Appendix S: Reduced Data SAP for existing dwellings

Changes for this update are highlighted in GREEN.

Reduced Data SAP (RdSAP) has been developed by government for use in existing dwellings based on a site survey of the property, when the complete data set for a SAP calculation is not available. It consists of a system of data collection (defined in Table S19) together with defaults and inference procedures, as defined by the rules given in this Appendix, that generate a complete set of input data for the SAP calculation. For any item not mentioned in this Appendix, the procedures and data given elsewhere in this document apply.

The calculation starting from reduced data is done in two stages. First the reduced data set is expanded into a full data set (see S14 for rounding rules), and then the SAP calculation is undertaken using the expanded data set. The actual SAP calculation is therefore identical, whether starting from a reduced data set or a full data set.

This Appendix forms part of SAP 2012 and provides a methodology for existing dwellings that is compliant with the Energy Performance of Buildings Directive. It is not appropriate for new dwellings for which all data for the SAP calculation should be acquired related to the dwelling concerned.

This Appendix contains the data and rules for expanding the data collected in a Reduced Data survey into the data required for the SAP calculation. Information in shaded boxes is primarily concerned with data collection and is addressed to energy assessors.

Table S19 lists the Reduced Data set.

Reduced Data SAP is for existing dwellings only. Any new dwelling, including (except in Scotland) dwellings created by change of use, must be assessed using SAP.

S1 Dwelling types

Dwellings are classified as one of
- house
- bungalow
- flat
- maisonette
- park home

and one of
- detached
- semi-detached
- mid-terrace
- end-terrace
- enclosed mid-terrace
- enclosed end-terrace

A house or bungalow has a complete heat loss ground floor and a completely exposed roof. A dwelling without a heat loss floor cannot be a house and must be treated as a flat or maisonette. A flat or maisonette does not have both a heat loss ground floor and a heat loss roof.

RdSAP makes no distinction between a flat and a maisonette as regards calculations; it is acceptable to select either type as definitions vary across the UK.

'Enclosed' is typically applicable for 'back-to-back' terraces and has the following meaning:
- mid-terrace has external walls on two opposite sides;
- enclosed mid terrace has an external wall on one side only;
- end-terrace has three external walls;
- enclosed end-terrace has two adjacent external walls.

Many dwellings have one or more extensions either added onto the main part, or built at the same time but of different construction or insulation. In these cases, dimensions and constructional details of the main part of the dwelling and each extension are recorded separately, to allow the assignment of different U-values to the original and to the extension. In addition, dwellings can have a different construction for some parts of the walls (for example, a timber framed bay window in otherwise masonry construction). These are recorded as a separate constructional element, termed 'alternative wall'. If the area of an alternative wall is less than 10% of the total wall area it can be disregarded.

S1.1 Park homes

The Energy Performance of Buildings regulations do not require an EPC for a park home. However, data are provided to enable the assessment of a park home.

S1.1.1 Data for park homes

The following data items apply to a park home.

Data items for park homes	
Data item	**Options**
Built form	Detached only
Measurements	Internal or external
Number of storeys	1 only
Number extension	Up to 4. Extensions must have park home attributes (wall, floor and roof types)
Habitable rooms	Up to 99
Roof type and insulation	Pitched access Pitched no access • Insulation at joists – use Table S9 if measured or documentary evidence of insulation thickness; otherwise Table S10 • Insulation at rafters – use Table S10 (park home column) • Unknown – use Table S10 park home column • As built – use Table S10 park home column • None Pitched sloping ceiling Flat As built – use Table S10 park home column o Unknown – use Table S10 park home column
Roof rooms	Disallowed
Walls	Park home wall only
Party walls	None – no party wall
Wall thickness	Measured or default from Table S3
Dry lining	Disallowed
Wall insulation	As-built Unknown Internal (U-value entry only) External (U-value entry only)
Alternative walls	No alternative wall
Floor	Ground Suspended timber only U-value entry possible.
Floor insulation	As built Unknown Retro- fitted (U-value entry only)
Glazing	Always much more than typical and measure all windows
Heating and hot water	All options as normal
Conservatory	Possible (one storey)
Open fireplaces	Always none
Ventilation	Always natural

S1.1.2 Insulation improvements for park homes

For the assessment of improvement measures for park homes the improved U-value of its wall, floor or roof is calculated using:

$$U_{insulated} = \frac{1}{\frac{1}{U_{existing}} + R_{ins}}$$

where $U_{insulated}$ is the improved U-value, $U_{existing}$ is the U-value of the existing element and R_{ins} is the thermal resistance added.

S2 Age bands

A set of age bands is defined according to Table S1 for the purposes of assigning U-values and other data.

Table S1 : Age bands

	Years of construction			
Age band	**England & Wales**	**Scotland**	**Northern Ireland**	**Park home (UK)**
A	before 1900	before 1919	before 1919	-
B	1900-1929	1919-1929	1919-1929	-
C	1930-1949	1930-1949	1930-1949	-
D	1950-1966	1950-1964	1950-1973	-
E	1967-1975	1965-1975	1974-1977	-
F	1976-1982	1976-1983	1978-1985	before 1983
G	1983-1990	1984-1991	1986-1991	1983-1995
H	1991-1995	1992-1998	1992-1999	(not applicable)
I	1996-2002	1999-2002	2000-2006	1996-2005
J	2003-2006	2003-2007	(not applicable)	(not applicable)
K	2007-2011	2008-2011	2007-2013	2006 onwards
L	2012 onwards	2012 onwards	2014 onwards	(not applicable)

From the 1960s, constructional changes have been caused primarily by amendments to building regulations for the conservation of fuel and power, which have called for increasing levels of thermal insulation. The dates in Table S1 are generally one year after a change in regulations, to allow for completion of dwellings approved under the previous regulations.

For a conversion which was a change of use (e.g. barn converted to dwelling) or where a dwelling has been sub-divided (e.g. house to flats) use the original construction date, unless there is documentary evidence that all thermal elements have been upgraded to the building regulation standards applicable at the conversion date. Enter insulation levels only for those elements for which evidence is available.

Age band L can apply to extensions added to an older property.

S3 Areas

Areas are determined separately for the main part of the dwelling and any extension. Horizontal dimensions can be measured either internally or externally.

The measurements required are the floor area, exposed perimeter, party wall length and room height on each storey. Exposed perimeter includes the wall between the dwelling and an unheated garage or a separated conservatory and, in the case of a flat or maisonette, the wall between the dwelling and an unheated corridor.

Internal dimensions are permissible in all cases. In the case of a house or bungalow external dimensions for area and perimeter are usually more convenient, except where access to all sides of the building is not possible or where there are differing wall thicknesses or other aspects that would make the dimensional conversion unreliable. When using external measurements for a dwelling joined onto another dwelling (semi-detached and terraced houses) the measurement is to the mid-point of the party wall. Flats and maisonettes are usually measured internally (although it is not a requirement of the specification that internal measurements are always used and if measured externally the measurement is to the mid-point of the party wall). Whichever is chosen the same basis must be used for all parts of the dwelling. Party wall length uses the same basis as exposed perimeter.

Room heights are always measured internally within the room.

State on site plans whether the dimensions recorded are external or internal. Where a combination of external and internal is used this must be made clear for each dimension indicated.

When measuring internally, measure between the finished internal surfaces of the walls bounding the dwelling. Where that cannot be done directly (i.e. when measuring room by room) include an allowance for the thickness of internal partitions.

Measure all perturbations (e.g. bay windows) but disregard chimney breasts unless assessor considers significant e.g. large inglenook.

Vertical dimensions (room heights) are always measured internally within the room. Also, the floor area of room(s)-in-roof are always measured internally (irrespective of the dimensions basis for other storeys).

Measure lengths to one decimal place (0.1 m) or better. Retain higher precision when that has been measured (especially room heights).

If there is an alternative wall, it is identified as being part of the external wall of main dwelling or of one of the extensions. When calculating the area of alternative wall exclude the area of any windows and doors contained within it.

Include the length of party wall between the dwelling being assessed and another heated space which can be:
- another dwelling
- commercial premises
- a heated corridor or stairwell in a block of flats
- a heated common area

S3.1 Definition of the extent of the dwelling

Generally rooms and other spaces, such as built-in cupboards, are included as part of the dwelling where these are directly accessible from the occupied area of the dwelling, whereas unheated spaces clearly divided from the dwelling are not.

Basements

Include in the assessment when accessed via a permanent fixed staircase such that one is able to walk downwards facing forwards and either:-
- basement is heated via fixed heat emitters, or
- basement is open to the rest of the dwelling, i.e. no door.

A basement does not necessarily contain habitable rooms.

Do not mix internal and external measurements. If a basement is included in the assessment, it is likely that internal dimensions will be used throughout the dwelling.

Attics and roof rooms

Include in the assessment when accessed via a permanent fixed staircase such that one is able to walk downwards facing forwards. Does not necessarily contain habitable rooms.

For a roof room to be classed as such and not a separate storey, the height of the common wall must be less than 1.8 m for at least 50% of the common wall (excluding gable ends or party walls). The common wall is a vertical continuation of the external wall of the storey below.

There is no explicit allowance for dormer windows except to include in the floor area of the roof rooms.

See Figures S1 and S2 (next page).

Rooms within a Mansard roof

A storey having non-vertical walls of at least 70° pitch constitutes a separate storey; it is not treated as roof rooms. Use alternative wall if appropriate.

Whole dwelling within roof

When property is a single storey entirely located within a roof, enter it as:
- lowest occupied level
- timber frame construction of appropriate age band
- room height 2.2 m
- include area and perimeter measurements as a normal storey
- enter roof as pitched roof.

If there are two storeys within roof, enter the lower storey as above and the upper storey as rooms-in-roof.

S3.2 Illustrations of roof rooms

The following are all classified as roof rooms:

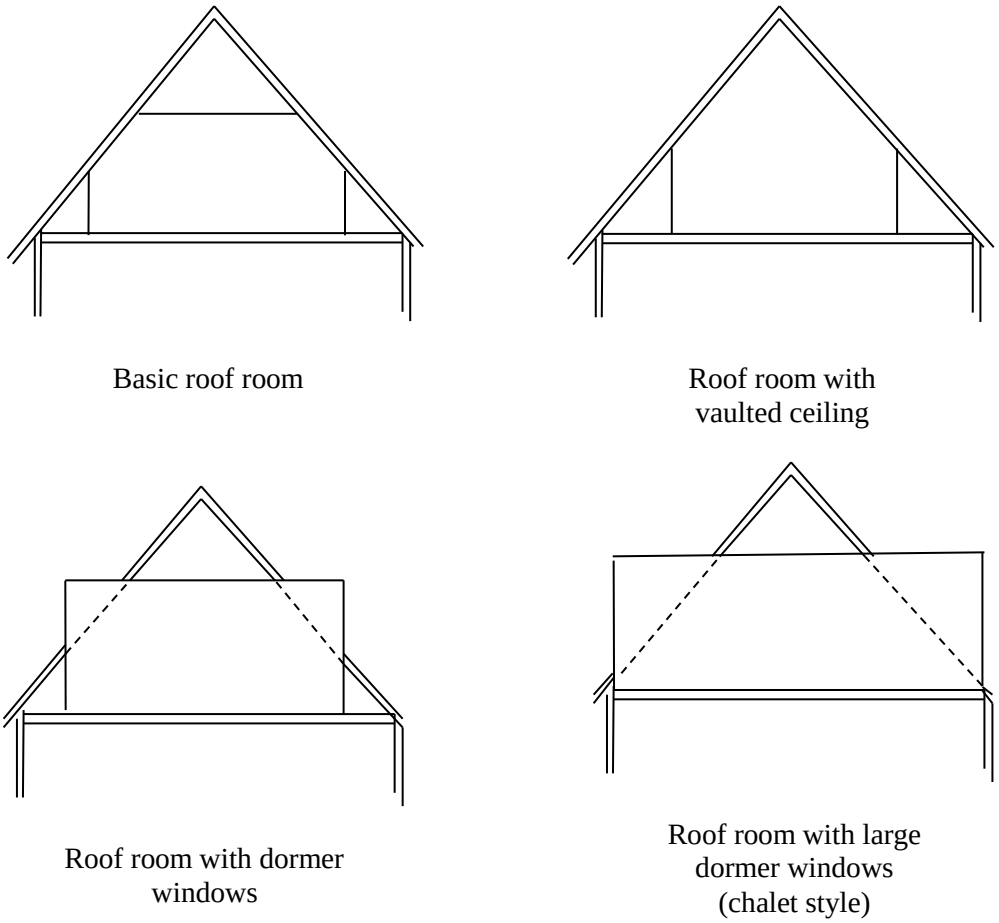

Figure S1 : Roof rooms

Where there is a common wall it is:
- a roof room if the height of the common wall in the upper storey is less than 1.8 m;
- a separate storey if greater or equal to 1.8 m:

as illustrated in Figure S2.

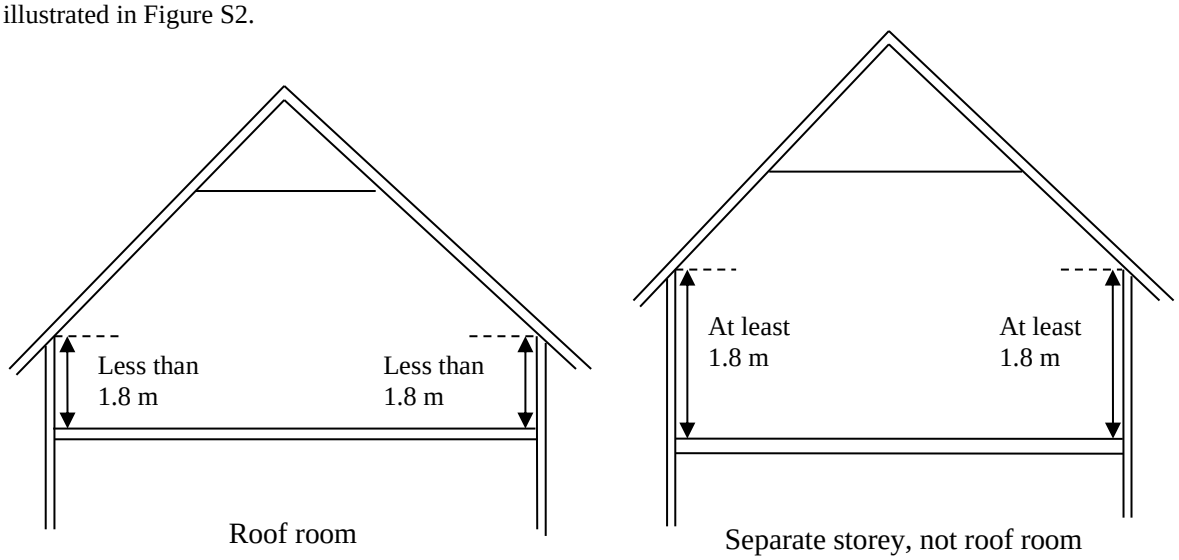

Figure S2 : Upper storey with common wall

Mezzanine floor

Enter the part of the property above and below the mezzanine deck as a two storey extension. Treat the remaining part as a single level with the full floor to ceiling/roof height.

If the mezzanine is located such that it has no heat loss perimeter then assign a nominal 1 m perimeter to each floor of the mezzanine part and deduct 1 m from the heat loss perimeter of the other part.

Porches

If heated always include (separated or not).
If external and not heated, disregard.
If internal, not heated and thermally separated, disregard.
('external' means an addition protruding from the line of the external wall of the dwelling)

Store rooms and utility rooms

If heated always include.
If accessible only via a separate external door and not heated, disregard
If directly accessible, not heated and thermally separated, disregard

Garages

If heated from main heating system, always include. The presence of a boiler within the garage does not make it heated.

