect of the ground, in this instance the more complicated situation of a suspended floor.

The learning objectives are:

- Learning rules for modelling ground according to EN13370
- Further practice at THERM drawing, particularly at large scale.
- Understanding the method of calculating the void temperature for suspended floors



## 10. Exercise 5 – Window Installation (40 Minutes)

The junction between a window or door and the surrounding wall or roof can form the largest thermal bridge in a building. This exercise shows the "short form" method of calculating a window installation psi value.

The full form requires that you model all of the window, glass, spacer etc, which is a very complicated and time consuming process. The short form gives you a good enough answer quickly by simplifying the window frame to a rectangle, and inserting it into the wall or roof.

Learning outcomes of this exercise:

- Gain an understanding of how to calculate an equivalent thermal conductivity.
- Use THERM to calculate a window installation thermal bridge.

## 11. Thermal Bridges in Building Regulations Part L (10 Minutes)

This section is in note form only and gives an overview of how thermal bridges are considered in SAP.

## 12. Thermal Bridges in The Passivhaus Planning Package (PHPP) (10 Minutes)

This section is in note form only and gives an overview of how thermal bridges are considered in Passivhaus design, and how to enter them into the PHPP.

## 13. End-of-Course Exercise (180 Minutes)

The end-of-course exercise is a test of your understanding after completing the whole course. You are given a wall-floor junction detail to model and obtain a  $\psi$  value for, and this is self-marked against the  $\psi$  values given in the answers section. A video solution is given at the bottom of the section.

You are then asked to modify the detail to improve the  $\psi$  value. Our own modified detail can be downloaded, along with an example THERM calculation.

## 14. Final Notes

Links to further resources.