



Energy Efficiency Best Practice in Housing Whole House Boiler Sizing Method for Houses and Flats



This 'whole house' procedure provides the busy heating installer with a simple method of sizing which is both quick and easy to use.

Good boiler sizing leads to:

- lower installed costs
- higher boiler efficiencies
- lower running costs
- reduced emissions to the environment



The aims of this method

Replacement boilers are rarely sized correctly. Oversized boilers cost more to purchase and generally operate less efficiently resulting in higher running costs and increased emissions to the atmosphere. This 'whole house' procedure provides the busy heating installer with a simple but reasonably accurate method of sizing which is both quick and easy to use.

This method is aimed at typical dwelling types found in the UK as indicated by the U-values and window areas in the tables opposite. Where the dwelling is untypical, then a more detailed procedure should be used. The method should only be used for gas, oil and LPG boilers up to 25 kW and should not be used for combination boilers or solid fuel heating systems. It is based on a number of assumptions:

- a design internal temperature of 21°C (included in the location factor)
- design external temperatures, dependent on the location of the property (included in the location factor)
- an allowance of 10% for intermittent heating (included in the location factor)
- an allowance of 5% for pipe losses (included in the location factor)
- a ventilation rate of 0.7 air changes per hour (included in the 0.25 ventilation factor)
- an allowance of 2 kW for heating hot water

Instructions

Complete section 1 to 7 by filling in the shaded boxes from actual measurements, or from the tables. The unshaded boxes should be filled by calculation.

Assess the shape of the house

- A** Simple rectangular shaped dwellings can be covered by the worksheet opposite.
- B** Small extensions or loft conversions, with up to two radiators, simply note the radiator output and add them in at section 7 of the worksheet and use the worksheet for the remainder of the house.
- C** More complicated dwelling shapes should be divided into rectangular boxes. Use a separate worksheet for each main box (e.g. divide an L-shaped property into two boxes, and do two calculations).

Section 1

Take internal measurements (in metres) of the overall length, width and room height.

The width is generally taken across the front of the property and the length is a front-to-back measurement. Also note the type of dwelling, the number of floors (excluding any loft conversion) and the number of external walls along the length and width.

Section 2

Calculate the total external wall area (including windows) in square metres. Count the number of 'length' external walls along the length measurement and the number of 'width' walls along the width measurement, e.g. a semi-detached will have only one external wall along its length but two along its width. The wall is not regarded as external where any extensions join the main property. Where there is a single storey extension on a two storey house then take half the wall area as external. The whole wall is still regarded as external when it is attached to an unheated garage.

Section 3

Using values from tables 1, 2, and 3, calculate the heat losses from the windows and masonry walls.

If the property has an unusually large number of windows then use the actual window area taken from measurements.

Section 4

Calculate the roof and floor areas using the length and width. If the dwelling is a mid or bottom flat then use a **roof** area of zero. If it is a mid or top flat then use a **floor** area of zero. Calculate the heat losses from the floor and roof using table 4.

Section 5

Add boxes A, B, C, and D and multiply by the location factor from table 5 to reach the overall heat losses from conduction through the fabric. This factor includes an allowance for design temperatures, intermittent heating and pipe losses.

Section 6

Using the floor plan area, calculate the volume of the dwelling. Calculate the overall ventilation heat losses again using the same value from table 5.

Section 7

Calculate boiler output (in kW)

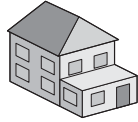
- Add the fabric (E) and ventilation (F) losses and a further 2000 Watts for heating hot water.
- Add in the results of any separate worksheets for extensions or box-shapes identified in stage 1.
- Simply add in the radiator outputs (in Watts) for loft conversions or small extensions.
- This gives the required boiler output in Watts. To convert to kW divide by 1000. This calculation worksheet includes all the necessary factors and no further additions should be made to the end result. Choose a boiler that is closest, but above, the calculated output, eg for a calculated output of 8.7 kW install a 9 kW boiler.

Boiler sizing worksheet

Assess the dwelling shape



A. Simple rectangular dwelling
Use worksheet alone.

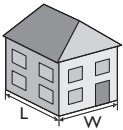


B. Extension and loft conversions
Use worksheet and add on radiators sizes in section 7.



C. Non-rectangular dwelling
Divide into sections and repeat calculations.

1. Take three measurements (in metres)



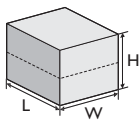
Length

Room height

Width

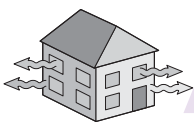
Number of floors

2. Calculate TOTAL external wall area



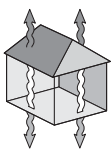
$$\begin{array}{l} \text{Width} \times \text{No of ext walls} = \text{ } \\ \text{Length} \times \text{No of ext walls} = \text{ } \end{array} \quad + \quad \text{Room height} \times \text{No of floors} = \text{Total ext. wall area m}^2$$

3. Calculate wall and window heat losses



$$\begin{array}{l} \text{Total ext. wall area} \times \text{Table 1} = \text{Window area} \times \text{Table 2} = \text{A Window heat loss} \\ \text{Total ext. wall area} - \text{Window area} = \text{Wall area} \times \text{Table 3} = \text{B Wall heat loss} \end{array}$$

4. Calculate floor and roof heat losses



$$\begin{array}{l} \text{Length} \times \text{Width} = \text{Roof area} \times \text{Table 4} = \text{C Roof heat loss} \\ \text{Length} \times \text{Width} = \text{Floor area} \times 0.7 = \text{D Floor heat loss} \end{array}$$

5. Add up fabric heat losses

$$\text{A} + \text{B} + \text{C} + \text{D} = \text{ } \times \text{Table 5} = \text{E Total fabric heat loss (W)}$$

6. Calculate ventilation heat loss



$$\text{Floor area} \times \text{Room height} \times \text{No of floors} = \text{Volume} \times 0.25 \times \text{Table 5} = \text{F Ventilation heat loss (W)}$$

7. Calculate boiler output (in kW)

$$\text{E} + \text{F} = \text{ } + \text{2000 Water heating (W)} = \text{ } + \text{ } \text{Add in any extension From separate worksheet or radiators sizes} = \text{ } \text{Divide by 1000 to get kW} \text{ BOILER OUTPUT}$$

Worksheet _____

Date _____

Sheet _____ of _____

Name _____

Address _____

Type of dwelling _____

Table 1 Window Factors

Detached	0.17
Semi-detached	0.2
Mid terrace	0.25
Flat	0.25

Table 2 Window U-Values

Double glazed wood/plastic	3.0
Double glazed metal frames	4.2
Single glazed wood/plastic	4.7
Single glazed metal frames	5.8

Table 3 Wall U-Values

Filled cavity wall	0.45
Unfilled cavity wall	1.6
Solid wall 220 mm	2.1

Table 4 Roof U-Values

Pitched < 50 mm insul.	2.6
Pitched 50-75 mm insul.	0.99
Pitched > 75 mm insul.	0.44
Flat uninsulated	2.0
Flat 50 mm insul.	0.54

Table 5 Location Factors

North & Midlands	29
Northern Ireland	26.5
Scotland	28.5
South East & Wales	27
South West	25



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