S3.3 Extensions and alternative walls

Provision is made for the main dwelling and up to four extensions, each with their own age band, dimensions and other characteristics. An extension can be alongside another part of the dwelling, or above another part of the dwelling or other premises. If alongside apply ground floor heat loss, if above another part of the same dwelling there is no floor heat loss for the extension and no roof loss for the part below it.

Each building part can have an additional wall type, 'alternative wall', which is part of the external walls of the building part. The assessor provides the area of the alternative wall, which is deducted from the external wall area of the building part calculated as described in S3.6. The U-value of an alternative wall is established on the same basis as other walls, as described in S5 (but see also S3.13 in the case of a sheltered alternative wall).

Extensions

For a vertical extension (new upper floor above existing dwelling) enter the new upper floor as an extension with 'same dwelling below', and the original part with 'same dwelling above' for the roof description.

Where an extension has been built over part of the existing dwelling, divide the part built over into two, one of which has 'same dwelling above' and for the other part describe the roof construction and insulation.

It is possible for an extension to be both above and alongside the rest of the dwelling. Such a building part is not defined in RdSAP and in this case divide the extension into two, one above and the other alongside.

Alternative wall

In determining whether an alternative wall is applicable the significant features are construction type, dry lining, age band, insulation and whether sheltered by an unheated corridor.

A sheltered wall between the dwelling and an unheated corridor or stairwell is always an alternative wall.

Walls of the same construction but different thickness within a building part are not considered alternative walls unless they are stone walls.

For stone walls assess thickness at each external elevation and at each storey and use alternative wall if the thickness varies by more than 100 mm.

Disregard when less than 10% of total exposed wall area of the building part (including windows and doors) unless documentary or visual evidence exists of different retrofitted insulation either of the alternative wall or of the remaining wall in the building part. When entering alternative wall area into software exclude the area of any windows and doors contained in the alternative wall.

Consolidate walls of same type.

If there are two areas of external wall of different construction types within a building part that should be regarded as alternative wall, review the way in which the property has been divided to try and eliminate this situation. Where that is not possible the alternative wall is the one with the larger area.

In the case of the wall separating the dwelling from an unheated corridor or stairwell, where this wall is of different construction or insulation to the external walls (e.g. not insulated but external walls are), make it an alternative wall and mark it as sheltered.

S3.4 Adjustment to levels of storeys for houses and bungalows

In the RdSAP data set, the dimensions of each building part start at "lowest occupied" and these may not align if a building part has a heated or unheated space below. If the lowest occupied floor of any extension is not a ground floor increase the level of each storey in that building part by 1.

S3.5 Conversion to internal dimensions

If horizontal dimensions are measured externally, they are converted to overall internal dimensions for use in SAP calculations by application of the appropriate equations in Table S2, using wall thickness of the main dwelling (or the appropriate wall thickness from Table S3 if thickness is unknown). The equations are applied on a storey-by-storey basis, for the whole dwelling (i.e. inclusive of any extension). This is done after any floor level adjustments (see S3.4).

Heights are always measured internally within each room and handled by software according to S3.6.

Table S2 : Conversion of dimensions

Dwelling type	Equations
Detached	$P_{int} = P_{ext} - 8\ w$ $A_{int} = A_{ext} - w\ P_{int} - 4\ w^2$
Semi-detached or End-terrace	If $P_{ext}^2 > 8A_{ext}$: $P_{int} = P_{ext} - 5\ w$ $a = 0.5\left(P_{ext} - \sqrt{P_{ext}^2 - 8A_{ext}}\right)$ $A_{int} = A_{ext} - w\ (P_{ext} + 0.5\ a) + 3\ w^2$ otherwise $P_{int} = P_{ext} - 3\ w$ $A_{int} = A_{ext} - w\ P_{ext} + 3\ w^2$
Mid-terrace	$P_{int} = P_{ext} - 2\ w$ $A_{int} = A_{ext} - w\ (P_{ext} + 2\ A_{ext}/P_{ext}) + 2\ w^2$
Enclosed end-terrace	$P_{int} = P_{ext} - 3\ w$ $A_{int} = A_{ext} - 1.5\ w\ P_{ext} + 2.25\ w^2$
Enclosed mid-terrace	$P_{int} = P_{ext} - w$ $A_{int} = A_{ext} - w\ (A_{ext}/P_{ext} + 1.5\ P_{ext}) + 1.5\ w^2$
All types	Perimeter ratio = P_{int}/P_{ext} Area ratio = A_{int}/A_{ext}

Notes:
1. P_{ext} and A_{ext} are the measured external perimeter and area (of whole dwelling)
2. P_{int} and A_{int} are the calculated internal perimeter and area
3. w is the wall thickness of the main dwelling
4. After obtaining the perimeter ratio and area ratio for the whole dwelling, multiply separately the measured perimeters and areas of (a) the main part of the dwelling and (b) any extension, by these ratios.
5. In the case of a party wall reduce its length by 2w

Table S3 : Wall thickness (mm)

Age band	A	B	C	D	E	F	G	H	I,	J, K, L
Wall type										
Stone*	500	500	500	500	450	420	420	420	450	450
Solid brick	220	220	220	220	240	250	270	270	300	300
Cavity**	250	250	250	250	250	260	270	270	300	300
Timber frame	150	150	150	250	270	270	270	270	300	300
Cob	540	540	540	540	540	540	560	560	590	590
System build	250	250	250	250	250	300	300	300	300	300
Park home						50	50		75	100

* If in Scotland add 200 mm for bands A and B, and 100 mm for other bands
** If in Scotland add 50 mm

The values in Table S3 are used only when the wall thickness could not be measured.

Wall thickness

Measure wall thickness in mm of each external wall (elevation) and any alternative wall within a building part.

It can be measured at door or window reveals or by internal/external measurement comparison (which can be direct measurement or estimated by counting bricks).

Where thickness varies, obtain a weighted average. For example, a detached house with all side of equal length where the rear wall is 250 mm thick and the remaining walls are 350 mm thick, the average is (0.25 × 250) + (0.75 × 350) = 325 mm.

S3.6 Heights and exposed wall areas

Heights are measured internally within each room, and 0.25 m is added by software to each room height except for the lowest storey, to obtain the storey height. For this purpose the lowest storey is considered separately for each building part (main dwelling and any extension). The lowest storey of a building part is the lowest for the dwelling unless it has been indicated as having the same dwelling below. Gross areas (inclusive of openings) are obtained from the product of heat loss perimeter (after conversion to internal dimensions if relevant) and storey height, summed over all storeys. Party wall area is party wall length multiplied by storey height, summed over all storeys.

For the main dwelling and any extension(s), window and door areas are deducted from the gross areas to obtain the net wall areas for the heat loss calculations, except for the door of a flat/maisonette to an unheated stair or corridor which is deducted from the sheltered wall area (see S3.13).

If an alternative wall is present, the area of the alternative wall is recorded net of any openings in it and the alternative wall is identified as part of the main wall or extension wall. This area is subtracted from the net wall area of the building part prior to the calculation of wall heat losses.

S3.7 Door and window areas

The area of an external door is taken as 1.85 m². A door to a heated access corridor is not included in the door count.

External doors except doors to an unheated corridor or stairwell are taken as being in the main part of the dwelling.

The door to an unheated corridor or stairwell is taken as part of the sheltered wall it is within, and so is in the building part containing the sheltered alternative wall (so not necessarily in the main dwelling).

If the property has more than one door, doors except the first one are directly to the outside and taken as being in the main part of the dwelling.

Total window area is assessed as being typical, more than typical, much more than typical, less than typical, or much less than typical.

In RdSAP the definition of what is a window and what is a door is defined by the area of glazing in relation to the area of the whole opening, i.e. door and frame. To be classed as a window a glazed door and frame must contain glazing amounting to 60% or more or its surface area. Generally 60% or more glazing is likely to occur only in a patio door. However a window with less than 60% glazing is not a door; a door always provides a means of entry to the property.

An external door is a door that forms part of the heat loss perimeter of the dwelling. A door to a heated access corridor is not included in the door count. It is possible for a property to have no external door in the RdSAP data set (when any entrance to the property is via patio doors with more than 60% glazing which are counted as windows in SAP, or via a heated corridor).

S3.7.1 Window area typical, more than typical or less than typical

Window areas are obtained by application of the appropriate equation from Table S4. The equation used is chosen according to the age band of the main part of the dwelling, with the resulting total window area apportioned between main part and extension(s) pro rata to their floor areas. If the window area of any part of the dwelling (main, extension, 2nd extension etc) is greater than 90% of the exposed façade area of that part, after deducting doors and alternative wall area if applicable to that part, the window area is set equal to 90% of the façade area.

Table S4 : Window area (m²)

Age band of main dwelling	House or Bungalow	Flat or Maisonette
A, B ,C	WA = 0.1220 TFA + 6.875	WA = 0.0801 TFA + 5.580
D	WA = 0.1294 TFA + 5.515	WA = 0.0341 TFA + 8.562
E	WA = 0.1239 TFA + 7.332	WA = 0.0717 TFA + 6.560
F	WA = 0.1252 TFA + 5.520	WA = 0.1199 TFA + 1.975
G	WA = 0.1356 TFA + 5.242	WA = 0.0510 TFA + 4.554
H	WA = 0.0948 TFA + 6.534	WA = 0.0813 TFA + 3.744
I	WA = 0.1382 TFA – 0.027	WA = 0.1148 TFA + 0.392
J, K, L	WA = 0.1435 TFA – 0.403	WA = 0.1148 TFA + 0.392
WA = window area TFA = total floor area of main part plus any extension		

This does not include conservatories, which are treated separately: see S6.

The window areas calculated using Table S4 are to be reduced by 25% if it is assessed as being less than typical for the age and type of property, and increased by 25% if assessed as being more than typical for the age and type of property.

When assessing window area consider the whole dwelling (windows, glazed doors and roof lights), including any extensions (**but not conservatories**).

Typical applies if the surface area of the glazing in the dwelling is essentially as would be expected of a typical property of that age, type, size and character. Even if there is slightly more or less glazing than would be expected, up to 10% more or less.

More than typical applies if there is significantly more surface area of glazing than would be expected (15%-30% more), perhaps because there is a large sun room or numerous patio doors have been added.

Less than typical applies if there is significantly less glazing than would be expected. This is rare as homeowners tend not to take out windows, but a property may have an unusual design with few windows.

Much more than typical and **Much less than typical** should be used for those dwellings with very unusual amounts of glazing; such as a glass walled penthouse flat or a Huff Haus. Due to this option allowing measurements of each window to be accounted for, it should also be used if a dwelling has a mixture of multiple glazing types, e.g. double, triple, secondary, or a mixture of glazing gaps.

Sun rooms

For a highly glazed part of the dwelling, such as a sun room, which does not meet the criteria for a conservatory (50% of walls and 75% of roof glazed), in most cases use the glazing option of 'more than typical'. That adds 25% to the total glazed area of the dwelling. If that is considered not appropriate, the window area is assessed by either:

a) measuring all windows and roof windows throughout the dwelling, or

b) measuring all windows and roof windows in the sun room, and use Table S4 to obtain the window area of remaining part of dwelling which is entered as a single window.

Record method used in site notes.

Two types of window are allowed for, single and multiple glazed. Multiple glazing can be double glazed units installed before 2002[1], double glazed units installed during/after 2002[1], double glazing unknown date, secondary glazing or triple glazing. For multiple glazing the U-value can be known.

> If more than one of type of multiple glazing is present, the assessor selects the type according to what is the most prevalent in the dwelling.
>
> If single glazing with secondary glazing, record as secondary glazing.
>
> If double glazing with secondary glazing, record as newer double glazing (i.e. later than the date in footnote [1]).
>
> If secondary glazing has been removed in summer, enter as secondary glazing only if assessor can confirm that the panels exist and can be re-fitted. Evidence to be recorded on site notes.

The window area of each part of the dwelling (main, extension 1, extension 2 etc) is divided into two areas, single and multiple, according to the assessor's estimate of the multiple-glazed percentage. The same percentage is used in main dwelling and each extension.

S3.7.2 Window area much more or much less than typical, and park homes

If window area is assessed as much greater than typical or as much less than typical, the total window area should be obtained from measurements of each individual window. That also applies to park homes. In this case the location area of each window in the main part of the dwelling and in any extension are recorded separately, along with:

- single glazed, double glazed before or during/after 2002[1], secondary glazing or triple glazed;
- U-value if known
- window or roof window;
- orientation

and Table S4 is not used. In this case there can be several types of window. The multiple-glazed percentage is calculated on the basis of the area and type of each window or roof window.

If external dimensions were used, all windows were measured and there is a roof window with area greater than the roof area of the building part concerned, change the roof window area to be equal to the roof area. This can occur with a fully glazed roof because the roof window area entered by the assessor does not take account of the reduction in areas that occurs when the dimensions are converted from external to internal.

S3.8 Roof area

Roof area is the greatest of the floor areas on each level, calculated separately for main dwelling and any extension.

In the case of a pitched roof with a sloping ceiling, divide the area so obtained by cos(30°).

S3.9 Rooms in roof

The following procedure is applied to main dwelling and separately to any extension with roof rooms as applicable.

Note. A roof room cannot be an extension in its own right, roof rooms are defined only when a building part consisting of normal storey(s) has been defined.

If there are roof rooms, with a total floor area of F_{rr} (measured internally), then:
(1) Area F_{rr} is deducted from the roof area determined at S3.8.
(2) A separate heat-loss roof of area $A_{rr} = F_{rr}$ is defined.
(3) A separate heat-loss wall of area A_{rw} is defined , where

$$A_{rw} = 11.0\sqrt{F_{rr}/1.5}$$ where the roof rooms are not connected to another building part, or

$$A_{rw} = 8.25\sqrt{F_{rr}/1.5}$$ where the roof rooms are connected to another building part.

Roof rooms are ‘connected’ if they are adjacent to (i.e. at the same level as) habitable space in another building part of the same dwelling. The adjacent part can be another roof room or a normal storey.

[1] 2002 in England & Wales, 2003 in Scotland, 2006 in Northern Ireland

The areas A_{rr} and A_{rw} are based on a rectangular room-in-roof area of average height 2.2 m, and A_{rw} includes the walls of the roof rooms and the sloping parts their roof. The storey height for the room-in-roof is (2.2 + 0.25) = 2.45 m.

Roof rooms constitute an additional storey.

The software's user interface has an option to allow entry of detailed information about roof rooms. When this has been selected see S3.9.2. Otherwise S3.9.1 applies.

Detailed measurements of roof rooms

Detailed measurements of roof rooms are required only if evidence exists that the slope, stud wall (or common wall) or gable wall (see Figure S3) have differing levels of insulation and each of their U-values is known. See Figure S3.

If all elements of the roof room (slope/stud/gable) have the same insulation and the U-value is available, the U-value can be overwritten whilst leaving the RdSAP assumed areas as is.

Where detailed measurements are made and the floor area of the parts of the dormer windows protruding beyond the roof line is less than 20% of the floor area of the roof room, measure the elements of the roof room as if the dormers were not there. Otherwise total the vertical elements of all dormers in that building part and enter as stud wall and the flat ceiling elements as flat ceiling.

A roof room is indicated as 'connected' if it is adjacent to (i.e. at the same level as) another building part of the same dwelling (which can be either a roof room or a normal storey).

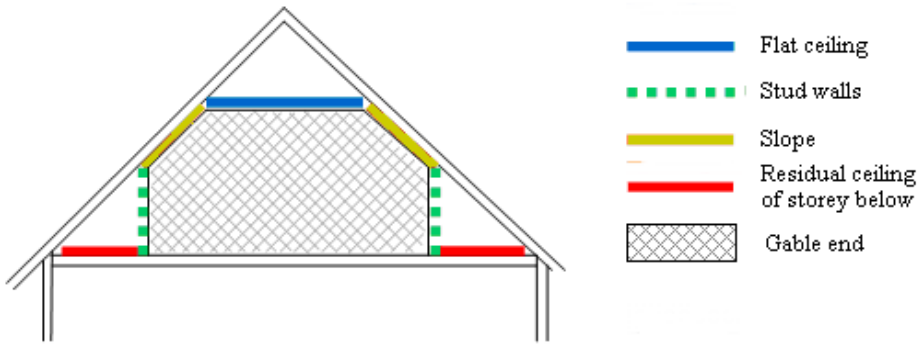

Figure S3 : Different parts of roof rooms
(instead of stud wall and residual ceiling there can be a common wall)

For detailed measurements of roof rooms there can be up to two of each of:
- flat ceiling
- sloping ceiling
- stud wall (or common wall)
- gable wall

A U-value must be provided for each non-zero area.

S3.9.1 Area and U-value details of the roof rooms not collected

A_{rr} is a roof area and A_{rw} is a wall area.

The options for insulation of roof rooms are: unknown, as built, flat ceiling only, all elements.

The default U-values for A_{rr} and A_{rw} are those for the appropriate age band for the construction of the roof rooms (see Table S10). The default U-values apply when the roof room insulation is 'as built' or 'unknown'.

Where the thickness of insulation on the flat ceiling of the roof room has been determined (roof room insulation is 'flat ceiling only' or 'all elements'), the U-value U_{rr} (associated with A_{rr}) is the U-value from Table S9 for the insulation thickness concerned.

Where the walls and sloping parts of the roof are known to be insulated (roof room insulation is 'all elements'), the U-value U_{rw} (associated with A_{rw}) is the U-value from Table S10 for the age band of the roof room taking account

of footnote (1) to the table. U_{rr} is the value from Table S9 for the insulation thickness on the flat ceiling, except for a vaulted roof when the insulation of the flat ceiling is marked as 'not applicable' and for the purposes of the calculation $U_{rr} = U_{rw}$.

The residual area (area of roof determined at S3.8 less the floor area of room(s)-in-roof) has a U-value according to its insulation thickness if at least half the area concerned is accessible, otherwise it is the default for the age band of the original property or extension.

S3.9.2 Area and U-value details of the roof rooms are collected

A_{rr} and A_{rw} (see S3.9) and their corresponding U-values are to be calculated and shown on the software's user interface to guide the assessor. The assessor over-writes these values as appropriate.

The data supplied by the assessor are used directly in the SAP calculations. This consists of the area and U-value of up to 8 elements: two each of flat ceiling, sloping roof, stud walls (or common wall) and gable walls. See Figure S3 above.

S3.10 Heat loss floor area

The lowest floor of a part of a dwelling ('part' means main dwelling or any extension) can be a basement, a ground floor, an exposed floor (external air below e.g. over a passageway) or a semi-exposed floor (unheated space below e.g. over an integral garage) or not a heat loss floor (upper flats/maisonettes or same or another dwelling below).

If it is a basement it is treated as if it were a ground floor for heat loss purposes.

S3.11 Heat loss floor area for houses and bungalows

The area of the lowest occupied floor of the main dwelling is a ground floor. If the lowest occupied floor of any extension is not a ground floor the level of each storey in that building part is increased by 1 as described in S3.4.

For each building part examine the floor areas on each storey. If the area of any upper floor is greater than that of the floor below, the difference in these areas is an exposed or semi-exposed floor. This can occur particularly when there is an integral garage. When external dimensions are being used, however, the method of dimensional conversion can result in a small, but spurious, exposed floor area. To avoid that situation., the area of exposed floor on any level cannot be greater than the difference between the area of the current floor and the floor below measured using external dimensions. This rule is implemented as follows:

1. Calculate the exposed floor area before converting dimensions, call this A_1
2. Convert dimensions
3. Calculate exposed floor area from the internal areas, call this A_2
4. If $A_2 \le A_1$ the exposed floor area is A_2
5. If $A_2 > A_1$ the exposed floor area is A_1
6. Repeat for all levels if dwelling has more than two storeys, and obtain the total exposed floor area.

When dimensions have been measured internally, the exposed floor area is simply the difference in area between the current floor and the floor below.

Semi-exposed floors are treated as if they were fully exposed.

The ground floor area of the main dwelling and that of any extension are treated separately as they can have different U-values.

S3.12 Heat loss floor area for flats and maisonettes

There is no heat loss through the floor if there is another flat below. Otherwise the floor area of the flat, or the lower floor of the maisonette, is:

- an exposed floor if there is an open space below;
- a semi-exposed floor if there are unheated premises below it (e.g. an enclosed garage);
- above a partially heated space if there are non-domestic premises below (heated, but at different times);
- a ground floor if there is ground below

Semi exposed floors are treated as if they were fully exposed.

S3.13 Sheltered walls for flats and maisonettes

If the flat or maisonette is adjacent to an unheated corridor or stairwell, the area of wall between the dwelling and the corridor or stairwell is treated as a sheltered (semi-exposed) wall, see S5.2. The area of sheltered wall is the shelter length multiplied by the height of the lowest storey, less the door area (see S3.6 and S3.7). The resulting

sheltered wall area is deducted from the exposed wall area determined in S3.6 and treated as a separate heat-loss wall. Semi-exposed walls in houses and bungalows are treated as if they were fully exposed.

In any building part there can be an alternative wall which is indicated as sheltered. In this case the assessor does not provide the area of alternative wall; instead it is calculated from the shelter length as above (this avoids the door to the unheated corridor being deducted twice).

> The length of wall between the dwelling and the unheated corridor or stairwell is included in the exposed perimeter.
>
> When a dwelling (flat or maisonette) has a sheltered wall to an unheated corridor on more than one storey the sheltered length is the total for all storeys with a sheltered wall (example: 2 storeys with sheltered wall on each storey, length of sheltered wall is 5 m on each storey: enter 10 m for the sheltered length).
>
> In the case of the wall separating the dwelling from an unheated corridor or stairwell, where this wall is of different construction or insulation to the external walls (e.g. not insulated but external walls are), make it an alternative wall and mark it as sheltered.

S4 Parameters for ventilation rate

The parameters needed for calculation of the ventilation rate are obtained from Table S5.

Table S5 : Ventilation parameters

Parameter	Value
Chimneys	Number of open fireplaces
Flues	Number of open flues (main and secondary heating systems). Flue for solid fuel boiler in unheated space is not counted.
Ventilation system	Natural with intermittent extract fans, unless mechanical system clearly identified
Extract fans	Not park home: Age bands A to E — all cases — 0 Age bands F to G — all cases — 1 Age bands H to L — up to 2 habitable rooms — 1 " — 3 to 5 habitable rooms — 2 " — 6 to 8 habitable rooms — 3 " — more than 8 habitable rooms — 4 Park home: Age band F — all cases — 0 Age bands G, I, K — all cases — 2
Wall infiltration	According to the largest area of wall, system build treated as masonry, and infiltration according to masonry if equal. Net wall area after deduction of openings is used for this purpose, walls of roof rooms are not included. Park home: timber frame.
Floor infiltration (suspended timber ground floor only)	Age band of main dwelling A to E: unsealed Age band of main dwelling F to L: sealed (the floor infiltration for the whole dwelling is determined by the floor type of the main dwelling) Park home: unsealed suspended timber
Draught lobby	House, bungalow or park home: no Flat or maisonette: yes if heated or unheated corridor, otherwise no
Number of storeys	Greater of the number of storeys in the main part of the dwelling and in any extension. If an extension is above another part, no account of this is taken in calculating the storey count.

Parameter	Value
Sheltered sides	4 for flat/maisonette up to third storey above ground level 2 in other cases
Number of wet rooms (required for an exhaust air heat pump)	1 to 2 habitable rooms: Kitchen + 1 3 to 4 habitable rooms: Kitchen + 2 5 to 6 habitable rooms: Kitchen + 3 7 to 8 habitable rooms: Kitchen + 4 9 to 10 habitable rooms: Kitchen + 5 11 or more habitable rooms: Kitchen + 6

Age bands in Table S5 relate to the age of the main dwelling and not to any extension.
The number of rooms is as defined in S9.1.

Include all open chimneys/fireplaces in the fireplace count (both downstairs and upstairs). The definition is a vertical duct with a flue diameter of at least 200 mm or its equivalent. The following are not counted as open fireplaces:

- Any open flue that is less than 200 mm diameter
- A permanently blocked up fireplace, even if fitted with an airbrick
- Any heating appliance with controlled flow of air supply i.e. appliance has closing doors
- A flexible gas flue liner sealed into the chimney (because the diameter is less than 200 mm)
- A chimney fitted with a damper enabling the flue to be mechanically closed when not in use

Temporary means of blocking a flue, e.g. cardboard, newspaper bungs and similar, are not a permanent means of controlling ventilation and therefore the chimney is counted as an open fireplace.

Note that this relates only to the number of open fireplaces (it affects the ventilation rate assumed for the calculation). Other rules apply when considering the choice of main or secondary heating systems.

S4.1 Mechanical ventilation

If a mechanical ventilation system, it is treated as mechanical extract ventilation (MEV) if an extract-only system and as mechanical ventilation with heat recovery (MVHR) if a balanced system, using the default values in SAP Table 4g and the in-use factors for default data from SAP Table 4h.

S5 Constructional types and U-values

Except for loft insulation which should be measured wherever possible, in many cases the construction elements will be indicated as ‘as-built’ or ‘unknown insulation’. Then RdSAP assigns default insulation on the basis of the age band of the part of the property concerned (main dwelling, extension, room in roof).

Where there is evidence of additional insulation, see shaded box following, the assessor has options to:

a. indicate the thickness of insulation, or
b. provide the U-value of the construction element.

Where it can be established that a building element has insulation beyond what would normally be assumed for the age band, this can be indicated if adequate evidence exists. Evidence can be:

- what is observed in the site inspection (e.g. loft insulation, rafter insulation, cavity wall insulation), and/or
- on the basis of documentary evidence.

Acceptable documentary evidence includes certificates, warranties, guarantees, building regulation submissions and official letters from the applicable Registered Social Landlord (RSL). The assessor must be confident, and able to demonstrate, that any documentation relates to the actual property being assessed and that there is no physical evidence to the contrary.

Walls

If the dwelling has a wall type that does not correspond closely with one of the available options, select the nearest equivalent taking account of the U-values in the tables below and include addendum 1 (see S15).

Where a cavity wall has been identified, enter as such irrespective of the width of the cavity.

If there is a system built wall that has evidence of retro cavity fill, record as system build with internal insulation.

Do not use the 'unknown' option for wall insulation inappropriately as this automatically suppresses any insulation recommendation; assume as-built if no evidence of retro-fitted insulation.

'Unknown' should be used only in exceptional circumstances, e.g. when there is conflicting evidence (inspection and/or documentary) of added insulation whose presence cannot be ascertained conclusively. In these cases clarification must be provided in site notes.

Loft insulation

If joist and rafter insulation are both present record joist insulation only

If loft is fully boarded enter unknown unless householder has documentary evidence (maximum thickness is depth of joists) or is prepared to lift the boards

If the property has multifoil or foam insulation at joists the depth of the insulation is entered as double its actual thickness.

If varying levels, apply an area-weighted average. However if there is an area with no insulation the dwelling should be split to give different roof scenarios.

Non-domestic (commercial) premises adjacent to dwelling

If a dwelling or part of a dwelling has commercial premises below record as partially heated space below.

If a dwelling or part of a dwelling has commercial premises above record as another dwelling above.

If a dwelling has commercial premises alongside it, treat as ~~non-heat loss wall.~~a party wall

Where the assessor has entered the U-value of any construction element that is used directly for the calculations.

U-value entry (walls, roofs, floors)

The U-value is that of the whole element, including any added insulation. Documentary evidence applicable to the property being assessed (see convention 9.02) must be provided and recorded if overwriting any default U-value. This evidence shall be either:

- relevant building control approval, which both correctly defines the construction in question and states the calculated U-value; or
- a U-value calculation produced or verified by a suitably qualified person.

Evidence of suitable qualification is through membership of a recognised U-value calculation competency scheme (BBA/TIMSA (UK)), OCDEA membership (England & Wales, Northern Ireland) or level 4 on-construction non-domestic energy assessors.

Otherwise Table S19 indicates the options used for collection of data on site in respect of additional insulation of elements. These are:
- floor insulation
- cavity filled wall
- internal or external wall insulation
- party wall insulation (cavity fill)
- measured thickness of loft insulation
- rafter insulation
- flat roof insulation
- insulation of roof rooms

A U-value is assigned to an insulated loft according to the measured insulation thickness. In other cases the U-value with additional insulation is based on 50, 100 or 150 mm of insulation of the mineral wool type (assume 50 mm if thickness is unknown).

If insulation is multifoil or foam insulation the thickness is entered as double the actual thickness.

If there is both internal and external wall insulation add the insulation thicknesses together and enter as external.

U-values of construction elements are determined within software from the constructional type, date of construction and, where applicable, thickness of additional insulation, according to the tables below. U-values are obtained separately for the main part of the dwelling and for any extension. If the insulation status is unknown, the relevant value for 'as built' is used.

S5.1 U-values of external walls

Wall types

Where a cavity wall has been identified, enter as such irrespective of the width of the cavity..

If there is a system built wall that has evidence of retro cavity fill, record as system build with internal insulation..

Do not use the 'unknown' option for wall insulation inappropriately as this automatically suppresses any insulation recommendation; assume as-built if no evidence of retro-fitted insulation.

'Unknown' should be used only in exceptional circumstances, e.g. when there is conflicting evidence (inspection and/or documentary) of added insulation whose presence cannot be ascertained conclusively. In these cases clarification must be provided in site notes.

Unless the U-value is provided by the assessor obtain wall U-values from Table S6, S7 or S8.

Table S6 : Wall U-values – England and Wales

Age band	A	B	C	D	E	F	G	H	I	J	K	L
Wall type												
Stone: granite or whinstone as built	a	a	a	a	1.7 b	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Stone: sandstone or limestone as built	a	a	a	a	1.7 b	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Solid brick as built	1.7	1.7	1.7	1.7	1.7	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Stone/solid brick with 50 mm external or internal insulation	0.55	0.55	0.55	0.55	0.55	0.45*	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
Stone/solid brick with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.28*	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
Stone/solid brick with 150 mm external or internal insulation	0.23	0.23	0.23	0.23	0.23	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
Stone/solid brick with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*
Cob (as built)	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.60	0.45	0.35	0.30	0.28
Cob with 50 mm external or internal insulation	0.40	0.40	0.40	0.40	0.40	0.40	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
Cob with 100 mm external or internal insulation	0.26	0.26	0.26	0.26	0.26	0.26	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
Cob with 150 mm external or internal insulation	0.20	0.20	0.20	0.20	0.20	0.20	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
Cob with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.16	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*
Cavity as built	1.5	1.5	1.5	1.5	1.5	1.0	0.60	0.60	0.45	0.35	0.30	0.28
Unfilled cavity with 50 mm external or internal insulation	0.53	0.53	0.53	0.53	0.53	0.45	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
Unfilled cavity with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.30	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
Unfilled cavity with 150 mm external or internal insulation	0.23	0.23	0.23	0.23	0.23	0.21	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
Unfilled cavity with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*
Filled cavity	0.7	0.7	0.7	0.7	0.7	0.40	0.35	0.35	0.45†	0.35†	0.30†	0.28†
Filled cavity with 50 mm external or internal insulation	0.37	0.37	0.37	0.37	0.37	0.27	0.25*	0.25*	0.25*	0.25*	0.21*	0.21*
Filled cavity with 100 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.20	0.19*	0.19*	0.19*	0.19*	0.17*	0.16*
Filled cavity with 150 mm external or internal insulation	0.19	0.19	0.19	0.19	0.19	0.16	0.15*	0.15*	0.15*	0.15*	0.14*	0.14*
Filled cavity with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.13	0.13*	0.13*	0.13*	0.13*	0.12*	0.12*
Timber frame as built	2.5	1.9	1.9	1.0	0.80	0.45	0.40	0.40	0.40	0.35	0.30	0.28
Timber frame with internal insulation	0.60	0.55	0.55	0.40	0.40	0.40	0.40†	0.40†	0.40†	0.35†	0.30†	0.28†
System build as built	2.0	2.0	2.0	2.0	1.7	1.0	0.60	0.60	0.45	0.35	0.30	0.28
System build with 50 mm external or internal insulation	0.60	0.60	0.60	0.60	0.55	0.45	0.35*	0.35*	0.30*	0.25*	0.21*	0.21*
System build with 100 mm external or internal insulation	0.35	0.35	0.35	0.35	0.35	0.32*	0.24*	0.24*	0.21*	0.19*	0.17*	0.16*
System build with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.14*
System build with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.12*

a See equations in S5.1.1

b Or from equations in S5.1.1 if that is less.

* wall may have had internal or external insulation when originally built; this applies only if insulation is known to have been increased subsequently (otherwise 'as built' applies)

† assumed as built

If a wall is known to have additional insulation but the insulation thickness is unknown, use the row in the table for 50 mm insulation

Table S7 : Wall U-values – Scotland

Age band	A	B	C	D	E	F	G	H	I	J	K	L
Wall type												
Stone: granite or whinstone as built	a	a	a	a	1.7 b	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Stone: sandstone or limestone as built	a	a	a	a	1.5 b	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Solid brick as built	1.7	1.7	1.7	1.7	1.7	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Stone/solid brick with 50 mm external or internal insulation	0.55	0.55	0.55	0.55	0.55	0.45*	0.35*	0.30*	0.30*	0.21*	0.19*	0.17*
Stone/solid brick with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.28*	0.24*	0.24*	0.21*	0.19*	0.17*	0.14*
Stone/solid brick with 150 mm external or internal insulation	0.23	0.23	0.23	0.23	0.23	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.12*
Stone/solid brick with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*
Cob as built	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.60	0.45	0.30	0.25	0.22
Cob with 50 mm external or internal insulation	0.40	0.40	0.40	0.40	0.40	0.40	0.35*	0.35*	0.30*	0.21*	0.19*	0.17*
Cob with 100 mm external or internal insulation	0.26	0.26	0.26	0.26	0.26	0.26	0.24*	0.24*	0.21*	0.19*	0.17*	0.14*
Cob with 150 mm external or internal insulation	0.20	0.20	0.20	0.20	0.20	0.20	0.18*	0.18*	0.17*	0.15*	0.14*	0.12*
Cob with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.16	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*
Cavity as built	1.5	1.5	1.5	1.5	1.5	1.0	0.60	0.45	0.45	0.30	0.25	0.22
Unfilled cavity with 50 mm external or internal insulation	0.53	0.53	0.53	0.53	0.53	0.45	0.35*	0.30*	0.30*	0.25*	0.19*	0.17*
Unfilled cavity with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.30	0.24*	0.21*	0.21*	0.19*	0.17*	0.14*
Unfilled cavity with 150 mm external or internal insulation	0.23	0.23	0.23	0.23	0.23	0.21	0.18*	0.17*	0.17*	0.15*	0.14*	0.12*
Unfilled cavity with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*
Filled cavity	0.7	0.7	0.7	0.7	0.7	0.40	0.35	0.45†	0.45†	0.30†	0.25†	0.22†
Filled cavity with 50 mm external or internal insulation	0.37	0.37	0.37	0.37	0.37	0.27	0.25*	0.25*	0.25*	0.25*	0.25*	0.17*
Filled cavity with 100 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.20	0.19*	0.19*	0.19*	0.19*	0.19*	0.14*
Filled cavity with 150 mm external or internal insulation	0.19	0.19	0.19	0.19	0.19	0.16	0.15*	0.15*	0.15*	0.15*	0.15*	0.12*
Filled cavity with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.13	0.13*	0.13*	0.13*	0.13*	0.12*	0.10*
Timber frame as built	2.5	1.9	1.9	1.0	0.80	0.45	0.40	0.40	0.40	0.30	0.25	0.22
Timber frame with internal insulation	0.60	0.55	0.55	0.40	0.40	0.40	0.40†	0.40†	0.40†	0.30†	0.25†	0.22†
System build as built	2.0	2.0	2.0	2.0	1.7	1.0	0.60	0.45	0.45	0.30	0.25	0.22
System build with 50 mm external or internal insulation	0.60	0.60	0.60	0.60	0.55	0.45	0.35*	0.30*	0.30*	0.21*	0.19*	0.17*
System build with 100 mm external or internal insulation	0.35	0.35	0.35	0.35	0.35	0.32*	0.24*	0.24*	0.21*	0.19*	0.17*	0.14*
System build with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	0.15*	0.14*	0.12*
System build with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	0.13*	0.12*	0.10*

a See equations in S5.1.1

b Or from equations S5.1.1 if that is less.

* wall may have had internal or external insulation when originally built; this applies only if insulation is known to have been increased subsequently (otherwise 'as built' applies)

† assumed as built

If a wall is known to have additional insulation but the insulation thickness is unknown, use the row in the table for 50 mm insulation

Table S8 : Wall U-values – Northern Ireland

Age band	A	B	C	D	E	F	G	H	I	J	K	L
Wall type												
Stone: granite or whinstone as built	a	a	a	a	1.7 b	1.0	0.60	0.45	0.45	-	0.30	0.28
Stone: sandstone or limestone as built	a	a	a	a	1.7 b	1.0	0.60	0.45	0.45	-	0.30	0.28
Solid brick as built	1.7	1.7	1.7	1.7	1.7	1.0	0.60	0.45	0.45	-	0.30	0.28
Stone/solid brick with 50 mm external or internal insulation	0.55	0.55	0.55	0.55	0.55	0.45*	0.35*	0.30*	0.30*	-	0.21*	0.21*
Stone/solid brick with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.28*	0.24*	0.24*	0.21*	-	0.17*	0.16*
Stone/solid brick with 150 mm external or internal insulation	0.23	0.23	0.23	0.23	0.23	0.21*	0.18*	0.18*	0.17*	-	0.14*	0.14*
Stone/solid brick with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	-	0.12*	0.12*
Cob as built	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.60	0.45	-	0.30	0.28
Cob with 50 mm external or internal insulation	0.40	0.40	0.40	0.40	0.40	0.40	0.35*	0.35*	0.30*	-	0.21*	0.21*
Cob with 100 mm external or internal insulation	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	-	0.21*	0.16*
Cob with 150 mm external or internal insulation	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	-	0.20	0.14*
Cob with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.16	0.15*	0.15*	0.14*	-	0.12*	0.12*
Cavity as built	1.5	1.5	1.5	1.5	1.5	1.0	0.60	0.45	0.45	-	0.30	0.28
Unfilled cavity with 50 mm external or internal insulation	0.53	0.53	0.53	0.53	0.53	0.45	0.35*	0.35*	0.30*	-	0.21*	0.21*
Unfilled cavity with 100 mm external or internal insulation	0.32	0.32	0.32	0.32	0.32	0.30	0.24*	0.24*	0.21*	-	0.17*	0.16*
Unfilled cavity with 150 mm external or internal insulation	0.23	0.23	0.23	0.23	0.23	0.21	0.18*	0.18*	0.17*	-	0.14*	0.14*
Unfilled cavity with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	-	0.12*	0.12*
Filled cavity	0.7	0.7	0.7	0.7	0.7	0.40	0.35	0.45†	0.45†	-	0.30†	0.28†
Filled cavity with 50 mm external or internal insulation	0.37	0.37	0.37	0.37	0.37	0.27	0.25*	0.25*	0.25*	-	0.25*	0.21*
Filled cavity with 100 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.20	0.19*	0.19*	0.19*	-	0.19*	0.16*
Filled cavity with 150 mm external or internal insulation	0.19	0.19	0.19	0.19	0.19	0.16	0.15*	0.15*	0.15*	-	0.15*	0.14*
Filled cavity with 200 mm external or internal insulation	0.16	0.16	0.16	0.16	0.16	0.13	0.13*	0.13*	0.13*	-	0.12*	0.12*
Timber frame as built	2.5	1.9	1.9	1.0	0.80	0.45	0.40	0.40	0.40	-	0.30	0.28
Timber frame with internal insulation	0.60	0.55	0.55	0.40	0.40	0.40	0.40†	0.40†	0.40†	-	0.30†	0.28†
System build as built	2.0	2.0	2.0	2.0	1.7	1.0	0.60	0.45	0.45	-	0.30	0.28
System build with 50 mm external or internal insulation	0.60	0.60	0.60	0.60	0.55	0.45	0.35*	0.30*	0.30*	-	0.21*	0.21*
System build with 100 mm external or internal insulation	0.35	0.35	0.35	0.35	0.35	0.32*	0.24*	0.24*	0.21*	-	0.17*	0.16*
System build with 150 mm external or internal insulation	0.25	0.25	0.25	0.25	0.25	0.21*	0.18*	0.18*	0.17*	-	0.14*	0.14*
System build with 200 mm external or internal insulation	0.18	0.18	0.18	0.18	0.18	0.17*	0.15*	0.15*	0.14*	-	0.12*	0.12*

a See equations in S5.1.1

b Or from equations S5.1.1 if that is less.

* wall may have had internal or external insulation when originally built; this applies only if insulation is known to have been increased subsequently (otherwise 'as built' applies)

† assumed as built

If a wall is known to have additional insulation but the insulation thickness is unknown, use the row in the table for 50 mm insulation

Table S8A : Wall U-values – Park homes

Age band	F	G	I	K
Park home as built	1.7	1.2	0.7	0.6
Park home with additional insulation	Entered U-value (see S1.1.2)			

S5.1.1 U-values of uninsulated stone walls, age bands A to E

Granite or whinstone: U = 3.3 – 0.002 × thickness of wall in mm
Sandstone or limestone: U = 3.0 – 0.002 × thickness of wall in mm

Apply the adjustment in S5.1.2 if wall is dry-lined or lath and plaster.

S5.1.2 Stone, solid brick or cavity walls in age bands A to E with dry-lining or lath and plaster

1. Obtain the U-value of the wall without dry-lining from Table S6, S7 or S8. Call this U_0.

2. The U-value of the wall is

$$U = \frac{1}{\frac{1}{U_0} + R_{dl}}$$

where R_{dl} is the additional thermal resistance introduced by the internal finish. Use R_{dl} = 0.17 m²K/W. This is not applied for age band F and later.

> This applies to any type of internal lining on an uninsulated stone, solid brick or cavity wall that creates an airspace behind it, e.g. plasterboard on dabs, lath and plaster. Use tap test for plasterboard on dabs or on battens. If tap test is inconclusive regard as not dry-lined.

S5.2 U-values of sheltered walls

For sheltered walls of flats and maisonettes (between the dwelling and an unheated corridor or stairwell), the U-value for the applicable wall area is adjusted as described in Section 3.3 using R_u = 0.4 m²K/W.

S5.3 U-values of party walls

The U-value of party walls is taken from Table S8B.

Table S8B : U-values of party walls

Party wall type	Party wall U-value
Solid masonry / timber frame / system built	0.0
Cavity masonry unfilled	0.5
Cavity masonry filled	0.2
Unable to determine, house or bungalow	0.25
Unable to determine, flat or maisonette	0.0

Note. In the case of flats and maisonettes it is assumed that the construction is such as to avoid a thermal bypass.

S5.4 U-values of roofs

Loft insulation

If joist and rafter insulation are both present record joist insulation only.

If loft is fully boarded enter unknown unless householder has documentary evidence (maximum thickness is depth of joists) or is prepared to lift the boards.

If the property has modern foil or foam insulation at joists or rafters the depth of the insulation is entered as double its actual thickness.

If varying levels, apply an area-weighted average. However if there is an area with no insulation the dwelling should be split to give different roof scenarios.

The U-value assumed for a pitched roof with an insulated ceiling should, where possible, be based on the observed thickness of the loft insulation according to Table S9.

Table S9 : Roof U-values when loft insulation thickness at joists is known (for insulation between joists including insulation at flat ceiling of a roof room)

Insulation thickness at joists (mm)	Assumed roof U-value (W/m²K)	
	Slates or tiles	Thatched roof
None	2.3	0.35
12	1.5	0.32
25	1.0	0.30
50	0.68	0.25
75	0.50	0.22
100	0.40	0.20
150	0.30	0.17
200	0.21	0.14
250	0.17	0.12
270	0.16	0.12
300	0.14	0.11
350	0.12	0.10
>= 400	0.11	0.09

Note: The U-values in Table S9 take account of joists. The insulation is taken as being between joists only up to 150 mm, and between and over joists for 200 mm or more.

In other cases, unless provided by the assessor the U-value is taken from Table S10. For a pitched roof with no access, use the column for ‘between joists’.

Table S10 : Assumed roof U-values when Table S9 does not apply

Age band	Assumed Roof U-value (W/m²K) [a]						
	Pitched, slates or tiles, insulation between joists or unknown	**Pitched, slates or tiles, insulation at rafters**	**Flat roof [b]**	**Room-in-roof, slates or tiles**	**Thatched roof [c]**	**Thatched roof, room-in-roof**	**Park home**
A, B, C, D	2.3 (none)	2.3 [1]	2.3 [1]	2.3 [1]	0.35	0.25	-
E	1.5 (12 mm)	1.5 [1]	1.5 [1]	1.5 [1]	0.35	0.25	-
F	0.68 (50 mm)	0.68 [1]	0.68 [1]	0.80 [1]	0.35	0.25	1.7
G	0.40 (100 mm)	0.40 [1]	0.40 [1]	0.50 [1]	0.35	0.25	0.6
H	0.30 (150 mm)	0.35 [1]	0.35 [1]	0.35 [1]	0.35	0.25	-
I	0.26 (150 mm)	0.35 [1]	0.35 [1]	0.35 [1]	0.35	0.25	0.35
J	0.16 (270 mm)	0.20	0.25	0.30	0.30	0.25	-
K	0.16 (270 mm)	0.20	0.25 [2]	0.25 [2]	0.25 [2]	0.25 [2]	0.30
L	0.16 [3] (270 mm)	0.18	0.18	0.18	0.18	0.18	-

[a] If the roof insulation is "none" use U = 2.3 (all roof types).

[b] Applies also to roof with sloping ceiling

[c] If there is also retro-fitted insulation between the rafters reduce the U-value to $1/(1/U_{table} + R_{ins})$ where R_{ins} is 0.7 m²K/W for 50 mm, 1.4 m²K/W for 100 mm and 2.1 m²K/W for 150 mm. If retro-fit insulation present of unknown thickness use 50 mm.

[1] The value from the table applies for unknown and as built. If the roof is known to have more insulation than would normally be expected for the age band, either observed or on the basis of documentary evidence, use the lower of the value in the table and:
50 mm insulation 0.68
100 mm insulation: 0.40
150 mm or more insulation: 0.30

[2] 0.20 W/m²K in Scotland

[3] 0.15 W/m²K in Scotland

Note: These U-values take account of joists. They may differ from Elemental U-values in regulations applicable at the time of construction, where the Elemental U-values in regulations (up to age band H) were set on the basis of ignoring joists in U-value calculations.

In the case of roof rooms, the insulation thickness on the flat part of the ceiling should be measured where possible and the U-value taken from Table S9. The U-value of the remaining parts of the roof rooms, i.e. walls and sloping ceilings, is taken from Table S10 according to the age band of the roof rooms, unless evidence is available as to the insulation of these parts in which case footnote (1) to Table S10 applies.

There is no heat loss through the roof of a building part that has the same dwelling above or another dwelling above.

S5.5 U-values of floors next to the ground

Unless provided by the assessor the floor U-value is calculated according to BS EN ISO 13370 using its area (A) and exposed perimeter (P), and rounded to two decimal places. Floor U-values are obtained separately for the main dwelling and for any extension, using the applicable area, exposed perimeter and wall thickness. The following parameters are used:

– wall thickness (w) in metres as provided in the RdSAP data set or from Table S3 if thickness unknown
– soil type clay (thermal conductivity λ_g = 1.5 W/m·K)
– R_{si} = 0.17 m²K/W
– R_{se} = 0.04 m²K/W
– floor construction as specified by assessor, or from Table S11 if unknown
– all-over floor insulation of thickness as provided by the assessor or from Table S11 if unknown
– thermal conductivity of floor insulation 0.035 W/m·K
(so that $R_f = 0.001*d_{ins}/0.035$ where d_{ins} if the insulation thickness in mm)

A non-separated conservatory has an uninsulated solid ground floor and wall thickness 300 mm.

A park home has a suspended timber floor.

For solid ground floors

1. $d_t = w + \lambda_g \times (R_{si} + R_f + R_{se})$
2. $B = 2 \times A/P$
3. if $d_t < B$, $U = 2 \times \lambda_g \times \ln(\pi \times B/d_t + 1)/(\pi \times B + d_t)$
4. if $d_t >= B$, $U = \lambda_g / (0.457 \times B + d_t)$

For suspended ground floors:
– thermal resistance of floor deck R_f = 0.2 m²K/W if uninsulated,
or R_f = thermal resistance of insulation + 0.2 if insulated
– height above external ground level h = 0.3 m
– average wind speed at 10 m height v = 5 m/s
– wind shielding factor f_w = 0.05
– ventilation openings per m exposed perimeter ε = 0.003 m²/m
– U-value of walls to underfloor space U_w = 1.5 W/m²K

1. $d_g = w + \lambda_g \times (R_{si} + R_{se})$
2. $B = 2 \times A/P$
3. $U_g = 2 \times \lambda_g \times \ln(\pi \times B/d_g + 1)/(\pi \times B + d_g)$
4. $U_x = (2 \times h \times U_w/B) + (1450 \times \varepsilon \times v \times f_w/B)$
5. $U = 1 / (2 \times R_{si} + R_f + 1/(U_g + U_x))$

Table S11 : Basis for floor U-value calculation for ground floors when insulation thickness is unknown

Age band	**Floor construction** (1)	**All-over floor insulation** (2)			
		England & Wales	**Scotland**	**Northern Ireland**	**Park home** (3)
A, B	suspended timber (4)	none	none	none	-
C to F	solid	none	none	none	none
G	solid	none	none	none	25 mm
H	solid	none	25 mm	25 mm	-
I	solid	25 mm	50 mm	50 mm	50 mm
J	solid	75 mm	75 mm	-	-
K	solid	100 mm	100 mm	100 mm	70 mm
L	solid	100 mm	120 mm	100 mm	-

(1) Where floor construction is unknown
(2) For floors which have retro-fitted insulation, use the greater of 50 mm and the thickness according to the age band.
(3) Suspended timber in all cases.
(4) Solid ground floor if underfloor heating.

S5.6 U-values of exposed and semi-exposed upper floors

U-values of exposed and semi-exposed upper floors may be provided by the assessor.

Otherwise, to simplify data collection no distinction is made in terms of U-value between an exposed floor (to outside air below) and a semi-exposed floor (to an enclosed but unheated space below) and the U-values in Table S12 are used.

Table S12 : Exposed/Semi-exposed floor U-values

Age band	U-value (W/m²K)			
	Insulation unknown or as built	Insulated 50 mm	Insulated 100 mm	Insulated 150 mm
A to G	1.20	0.50 (1)	0.30	0.22
H or I	0.51	0.50 (1)	0.30	0.22
J	0.25	0.25	0.25	0.22
K	0.22	0.22	0.22	0.22
L	0.22 (2)	0.22 (2)	0.22 (2)	0.22 (2)

(1) Use these values if known to be insulated but insulation thickness not known
(2) 0.18 W/m²K in Scotland

S5.7 U-value of floor above a partially heated space

The U-value of a floor above partially heated premises is taken as 0.7 W/m²K. This applies typically for a flat above non-domestic premises that are not heated to the same extent or duration as the flat.

S5.8 Allowance for thermal bridging

The thermal bridging factor, y, as defined in Appendix K is taken from Table S13.

Table S13 : Thermal bridging

	Thermal bridging factor y (W/m²K)	
Age band	Not park home	Park home
A to I	0.15	0.15
J	0.11	0.15
K, L	0.08	0.15

y is determined according to the age band of the main dwelling and applied to the all the exposed area including main dwelling, extensions, and non-separated conservatory.

S5.9 Thermal Mass

The thermal mass parameter is taken as 250 kJ/m²K.

S6 Conservatory

The floor area and volume of a non-separated conservatory are added to the total floor area and volume of the dwelling. Its roof area is taken as its floor area divided by cos(20°), and wall area is taken as the product of its exposed perimeter and its height. Its height is estimated from the equivalent number of storey heights of the dwelling to the nearest half storey (based on average internal height within the conservatory). The conservatory walls and roof are taken as fully glazed (and this glazed area applied in addition to that from Table S4). Glazed walls are taken as windows, glazed roof as rooflight, see Table S14.

The number of storey heights are translated into an actual height according to:
- 1 storey: ground floor room height
- 1½ storey: ground floor room height + 0.25 + 0.5*(first floor room height)
- 2 storey: ground floor room height + 0.25 + first floor room height
etc.

In the case of a separated conservatory that has fixed heater(s) this is noted for the EPC but does not affect the energy calculations (calculations done as if conservatory were not present).

A separated conservatory without fixed heaters is disregarded.

S7 Solar gains

Solar gains are calculated for average overshading (SAP Table 6d). When all windows are measured the collected data includes the orientation of each window; otherwise assign East/West orientation to all windows.

S8 Windows and doors

S8.1 Draught proofing

All external doors and at least 2 openable windows per building part should be examined.

If a window is locked or inaccessible then endeavour to check another one.

If the state of the draught proofing cannot be determined then take triple, double or secondary glazed as being draught proofed, and single glazed windows and doors as not draught stripped.

Include glazing in a non-separated conservatory.

The percentage draught proofed is [(number of draught proofed openable windows & doors) divided by (total number of openable windows & doors)] x 100

S8.2 Window U-values and g-values

U-values and g-values for windows can be overwritten only if documentary evidence is provided, which can be either a Window Energy Rating certificate (as defined by BFRC) or manufacturer's data. The U-value is for whole window, not centre pane.

The U-value of windows and the solar transmittance of glazing is taken from Table S14.

Table S14 : Window characteristics

Glazing	Installed	Glazing gap	U-value (window)	U-value** (roof window)	g-value
Single	any	-	4.8	5.1	0.85
Double glazed unit*	England & Wales: before 2002, Scotland: before 2003 N. Ireland: before 2006	6 mm in PVC frame, or any in non-PVC frame	3.1	3.3	0.76
		12 mm in PVC frame	2.8	3.0	
		16 mm or more in PVC frame	2.6	2.8	
Double glazed unit	England & Wales: 2002 or later, Scotland: 2003 or later N. Ireland: 2006 or later	any	2.0	2.2	0.72
Secondary glazing	any	any	2.4	2.6	0.76
Triple glazing	any	any	1.8	2.0	0.68
Double or triple, known data	any	any	As provided in RdSAP data set		

* Use this row for conservatories and for other double glazing whose installation date is unknown.
** Roof pitch 45° (unless horizontal). Applies only where all windows are measured individually (otherwise all glazing is assigned to windows).

Frame factor is 0.7 for all window types (not applied if data source is BFRC)

Frame type is wood for single glazing and secondary glazing, PVC for other types

U-values are adjusted for curtains (section 3.2 of the SAP specification).

Table S15 applies to a non-separated conservatory.

Table S15 : Non-separated conservatory

Glazing	Age band	Frame (for Table 6c)	Wall U-value	Roof U-value	g-value
Single	Any	wood frame	4.8	5.3	0.85
Double	Any	PVC frame	3.1	3.4	0.76
U-values are adjusted for curtains (section 3.2 of the SAP specification).					

The orientation of windows in a conservatory is not recorded, thus solar gains are calculated using the default solar flux (East/West orientation, with 20° pitch for roof windows) in all cases.

S8.3 Door U-values

The RdSAP data set contains the total number of external doors and the number of those doors that are insulated. The U-value of insulated doors is part of the data set; the U-value of other external doors is taken from Table 15A.

Table S15A : Doors

Door opens to	Age band	Door U-value
Outside	A to J	3.0
	K	2.0
	L	E&W and N.I: 1.8 Scotland: 1.6
Unheated corridor or stairwell	any	1.4
Heated corridor or stairwell		(omitted from data collection)

A multiple door should be recorded as such, e.g. a double door should be counted as 2 doors. A door is counted as insulated only if documentary evidence is provided, which must include U-value or manufacturer reference enabling the assessor to ascertain the U-value from the manufacturer. If there is more than one insulated door and they have different U-values, enter the average U-value.

S9 Room count and living area

S9.1 Room count

The room count is equal to the number of habitable rooms[2].

> Habitable rooms include any living room, sitting room, dining room, bedroom, study and similar; and also a non-separated conservatory. A kitchen/diner having a discrete seating area also counts as a habitable room.
>
> A non-separated conservatory adds to the habitable room count if it has an internal quality door between it and the dwelling.
>
> Excluded from the room count are any room used solely as a kitchen, utility room, bathroom, cloakroom, en-suite accommodation and similar; any hallway, stairs or landing; and also any room not having a window.
>
> For open plan dwellings count all spaces thermally connected to the main living area (e.g. a living/dining room) as one room.
>
> For a kitchen to be a kitchen/diner it must have space for a table and 4 chairs.
>
> A lounge/dining room where the door was temporarily removed (i.e. architrave and hinges still there) is two habitable rooms.
>
> A lounge/dining room with the door permanently removed (hinge holes filled etc) is one habitable room.

S9.2 Living area

The living area fraction is determined from the number of habitable rooms.

Table S16 : Living area fraction

Number of rooms:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Living area fraction:	0.75	0.50	0.30	0.25	0.21	0.18	0.16	0.14
Number of rooms:	**9**	**10**	**11**	**12**	**13**	**14**	**15+**	
Living area fraction:	0.13	0.12	0.11	0.10	0.10	0.09	0.09	

The living area is then the fraction multiplied by the total floor area.

S10 Space and water heating

S10.1 Main space heating system(s)

In the case of a gas or oil boiler, micro-CHP and heat pumps, the database is to be used whenever possible. There is a significant difference between the database values and the defaults in Table 4a/4b in many cases.

In the case of micro-CHP or a heat pump, if the Plant Size Ratio is out of range (see N2 in Appendix N) the software reports the situation advising the assessor to select:
- in the case of micro-CHP, a condensing boiler;
- in the case of a heat pump, the appropriate one from Table 4a.

Otherwise space heating systems are those marked "rd" in Tables 4a and 4b. Some systems which are difficult to distinguish in a site survey are omitted; the SAP assessor selects the nearest equivalent from those available in the reduced data set. The following are to be assumed as not fan-assisted:
- gas boiler pre 1998 with balanced or open flue
- oil boiler
- gas warm air, balanced or open flue

[2] In Scotland, usually referred to as 'apartments'.

The following fuels apply only for boilers from the database:

- Biogas
- biodiesel from any biomass source
- biodiesel from vegetable oil only
- appliances able to use mineral oil or liquid biofuel

Where no space heating system is present, the calculation is done for portable electric heaters (with no controls) in all habitable rooms. The control type for this case (as is needed for SAP Table 9) is 2, the same as for portable electric heaters with no controls.

For treatment of unheated habitable rooms see A4 in Appendix A.

If one heating system feeds both underfloor and radiators, enter radiators. This is because if radiators are present a higher flow temperature is assumed (unless flow temperature is known to be low).

If electric storage heaters are present as main heating but single meter, enter as electric panel heaters and include addendum 6 (see S15). If the storage heaters are fan-assisted suppress the recommendation for fan-assisted storage heaters.

If boiler/heating system is present but not working (or condemned) it should still be entered as the main heating system. However if boiler is not present enter no heating system even though a boiler is intended.

A community heating system is one that serves more than one dwelling. Select the actual fuel used by the community system where that can be ascertained; if it cannot be, select mains gas.

If the dwelling has a micro-CHP system that cannot be located in the database enter as a condensing boiler and include addendum 5 (see S15).

Two main systems

There is an option for two main systems to cover the situation of different systems heating different parts of the dwelling.

If main system 1 heats all habitable rooms, there is no main system 2 unless it serves DHW only (see S10.4).

Main systems 1 and 2 cannot be room heaters except in the case of the dwelling's heating consisting solely of room heaters.

A main system is generally one that would be described as central heating (a heat generator providing heat to several rooms via a heat distribution system), although the term does also include, for example, storage heaters and fixed direct-acting heaters in each room.

When there are two main systems, system 1 always heats the living area and:

- when both systems heat the living area, main system 1 is the one that heats the most habitable rooms;
- when both systems heat the same number of habitable rooms; main system 1 is the system that provides water heating;
- when neither or both main heating systems heat water, main system 1 is the system which is cheapest to run (fuel cost from SAP Table 12 divided by the efficiency of heating system).
- where two systems serve different spaces, the percentage recorded for each system is in proportion to the heated floor area served by each system;
- where two systems serve the same heating circuit the default assumption is a 50/50 split. A different ratio can be used only if there is clear documentary evidence to back it up.

When there are two main systems and a recommendation is made for heating system upgrade, include addendum 9.

A second main system is not to be confused with a secondary heater. The latter are room heater(s) heating individual room(s) either as a supplement to the main heating in the room (e.g. a wood burning stove in the main room) or for rooms not heated by the main system(s). See section S10.3 for rules on secondary heaters.

If there is more than one main system within a room, select one of them according to the rules in SAP Appendix A and disregard the other.

Integrated storage/direct acting in living area, normal storage heating elsewhere: treat as two main systems.

If there are two main heating systems then:
- the two systems are taken as heating different parts of the dwelling;
- the assessor estimates the percentage of the total heated floor area served by system 2;
- the fraction of main heat from system 2 is 0.01 times the percentage.

S10.2 Space heating controls

Space heating controls are those marked "rd" in Table 4e. Some control features whose effect is small are omitted.

S10.3 Secondary heating

Include a secondary heater if there is a fixed emitter present regardless of whether the main heating system(s) heat all rooms.

If more than one secondary heater:
(a) select the device that heats greatest number of habitable rooms;
(b) if that does not resolve it, select the device using the cheapest fuel;
(c) if that does not resolve it, select the device with the lowest efficiency.

Electric focal point fires are included even if not wired by fixed spur.

An open fireplace is to be considered in the heating assessment if capable of supporting an open fire, even if no fuel is present. The fuel to be specified is smokeless fuel in smoke control areas and dual fuel outside smoke control areas.

Open fires in bedrooms are disregarded when identifying the heating systems (main and secondary) and heated habitable room count. They are counted in the number of open chimneys, if appropriate.

Solid Fuels

If the appliance can burn only one fuel, specify that fuel (includes exempted appliances burning wood in Smoke Control Areas). Otherwise:

Smoke control area: Open fire - smokeless fuel; closed heater - anthracite

Not smoke control area: Open fire - dual fuel; closed heater - wood logs if capable otherwise anthracite.

In the case of micro-CHP or a heat pump where Table N8 indicates a non-zero secondary heating requirement and no secondary heater has been specified, include secondary heating by portable electric heaters for the purposes of the calculation.

S10.4 Water heating

The size of a hot-water cylinder is taken as according to Table S17.

Table S17 : Cylinder size

Descriptor	**Indicative size range**	**Size to be used in SAP calculation ***
Inaccessible		if off-peak electric dual immersion: 210 litres if from solid fuel boiler: 160 litres otherwise: 110 litres
Normal	up to 130 litres	110 litres
Medium	131 – 170 litres	160 litres
Large	> 170 litres	210 litres
* Actual size to be used if present in the data set (in conjunction with solar panel data)		

If water is heated by a dual immersion and the electricity supply is a single meter include addendum 6.

Sometimes there is a separate boiler providing DHW only. A generic boiler can be selected from the water heating options. If the boiler is located in the database, specify two main heating systems with:
- main system 1 is the one providing space heating
- main system 2 is the DHW boiler
- percentage of main heat from system 2 is zero
- water heating is from main system 2.

An electric immersion is assumed dual in the following cases:
- cylinder is inaccessible and electricity tariff is dual;
- the DHW is heated by an electric boiler (191) and the electricity tariff is dual.

S10.5 Back boilers

Where water heating is from a back boiler or room heater with boiler, and the boiler provides water heating only, the appropriate fire or room heater is identified in the data collection process, and the water heating is identified as from main system or from secondary system.

Where the back boiler provides space heating:
- if gas, the back boiler is selected as main heating, the associated fire is selected as the secondary heating, and the water heating is from main system.
- if oil or solid fuel, the combination of room heater and boiler is selected as main heating and the water heating is from main system.

For the purposes of the calculation the appropriate fire or room heater is substituted. In the case of a gas fire with back boiler, the efficiency of the fire is from the room heater section of Table 4a according to the type of fire and the efficiency of the back boiler is 65% (from water heating section of Table 4a). In the case of oil or solid fuel, the efficiency from the room heater section of Table 4a is applied to both the fire/room heater and the boiler.

S10.6 No water heating system

Where no water heating system is present, the calculation is done for an electric immersion heater. If the electric meter is dual the immersion heater is also dual, but is a single immersion otherwise (including unknown meter). The calculation is done for a cylinder defined by the first row of Table S17 and the first row of Table S18.

S10.7 Solar water heating

Documentary evidence is required to over-write collector or solar store values except that orientation, tilt and overshading can be overwritten with visual evidence.

If the panel/collector details are available but the solar store information is not, the default values can be used for the solar store.

If the solar store is combined and details are being recorded the volume of the combined cylinder must also be recorded.

S10.8 Flue gas heat recovery

Calculation according to SAP Appendix G.

Include flue gas heat recovery only if found in the database, identified in same way as for heating systems. When the model cannot be found no default option is available but the presence of the device should be recorded in site notes.

S10.9 Waste water heat recovery

Calculation according to SAP Appendix G.

Include waste water heat recovery only if found in the database. When the model cannot be found no default option is available but the presence of the device should be recorded in site notes.

For instantaneous systems, number of rooms with bath and/or shower includes rooms with only an electric shower. If two showers found in a room, count as one.

Only mixer showers count for instantaneous waste water heat recovery. Mixer shower means a shower where the hot water is provided by a boiler (combi or regular), heat pump or immersion heater. A mixer shower attached to bath taps is recorded as a mixer shower only if there is a permanent bracket over the bath and there is a shower curtain or screen.

S10.10 Space and water heating assumptions

Parameters not included in the data collection (Table S19) are defined in Table S18.

Table S18 : Heating and hot water parameters

Parameter	Value
Hot water cylinder insulation if not accessible	Age band of main property A to F: 12 mm loose jacket Age band of main property G, H: 25 mm foam Age band of main property I to L: 38 mm foam
Cylinderstat if no access	No cylinderstat (but see also 9.4.9)
Cylinder heat exchanger area (required for some database heat pumps)	1.0 m²
Insulation of primary pipework	Age bands A to J: none Age band K. L: full
Space heating circulation pump for wet systems	Within heated space
Oil pump for oil boilers	Not in heated space
Gas boilers pre 1998, balanced or open flue	Not fan-assisted
Oil boilers from SAP table	Not fan-assisted
CPSU	In airing cupboard Gas: if data from Table 4b, store volume 80 litres, store loss rate 2.72 kWh/day Gas: if data from database use store volume and insulation thickness from database Electric: store volume 300 litres, store loss rate 3.16 kWh/day, store temperature 90°C
Gas warm air system, balanced or open flue (not the fan-assisted types)	Not fan assisted
Solid fuel boiler or room heater	Not HETAS approved
Underfloor heating	If dwelling has a ground floor, then according to the floor construction (see Table S11 if unknown): - solid, main property age band A to E: concrete slab - solid, main property age band F to L: in screed - suspended timber: in timber floor - suspended, not timber: in screed Otherwise (i.e. upper floor flats), take floor as suspended timber if the wall is timber frame and as solid for any other wall type, and apply the rules above.
Emitter temperature for condensing boilers and heat pumps	If unknown in RdSAP dataset: - if heating by radiators, > 45°C - underfloor heating, <= 35°C
Design water use target not more than 125 litres per person per day	No
Hot water separately timed	Age bands A to I (main dwelling): no Age bands J, K, L (main dwelling): yes
Hot water cylinder in heated space	Yes
Boiler interlock	Assumed present if there is a room thermostat and (for stored hot water systems heated by the boiler) a cylinder thermostat. Otherwise not interlocked.
Summer immersion where DHW is provided by a solid fuel open fire or closed room heater	Yes; single immersion unless already has dual immersion

Parameter	Value
Supplementary immersion heater for DHW from heat pump	Yes if generic heat pump (from Table 4a). Not applicable if heat pump from database since supplementary heating is incorporated in the water heating efficiency in the database record.
Electricity tariff	See S12
Solar panel	If solar panel present, the parameters for the calculation not provided in the RdSAP data set are: - panel aperture area 3 m² - flat panel, η_0 = 0.80, a_1 = 4.0, a_2 = 0.01 - facing South, pitch 30°, modest overshading - if regular boiler: combined cylinder, solar part one-third of total rounded to nearest litre (if separate pre-heat cylinder, assess total cylinder size (Table S17) on the basis of both cylinders) - if water heating by combi boiler or CPSU or heat pump or micro-CHP with integral DHW vessel or instantaneous water heater or DHW is from community system: 75 litre pre-heat cylinder - pump for solar-heated water is electric (75 kWh/year) - showers are both electric and non-electric
Storage waste water heat recovery system	Dedicated storage volume: - if combined, one third of the total cylinder size rounded to the nearest litre - if separate, the mean of the high and low dedicated volumes in the data record, rounded to the nearest litre.
Community heating scheme supplying - community space and water, or - community space heating only	For community schemes with data in the community heat network database, the network data are used for plant efficiency, distribution loss and pumping energy. Otherwise: - system based on boilers with efficiency 80% or heat pump with efficiency 300% - piping installed before 1990, pre-insulated - if CHP (waste heat or geothermal treat as CHP): fraction of heat from CHP = 0.35 CHP overall efficiency 75% heat to power ratio = 2.0 boiler efficiency 80%
Community heating scheme supplying - community water heating only	For community schemes with data in the community heat network database, the network data are used for plant efficiency, distribution loss and pumping energy. Otherwise: - system based on boilers with efficiency 80% or heat pump with efficiency 300% - piping installed before 1990, pre-insulated - flat-rate charging or if CHP fraction of heat from CHP = 1.0 CHP overall efficiency 75% heat to power ratio = 2.0

S11 Additional items

S11.1 Photovoltaics

If photovoltaics are present, look for the schematic which is usually adjacent to the electricity meter. The schematic should state the peak power (kWp) of the PV array. Record the following:

kWp
estimate of tilt of the PVs (horizontal, 30°, 45°, 60°, vertical)
if not horizontal, the orientation of the PVs (N, NE, E, SE, S, SW, W, NW)
overshading of PVs (very little, modest, significant or heavy, if on doubt select modest).

If there are PV panels on different planes of the roof, enter as different systems. If a single kWp figure is provided, in this case estimate the relative area of each and apportion the kWp accordingly.

If the kWp cannot be ascertained, record the percentage of the total roof area occupied by PVs. Here total roof area includes main dwelling and all extensions where present.

a) If the kWp is known, calculate the annual contribution according to M1 in Appendix M. Up to three separate PV arrays are allowed for, each with their own kWp, tilt orientation and overshading.

b) If the kWp is not known use the following:
- PV area is roof area for heat loss (before amendment for any room-in-roof), times percent of roof area covered by PVs, and if pitched roof divided by cos(35°). If there is an extension, the roof area is adjusted by the cosine factor only for those parts having a pitched roof.
- kWp is 0.12 × PV area.
- if not provided in the RdSAP data set then facing South, pitch 30°, modest overshading

S11.2 Wind turbine

If present and details not provided in the RdSAP data set, calculate for 1 turbine with 2 m rotor diameter and 2 m hub height.

Documentary evidence is required to overwrite default values.

S12 Electricity tariff

The electricity meter is recorded as single, dual (two separate readings), dual 18-hour, dual 24-hour or unknown (if inaccessible). Dual 24-hour is possible in Scotland and some parts of northern Northumberland.

Off-peak tariff is needed for the intended operation of:
- electric storage heaters (401 to 409)
- underfloor heating (421 or 422, but not 424)
- electric dry core or water storage boiler (193, 195)
- electric CPSU (192)
- dual electric immersion

If it is a single meter when any of these are present enter heating as panel heaters and/or immersion as single, and include Addendum 6.

If the electricity meter is unknown, treat as single meter except where:
- main heating or water heating are intended to run off an off-peak tariff (per systems listed in text box above) or
- main heating is ground source or water source heat pump.

If that results in a dual meter, assign tariff per rules 1. to 4. below.

If the electricity meter is single, the tariff is standard electric tariff and if the meter is dual 18-hour/24-hour it is 18-hour/24-hour tariff. Otherwise the choice between 7-hour and 10-hour is determined as follows.

1. If the main heating system (or either main system if there are two) is an electric CPSU (192) it is 10-hour tariff.

2. Otherwise if the main heating system (or either main system if there are two) is:
   - electric storage heaters (401 to 409), or
   - electric dry core or water storage boiler (193 or 195), or
   - electric underfloor heating (421 or 422)

   it is 7-hour tariff.
3. If that has not resolved it then if the main heating system (or either main system if there are two) is:
   - direct-acting electric boiler (191), or
   - heat pump (211 to 224, 521 to 524, or database), or
   - electric room heaters (unless assumed because there is no heating system).

   it is 10-hour tariff.
4. If none of the above applies it is 7-hour tariff. This includes assumed electric heaters because there is no heating system.

A dual meter is possible even if off-peak is not used for heating or DHW.

If dual, assign electricity uses to tariffs according to 12.4.3.

S13 Climatic data

For ratings (SAP rating and EI rating), the calculations are done using the UK average climate data as follows:

External temperature: row for UK average in SAP 2012 Table U1.
Wind speed: row for UK average in SAP 2012 Table U2.
Solar radiation on horizontal surfaces: row for UK average in SAP 2012 Table U3.
Solar radiation on vertical surfaces (for calculation of solar gains) and solar radiation on inclined surfaces (for solar panels and PVs): from the radiation on the horizontal converted by the procedures in SAP 2012 U3.2.

For costs and savings, energy demand, total emissions and primary energy, the calculations are done using the climate data for the location of the property, as follows:

External temperature, wind speed, solar radiation on horizontal surfaces: data provided for each postcode district.
Solar radiation on vertical surfaces (for calculation of solar gains) and solar radiation on inclined surfaces (for solar panels and PVs): from the radiation on the horizontal for the property's postcode converted by the procedures in SAP 2012 U3.2.

S14 Rounding of data

For consistency of application, after expanding the RdSAP data into SAP data using the rules in this Appendix, the data are rounded before being passed to the SAP calculator. The rounding rules are:

U-values: 2 d.p.
All element areas (gross) including window areas and conservatory wall area: 2 d.p.
All internal floor areas and living area: 2 d.p.
Storey heights and conservatory height: 2 d.p.
Draughtstrip percent and multiple glazing percent: integer
Solar part of combined cylinder: integer
kWp for photovoltaics: 2 d.p.

S15 Addendum to EPCs

Where a feature, e.g. wall type or heating system, is not part of the reduced data set, a near equivalent should be selected. For the circumstances indicated below, an explanation can be provided on the EPC by way of an addendum.

Reference Number	Circumstances	Addendum text on EPC
1	Wall type does not correspond to options available in RdSAP	The dwelling has a type of wall that is not included in the available options. The nearest equivalent type was used for the assessment.
4	Dwelling has a swimming pool	The energy assessment for the dwelling does not include energy used to heat the swimming pool.

Reference Number	Circumstances	Addendum text on EPC
5	Dwelling has micro-CHP	The performance characteristics of the micro-CHP system in this dwelling are not known and default values were used for the assessment.
6	Off-peak appliance(s) with single meter	A dual rate appliance(s) is present with a single-rate supply. A single-rate appliance has been used for the assessment. Changing the electricity tariff to an off-peak (dual rate) supply is likely to reduce fuel costs and improve the energy rating.
8	PVs or wind turbine present on the property (England, Wales or Scotland)	The assessment does not include any feed-in tariffs that may be applicable to this property.
9	Two main heating systems and heating system upgrade is recommended	As there is more than one heating system, you should seek professional advice on the most cost-effective option for upgrading the systems.
10	Dual electricity meter selected but there is also an electricity meter for standard tariff	The assessment has been done on the basis of an off-peak electricity tariff. However some heating or hot water appliances may be on the standard domestic tariff.
11	Single electricity meter selected but there is also an electricity meter for an off-peak tariff	The assessment has been done on the basis of the standard domestic electricity tariff. However some heating or hot water appliances may be on an off-peak tariff.
12	Dwelling is using a biomass fuel that is not in the RdSAP fuel options	The dwelling uses a type of fuel that is not included in the available options. The nearest equivalent fuel type was used for the assessment.

The list of addenda shown above is current at the date of this document; items will be modified or added as appropriate. An addendum may be added as a temporary measure; if an addendum is used frequently the reduced data set will be extended in a future revision so as to avoid the need for it.

> Software displays the current list of possible addenda (showing the 'circumstances' for each one); the assessor can select one or more to be included on the EPC.

S16 Improvement measures

The effect of improvement measures is assessed by amending the data for the existing dwelling according to the improvement measure being considered. When a number of measures are being considered, the effect of any one of them on the SAP and Environmental Impact ratings depends, in general, on the order in which they are introduced. A standard list of improvement measures and how their effect on energy performance is to be assessed is provided in Appendix T.

> Recommendations should be removed only if there is documentary evidence showing that a specific recommendation is not appropriate. A listed building or a property in a conservation area is not sufficient grounds in its own right to suppress a recommendation. If a recommendation is removed this must be recorded with reasons in site notes. Further guidance on specific recommendations can be sought from an appropriate professional organisation, for example heating engineers, building control officers, product manufacturers, trade associations, etc.

An improvement measure is assessed by adjusting the values within the reduced data set. For increased loft insulation, for example, the calculation would be re-done with a different roof U-value taken from Table S9 according to the proposed new thickness of the loft insulation.

S17 Data to be collected

Table S19 : Data to be collected

Item	Data	Comment
FOR THE DWELLING AS A WHOLE		
Country	One of: - England & Wales - Scotland - Northern Ireland	
Region	One of those in SAP 2012 Table U1	Derived from the postcode of the property
Transaction type	One of: - marketed sale - non-marketed sale - rental - not sale or rental - assessment for Green Deal - following Green Deal - FIT application - RHI application - ECO assessment - none of the above	Non-marketed sale includes right-to-buy
Tenure	One of - owner-occupied - rented (social) - rented (private) - unknown	Private rented includes institutions (e.g. university)
Dwelling type	One of - house - bungalow	

Item	Data	Comment
	- flat - maisonette - park home	
Built form and detachment	Classification according to S1.	Detachment does not need to be recorded for flats/maisonettes, provided that internal dimensions are being used.
Number of rooms	Number of habitable rooms Number of heated habitable rooms	Total as defined in S9.1, inclusive of main property and any extension. A heated room is one with a fixed heat emitter in the room.
Dimension type	Measured internally or externally	Applies to areas and perimeters. Room heights always measured internally within the room. See S3.
Conservatory	One of - no conservatory - separated, no fixed heaters - separated, fixed heaters - not separated	
Non-separated conservatory only	Floor area Glazed perimeter Double glazed (yes/no) Height (number of half storeys of main dwelling)	See section 3.3.3.
Flats and maisonettes only	Heat loss corridor, one of: - no corridor - heated corridor - unheated corridor	
	If unheated corridor, length of sheltered wall	The length of wall between flat and corridor. If a flat or maisonette is sheltered on more than one storey this is the total of the sheltered lengths on each storey.
	Floor level relative to the lowest level of the building (0 for ground floor).	This is the lowest floor level if property has more than one storey. If there is a basement, the basement is level 0 and the other floors from 1 upwards.
	Property position, one of: - basement - ground floor - mid floor - top floor	This is used for the description of the dwelling type on the EPC (e.g. 'Top-floor flat')
Number of extensions	Between 0 and 4	
FOR EACH BUILDING PART A building part is main dwelling, extension 1, extension 2, extension 3 or extension 4		
Age band	According to S2	

Item	Data	Comment
Below the building part	Whether the lowest floor is/has: - ground floor - above partially/intermittently heated space (commercial premises) - above unheated space - to external air - same dwelling below - another dwelling below	A partially heated space below applies when it is above non-domestic premises. An unheated space below applies when it is above a space not used for habitation. If above more than one type, it is classified according to the largest floor area concerned.
Above the building part	Whether the highest floor has: - pitched roof (slates or tiles), access to loft - pitched roof (slates or tiles), no access - pitched roof, sloping ceiling - pitched roof (thatched) - flat roof - same dwelling above - another dwelling above	for a park home select pitched or flat as appropriate
Dimensions	Area, average room height and exposed perimeter for each storey (from lowest occupied floor up to lowest occupied + 6) Party wall length on each storey	For rooms-in-roof, measure floor area only, inside the dwelling
Floor construction	One of: - unknown - solid - suspended timber - suspended, not timber	For lowest floor of the building part. Not if another dwelling or other premises below.
Floor insulation	One of: - unknown - as built - retro-fitted	Not if another dwelling or other premises below. There must be evidence for retro-fit insulation
Floor insulation thickness	One of: - unknown - 50 mm - 100 mm - 150 mm or more	Only if floor insulation is retro-fitted. Applies to ground floors and exposed upper floors..
Floor U-value	Value in W/m²K	'Insulation thickness' and 'U-value' are mutually exclusive alternatives
Wall construction	One of: - stone (granite or whinstone) - stone (sandstone or limestone) - solid brick - cob - cavity - timber frame - park home wall - system build (i.e. any other)	"park home wall" is the only option for a park home.
Wall thickness	Wall thickness in mm (or unknown if it cannot be measured)	Where thickness varies for the same construction use the average of the measured values.

Item	Data	Comment
Wall insulation type	One of: - as built - external - filled cavity - internal - cavity plus external - cavity plus internal - unknown	External, cavity or internal insulation to be indicated only if added subsequent to original construction and evidence exists. If it has only the insulation that was part of the original construction it is 'as built'.
Wall insulation thickness	One of: - unknown - 50 mm - 100 mm - 150 mm - 200 mm	Only if wall insulation is external, internal, or cavity (filled or unfilled) plus external or internal.
Wall U-value	Value in W/m²K. Can be given where known for any wall.	'Insulation thickness' and 'U-value' are mutually exclusive alternatives.
Wall dry-lined or lath and plaster	yes/no	Only for uninsulated stone, solid brick or cavity walls in age bands A to E.
Alternative wall (for any building part with an alternative wall)	All the above items for walls, plus - net area of alternative wall - is sheltered wall (yes/no)	Sheltered wall applies only to the building part of a flat or maisonette that is adjacent to an unheated corridor or stairwell. If sheltered its area is calculated from the shelter length and not specified separately.
Party wall construction	One of: - solid masonry, timber frame or system built - masonry cavity unfilled - masonry cavity filled - not applicable - unable to determine	Except for detached properties there must be at least one building part with a party wall. 'not applicable' applies to a detached property and to building parts of other properties not adjoining a party wall.
Roof insulation (if not same or another dwelling above)	One of: - none - at joists - at rafters - flat roof insulation - sloping ceiling insulation - unknown	'None' does not apply to a flat roof or to a pitched roof with sloping ceiling. There must be evidence for joist, rafter, flat roof or sloping ceiling insulation, otherwise it is 'unknown'. 'At rafters' can apply to a thatched roof.
Roof insulation thickness (loft space) (pitched roof with insulation at joists, applies to roof or parts of roof without roof room)	One of: - 12, 25, 50, 75, 100, 150, 200, 250, 270, 300, 350, 400+ mm	Only for roof insulation at joist level and where can be accessed. If none or unknown this is recorded via the preceding item.
Rafter insulation thickness	One of: - unknown - as built - 50 mm - 100 mm - 150 mm or more	Only if roof insulation is 'at rafters'

Item	Data	Comment
Flat roof insulation thickness	One of: - unknown - as built - 50 mm - 100 mm - 150 mm or more	Only if roof insulation is 'flat roof insulation'
Sloping ceiling insulation thickness	One of: - unknown - as built - 50 mm - 100 mm - 150 mm or more	Only if roof insulation is 'sloping ceiling insulation'
Roof U-value	Value in W/m²K	'Insulation thickness' (loft, rafter, flat roof or sloping ceiling) and 'U-value' are mutually exclusive alternatives
Roof room age band	According to S2	The age band of the roof rooms can be different to that of the rest of the building part.
Roof rooms connected	yes/no	Whether the roof rooms are connected to or are adjacent to another building part of the same dwelling. An adjacent part can be another roof room or a normal storey.
Roof room insulation	One of: - unknown - as built - flat ceiling only - all elements	Only when there is a roof room in the building part concerned There must be evidence for insulation of flat ceiling or all elements, otherwise it is 'as built' or 'unknown'.
Roof room insulation thickness (on flat part of roof of roof room)	One of: - 12, 25, 50, 75, 100, 150, 200, 250, 270, 300, 350, 400+ mm, not applicable	Only if roof room insulation is 'flat ceiling only' or 'all elements' 'not applicable' is for the case of (documentary) evidence of insulation of all elements, but it is a vaulted ceiling with no flat part.
Roof room insulation thickness (other parts of roof room)	One of: - unknown - as built - 50 mm - 100 mm - 150 mm or more	Only if roof room insulation is 'all elements'
Roof room area and U-value details	Area and U-value for: - flat ceiling - sloping ceiling - stud wall - gable wall (up to 2 of each of these)	Only where these details are collected; if so they supersede roof room insulation and roof room insulation thickness.

Item	Data	Comment
FOR THE DWELLING AS A WHOLE		
Number of external doors	Total number of external doors and Number of insulated external doors	Doors to a heated access corridor are not included in the door count. Only if their U-value is known.
Insulated door U-value (when there are insulated doors)	Value in W/m²K	Average for the insulated external doors (where applicable)
Windows (of the dwelling only, not including any conservatory)	Area: one of – typical – less that typical – much less than typical – more than typical – much more than typical	'Typical' refers to normal construction for the property type and age band concerned. If assessed as much more or much less than typical the area of each window should be measured.
If window area is typical, less than typical or more than typical	Proportion with multiple glazing Multiple glazing type, one of: - d/g pre year xxxx - d/g during or post year xxxx - d/g unknown date - secondary glazing - triple glazing - double, known U-value - triple, known U-value	As percentage xxxx is: - 2002 in England & Wales - 2003 in Scotland - 2006 in Northern Ireland.
PVC window frames and glazing gap	PVC window frames (yes/no) Glazing gap, one of - 6 mm - 12 mm - 16 mm or more	To be included when the multiple glazing type is d/g pre year xxxx or d/g unknown date. To be included if PVC window frames
Window U-value	Value in W/m²K	Only when multiple glazing type is double or triple with known U-value
Window g-value	Value to 2 d.p.	
Window data source	Manufacturer or BFRC	
If window area is much less or much more than typical	For each window: - location (building part) - window or roof window - area (including frame) - glazing type (as above, plus single) - PVC window frame (yes/no) - Glazing gap (6/12/16+) - orientation (one of S, SE, E ,NE, N, NW ,W, SW, horizontal) - U-value - g-value - data source	This option can also be used if more than one type of multiple glazing. PVC frame only when the glazing type is d/g pre year xxxx or d/g unknown date. Glazing gap only for PVC frame. U-value, g-value and data source only when multiple glazing type is double or triple with known U-value
Draught proofing	Between 0 and 100%	Percentage of all windows and doors that are draught proofed
Fireplaces	Number of open fireplaces	

Item	Data	Comment
Main heating system (option to say 'none')	Fuel for main heating	If none, the calculation is done for portable electric heaters with no controls
	Product index number whenever possible for boilers, micro-CHP, heat pumps, warm air systems, storage heaters, otherwise system (marked "rd") from Table 4a or 4b	If product can be identified, its characteristics are obtained via the database. Storage heaters (high heat retention types only): index number of each heater
	Flue type, one of - open - room-sealed	Applies to boilers, micro-CHP and warm-air systems. For fires and roomheaters use normal flue type indicated in Table 4a
	For gas boilers 1998 or later, the ignition type, one of - auto-ignition - permanent pilot light	Not if from database
	For gas boilers 1998 or later, the whether or not fan-flued	Not if from database
	For gas and oil boilers, for heat pumps to water and for electric CPSUs, the heat emitter type, one of - radiators - underfloor - fan coil units	If underfloor downstairs and radiators upstairs, select radiators Fan coil units only for heat pumps
	For wet systems, central heating pump age, one of: - 2012 or earlier - 2013 or later - unknown	Unknown if the pump cannot be located.
	For heat pumps, MCS installation (yes/no)	Yes only if documentary evidence available.
	Design flow temperature of heat generator, one of: - unknown - over 45°C - <= 45°C and over 35°C - <= 35°C	Applicable to heat pumps and condensing boilers. Unknown unless documentary evidence is available giving the design flow temperature. Option "<= 45°C and over 35°C" not available for heat pumps from SAP Tables.
Second main heating system (where applicable)	Details of system as above. plus the percentage of heated floor area served by the second system. System 1 is that heating the living area.	Estimate percentage to nearest 10% If there is a boiler providing DHW only, assign it as the 2nd main system with a space heating percentage of zero.
Community heating system	Index number of community heat network if known, otherwise fuel used by community system and heat generator type, one of - boilers - CHP and boilers - heat pump	If fuel cannot be ascertained, assume mains gas

Item	Data	Comment
Main heating controls	Item from Table 4e according to main system type Compensating controller (yes/no/not applicable) Product index number of controller if applicable	For both main systems if there are two
Secondary heating system	Fuel for secondary heating, and system from room heater section of Table 4a	'None' if no secondary heating system
Water heating	Either - from main heating system, or - from 2nd main system, or - from secondary system, or - any other water heater marked "rd" in hot-water-only section of Table 4a, or - no DHW system present	If no system, the calculation is done for an electric immersion, see text below Table S17. Fuel also needed if not from main system.
	Cylinder size, one of: - no cylinder - no access - normal (up to 130 litres) - medium (131-170 litres) - large (> 170 litres)	Separate thermal store (hot-water only or integrated) treated as if it were a cylinder
	Cylinder insulation type (unless no access), one of - none - loose jacket - factory-applied	
	Cylinder insulation thickness, one of: 0, 12, 25, 38, 50, 80, 120, 160 mm	
	If immersion, whether single or dual	
	Cylinderstat (unless no access): yes/no	
Solar water heating	Solar panel (yes/no)	
Solar water heating details known	yes/no. If yes, then details: - tilt: one of horizontal, 30°, 45°, 60°, vertical - orientation (if not horizontal): one of S, SE, E ,NE, N, NW ,W, SW - overshading: very little, modest, significant or heavy - solar water pump: electrically powered, solar powered or unknown - type(s) of showers in the property, one of - non-electric only - electric only * - both electric and non-electric - no shower	Only if solar panel present * where the water is heated as the shower runs. If the shower is supplied from a hot-water cylinder it is classified as non-electric even though the cylinder is electrically heated.

Item	Data	Comment
Solar collector details known	yes/no. If yes then details: - collector aperture area - collector type (evacuated tube, flat plate or unglazed) - collector zero loss efficiency - collector linear heat loss coefficient - collector 2nd order heat loss coefficient	Only if solar panel present and solar water heating details known. Documentary evidence is required to enter collector values
Solar store details known	yes/no. If yes, then details: - combined solar store (yes/no) - total hot water store volume - dedicated solar volume	Only if solar panel present and solar water heating details known and solar collector details known
Flue gas heat recovery	yes/no. If yes then: - product index number	Only if located in the database
PV for flue gas heat recovery	Details of the PV: - kWp - tilt: one of horizontal, 30°, 45°, 60°, vertical - orientation (if not horizontal): one of S, SE, E ,NE, N, NW, W, SW - overshading: very little, modest, significant or heavy	Only for systems with a PV powered immersion
Baths and showers	Number of rooms with bath and/or shower Number of rooms with mixer shower and no bath Number of rooms with mixer shower and bath	These items are always collected, to enable a recommendation for waste water heat recovery to be made

Item	Data	Comment
Waste water heat recovery	none or instantaneous or storage. If instantaneous type present: - number of systems (1 or 2) - system 1 product index number - number of mixer showers with system 1 in rooms with bath - number of mixer showers with system 1 in rooms without bath - system 2 product index number - number of mixer showers with system 2 in rooms with bath - number of mixer showers with system 2 in rooms without bath If storage type present: - product index number - total showers and bath - number of showers and bath routed through WWHRS	Only if located in the database. Number of rooms with bath and/or shower includes rooms with only an electric shower. If two showers found in a room, count as one. Only mixer showers count for instantaneous waste water heat recovery. Mixer shower means a shower where the hot water is provided by a boiler (combi or regular), heat pump or immersion heater. A mixer shower attached to bath taps is recorded as a mixer shower only if there is a permanent bracket over the bath at least 1.5 m above the plughole and there is a shower curtain or screen. Only if located in the database
Space cooling system present	yes/no	
Mechanical ventilation	yes/no, and if yes whether extract-only or balanced	Applies to whole house ventilation system only. Otherwise natural ventilation is assumed. Intermittent extract fans (kitchen and bathrooms) are not a mechanical ventilation system for SAP calculations, but continuously running extract fans in wet rooms are treated as mechanical extract ventilation..
Electricity meter	Dual/single/18-hour/ 24-hour/unknown	See S12
Mains gas available	yes/no	Yes means that there is a gas meter or a gas-burning appliance (e.g. cooker) in the dwelling. A closed-off gas pipe does not count. Where a boiler is present attached to a heating system (not in a box), and the mains gas meter has been removed for security reasons, enter a gas boiler as the main form of heating and indicate that mains gas is present. Can be relevant to improvement recommendations.

Item	Data	Comment
Photovoltaic array	yes/no, and if yes then either: a) % of external roof area with PVs, or b) details of the PV: - kWp - pitch: one of horizontal, 30°, 45°, 60°, vertical - orientation (if not horizontal): one of S, SE, E ,NE, N, NW ,W, SW - overshading: very little, modest, significant or heavy In either case, whether the PVs are connected to the dwelling's electricity meter (yes/no, separately for each PV if more than one)	b) to be used when the information on kWp is available. In this case up to 3 PV arrays can be specified a convention will define what to do when the situation is not immediately obvious
Terrain	One of: - dense urban - low rise urban or suburban - rural	Used to generate wind turbine recommendation where appropriate – data item must always be collected
Wind turbine	yes/no	
Wind turbine details known	yes/no. If yes, then details: - number of turbines - rotor diameter - height above ridge	Only if wind turbine present.
Lighting	Total number of fixed lighting outlets, and Total number of low-energy fixed lighting outlets	LEDs are considered as low energy lights. Where there are 4 or more downlighters/ceiling lights divide the bulb count by 2. Include fixed under-cupboard kitchen strip lights/
Swimming pool	A swimming pool is not included in the data set.	Count the room containing the swimming pool as a habitable room and add addendum 4 (see S15).

Appendix T: Improvement measures for Energy Performance Certificates

Table T1 defines the circumstances under which recommendations for improvements are made on EPCs.

For properties in England & Wales and Scotland software tests for the relevance of improvement measures, and applies them where relevant, in the order shown in this table. Several heating measures apply when mains gas is not available. When mains gas is available they are substituted by a fuel switch recommendation (item T).

Items Q2, J2, Z1, Z2, Z3 are alternative measures. They are shown on the EPC where relevant to the property; Q2 when there is a recommendation for cavity fill and the others when there is a recommendation to change or upgrade the heating system.

For Northern Ireland the sequence is A to H, A2, A3, W1, W2, X, Y, I, T2, J to V2 (not alternative measures).

In the case of new dwellings only items E, N, U and V2 are considered.

Table T1 : Improvement measures

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
A	Loft insulation Note. This is assumed to include insulation of the loft hatch.	Pitched roof (slates or tiles), accessible loft, insulation at ceiling level, not thatched roof. Note: This does not include insulation of a room-in-roof	<= 150 mm insulation or U-value entered by assessor >= 0.35	270 mm insulation. See Note 2 For park home additional resistance of 1.5 m²K/W.
A2	Flat roof insulation	Flat roof, not unknown insulation or Pitched roof with sloping ceiling, not unknown insulation	Flat roof insulation < 100 mm or flat roof U-value (entered or from RdSAP tables if as-built) > 0.4	Flat roof U-value = 0.18 For park home additional resistance of 1.5 m²K/W.
A3	Roof room insulation	Roof rooms, not thatched roof, as built age band <= F or insulated with U > 0.5	Any part of roof rooms with U-value (entered or from RdSAP tables if as-built) > 0.5	U-value of all elements of roof rooms with U > 0.5 have U = 0.18
B	Cavity wall insulation	Unfilled cavity wall (assessed as "as built" and not "unknown")	Wall U-value (as entered by assessor or assumed from RdSAP tables) > 0.6	Cavity filled wall. U-value from RdSAP tables according to age of wall. See Note 3
B4	Party wall insulation	Unfilled party walls	Party wall type is “cavity masonry unfilled”	U-value of party walls 0.2

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
Q	Solid wall insulation	Solid wall (stone or brick) or park home wall, assessed as "as built" and not "unknown"	Wall U-value (as entered by assessor or assumed from RdSAP tables) > 0.6	Internal or external wall insulation with: E&W: U-value 0.3 Scotland: U-value 0.22 For a park home use R_{ins} = 2.0 m²K/W in Appendix S1.1.2. See Note 7
Q2	External insulation with cavity wall insulation (Alternative measure).	Cavity walls	Cavity fill recommendation	For the walls recommended for cavity fill: E&W, NI: U-values 0.3 Scotland U-value 0.22
W1	Floor insulation (suspended floor)	Below the building part there is: - ground, or - external air, or - unheated space and floor is suspended	Floor is - as-built, age band <= J, or - has retro-fitted insulation <= 50 mm or U > 0.5	Insulated floor with E&W, NI: U = 0.25 Scotland: U = 0.18 For a park home use R_{ins} = 1.5 m²K/W in Appendix S1.1.2. Do not apply insulation in the case of an exposed or semi-exposed floor deduced by RdSAP S3.10 rather than entered by the RdSAP assessor
W2	Floor insulation (solid ground floor)	Below the building part there is - ground and floor is solid	Floor is - as-built, age band <= J, or - has retro-fitted insulation <= 50 mm or U > 0.5	Insulated floor with: E&W, NI: U = 0.25 Scotland: U = 0.18
C	Hot water cylinder insulation	Cylinder present and accessible.	No cylinder insulation	80 mm jacket
			Factory-applied insulation <= 25 mm	Add 80 mm jacket. See Note 1a.
			Jacket < 80 mm	Add additional jacket. See Note 1b.
D	Draught proofing	Existing dwelling	Less than 100% draught proofing of windows and doors	100% draught proofing
E	Low energy lights	Existing dwelling	LEL < 100% of fixed outlets	LEL in all fixed outlets
		New dwelling	LEL < 75% of fixed outlets	LEL in all fixed outlets

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
F	Cylinder thermostat	Cylinder present and accessible	No cylinderstat (Note: cylinderstat is assumed for electric immersions)	Cylinderstat
G	Heating controls for wet central heating system	Main heating by boiler with radiators	No controls	Roomstat, programmer and TRVs
			Programmer only	do.
			Roomstat only	do.
			Programmer, single roomstat (no TRVs)	do.
			TRVs (no roomstat or BEM), with or without programmer	do.
			Programmer and at least two roomstats	Time and temperature zone control
		Main heating by boiler with underfloor heating	Less than time and temperature zone control	Time and temperature zone control
		Main heating by heat pump with radiators or underfloor heating	Less than time and temperature zone control	Time and temperature zone control
H	Heating controls for warm air system	Main heating by mains gas or LPG warm air, or by heat pump	No control	Programmer and roomstat
			Programmer only	do.
J2	Biomass boiler (Alternative measure).	Heating other than by solid fuel or community	Heating system recommendation	Wood logs boiler. See Note 8
Z1	Air or ground source heat pump (Alternative measure).	Heating other than by: - heat pump or - community or - wet underfloor system	Heating system recommendation	Air source heat pump and radiators. See Note 9
Z2	Air or ground source heat pump with underfloor heating (Alternative measure).	Heating other than by: - heat pump or - community and wet underfloor system and Z1 not applicable	Heating system recommendation	Air source heat pump and underfloor heating. See Note 9
Z3	Micro-CHP (Alternative measure).	Heating other than by micro-CHP or community and mains gas available	Heating system recommendation	Heating by micro-CHP. See Note 10

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
J	Biomass boiler	Independent solid fuel boiler (not biomass or dual fuel)	Mains gas not available	Manual feed biomass boiler in heated space (wood logs) with radiators. See Note 8.
K	Biomass room heater with boiler	Solid fuel open fire with or without boiler (not biomass or dual fuel)	Mains gas not available	Wood pellet stove with radiators, summer immersion heater. See Note 8.
		Solid fuel room heater with or without boiler (not biomass or dual fuel)	Mains gas not available	Wood pellet stove with radiators, summer immersion heater. See Note 8.
I	Upgrade boiler, same fuel	Main heating by mains gas boiler (including range cooker boiler) or CPSU or by LPG or oil boiler (including range cooker boiler) and mains gas not available Note. Not applicable to liquid biofuels.	Boiler, not condensing, hot water cylinder in dwelling	Condensing regular boiler, same fuel as original. See Note 4
			Boiler, not condensing, no hot water cylinder in dwelling	Condensing combi boiler, same fuel as original. See Note 4
			CPSU, not condensing	Condensing CPSU. See Note 5
			Range cooker boiler, hot water cylinder in dwelling	Condensing regular boiler, same fuel as original. See Note 4
			Range cooker boiler, no hot water cylinder in dwelling	Condensing combi boiler, same fuel as original. See Note 4
R	Condensing oil boiler	Main heating by oil warm air	Mains gas not available, hot water cylinder in dwelling	Condensing regular oil boiler, radiators. See Note 4
			Mains gas not available, no hot water cylinder in dwelling	Condensing combi oil boiler, radiators. See Note 4
S	Change heating to condensing gas condensing boiler (no fuel switch)	Main heating by mains gas fires	Hot water cylinder in dwelling	Condensing regular mains gas boiler, radiators. See Note 4
			No hot water cylinder in dwelling	Condensing combi mains gas boiler, radiators. See Note 4

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
T	Change heating to condensing gas condensing boiler (fuel switch)	Main heating by: - solid mineral fuel boiler - LPG boiler (non-condensing) - oil boiler (non-condensing) - LPG fires - oil warm air - solid mineral fuel room heaters - oil room heaters - electric room heaters - electric ceiling heating Also if no space heating system present	Mains gas available, hot water cylinder in dwelling	Condensing regular mains gas boiler, radiators. See Note 4
			Mains gas available, no hot water cylinder in dwelling	Condensing combi mains gas boiler, radiators. See Note 4
		Main heating by: - electric storage heating - electric off-peak underfloor heating	Mains gas available, hot water cylinder in dwelling	Condensing regular mains gas boiler, radiators. Change electricity meter to single. See Note 4
			Mains gas available, no hot water cylinder in dwelling	Condensing combi mains gas boiler, radiators. Change electricity meter to single. See Note 4
		Main heating by LPG CPSU	Mains gas available	Mains gas condensing CPSU
T2	Flue gas heat recovery	New or replacement gas boiler recommended (I, S or T)	Replacement boiler provides DHW	Add FGHRS

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
L2	New or replacement storage heaters	Main heating by storage heaters, Old (large volume) or Slimline	Mains gas not available, and hot-water heating by cylinder with single immersion, or from solid-fuel secondary heater	High heat retention storage heaters and controls, and dual immersion water heating, large cylinder with 50 mm factory-applied insulation
			Mains gas not available, and any other hot water system	High heat retention storage heaters and controls
		Main heating by: - electric room heaters - electric ceiling heating Also if no space heating system present	Mains gas not available, and hot-water heating by cylinder with single immersion or from solid-fuel secondary heater or no hot water system present	High heat retention storage heaters and controls, 7-hour off-peak tariff and dual immersion water heating, large cylinder with 50 mm factory-applied insulation
			Mains gas not available, and any other hot water system	High heat retention storage heaters and controls, 7-hour off-peak tariff
M	Replacement warm-air unit	Main heating by mains gas	Non-condensing	New condensing warm-air unit, same fuel as original, on-off control, fan-assisted flue
		Main heating by LPG warm air	Age before 1998	New (non-condensing) warm-air unit, same fuel as original, on-off control, fan-assisted flue

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
N	Solar water heating	RdSAP assessment, house or bungalow, not thatched roof on main dwelling	No solar panel	Solar panel with parameters per Table S18. Increase a normal or unknown size cylinder to medium (see * below).
		SAP assessment, house or bungalow	No solar panel	Solar panel, 3 m^2 aperture area, evacuated tube with η=0.70, a_1=1.80, a_2 = 0.005, facing South, pitch 30°, modest overshading. Combined DHW cylinder at least 190 litres (see * below), solar part 75 litres; or if combi boiler, CPSU or instantaneous water heater, a separate solar pre-heat cylinder of 75 litres.
			All cases:	* Cylinder change not applicable to water heating by combi boiler or CPSU or heat pump or micro-CHP with integral DHW vessel or instantaneous water heater or community heating. In these cases add a separate solar cylinder of 75 litres. Cylinder has cylinderstat and 50 mm factory-applied insulation.
Y	Waste water heat recovery	Dwelling has a mixer shower and no WWHRS	WWHRS not present	Add WWHRS for each shower.
O	Double glazed windows	Single glazed windows present	Less than 80% of windows with multiple glazing	If all windows measured, all single glazed windows replaced by double glazing with U = 1.8 (roof windows) or U = 1.6 (other windows), and g = 0.63. Otherwise the windows with single glazing changed to double glazing with U = 1.6 and g = 0.63. See Note 6.
O3	Glazing replacement	Double glazing with PVC frames and 12 mm gap installed before 2002 (E&W) or 2003 (Scotland) or 2006 (Northern Ireland)	At least 80% of windows are of that type	Replace double glazed units with new units giving whole-window values of U = 1.6 and g = 0.74

Item	Measure	To be considered when existing dwelling is/has:	Recommended if existing dwelling has:	Improve to:
P	Secondary glazing	Single glazing present but assessor de-selected measure O. See Note 6	Less than 80% of windows with multiple glazing	If all windows measured apply secondary glazing to single glazed windows with U = 2.6 (roof windows) or U = 2.4 (other windows) and g = 0.76. Otherwise the windows with single glazing changed to secondary glazing with U = 2.4 and g = 0.76. See Note 6.
X	Insulated doors	House or bungalow or park home or (Flat or maisonette) and (no corridor or more than one door) i.e. door directly to outside	Door(s) directly to outside not insulated	Change doors directly to outside to insulated doors with U = 1.5
U	Photovoltaics	House or bungalow, not thatched roof	No photovoltaics	Photovoltaics, 2.5 kWp, facing South, pitch 30°, modest overshading, connected to dwelling's electricity meter
V2	Wind turbine	House or bungalow in rural location	No wind turbine	Wind turbine on mast, blade diameter 4.0 m, hub height 10 m above ridge

Note 1a : Cylinder insulation, existing is factory applied <= 25 mm. SAP Table 2 is constructed on the basis that 80 mm jacket is equivalent to 25 mm factory-applied insulation. Therefore an additional 80 mm jacket can be implemented by increasing the existing insulation thickness by an additional 25 mm, to the nearest RdSAP thickness option for cylinders. Thus 12 mm improves to 38 mm, and 25 mm improves to 50 mm.

Note 1b : Cylinder insulation, existing is jacket < 80 mm. 12 or 25 mm improves to 80 mm, and 38 or 50 mm improves to 120 mm.

Note 2 : Loft insulation. Loft insulation is considered separately for main roof and extensions 1, 2, 3, 4 as applicable and applied to all accessible roofs with insulation <= 150 mm.

Note 3 : Cavity wall insulation. Cavity wall insulation is considered separately for main wall, extensions 1, 2, 3, 4 and alternative walls as applicable and applied to all fillable walls. When cavity fill is recommended the data collection includes whether there might be issues of cavity less than 50 mm, high exposure or difficulties of access. If any of those apply an addendum is included on the EPC saying that the issues should be investigated to establish the best treatment for the walls.

Note 4 : New or replacement boiler or mCHP. Controls are:
- for radiator systems, programmer, roomstat and TRVs (or time and temperature zone control if already present), interlocked system, separate timing of space and water heating (if regular boiler);

- for underfloor systems: time and temperature zone control.

Also:

- emitter temperature unknown
- if existing system is not a boiler or mCHP, central heating pump age is 2013 or later
- in the case of measure I, leave cylinder as it is (but with cylinderstat and improved insulation if applied earlier in the sequence)
- in the case of measures R, S and T, if regular boiler, cylinder of normal size (no solar panel) or medium size (solar panel present) with 50 mm factory-applied insulation and cylinderstat
- when there are two boilers, if main system 1 is being upgraded to a new boiler the new boiler does the water heating, unless main system 2 is also being upgraded to a new boiler (improvement I for both boilers) and the water heating was from main system 2 – in that case water heating stays with main system 2.

Note 5 : Replacement CPSU. Controls are programmer, roomstat and TRVs, interlocked system.

Note 6 : Double glazed windows and secondary glazing. If 80% or less of the windows are single glazed, a recommendation should be made for double glazed windows replacing all single-glazed windows. If the assessor cancels this recommendation, a recommendation is made for secondary glazing for the single-glazed windows. The secondary glazing option appears only in these circumstances.

Note 7 : Solid wall insulation. Solid wall insulation is considered for main wall, extensions 1, 2, 3 and 4 and alternative walls as applicable and applied to all applicable walls. Implemented by changing the wall insulation to solid wall insulation but leaving the building dimensions (in the reduced data set) the same. In the Energy Report the total figure for the measure is shown without any mention of "main", "extension", etc. This measure is not applied to system built walls or cob walls.

Note 8 : Biomass boilers. Heating controls are programmer, room thermostat and TRVs. Upgrade hot water cylinder to medium size with 50 mm factory-applied insulation and cylinderstat, separate timing of water heating.

Note 9 : Heat pumps. Heating controls are programmer and room thermostat. Water cylinder is within the heat pump casing and replaces any existing one.

Note 10 : Micro-CHP. Heating controls are programmer, room thermostat and TRVs. If DHW is not from main system, change it to main system. If no existing DHW cylinder add one of normal size (110 litres) with 50 mm factory insulation; Upgrade an existing hot water cylinder to at least normal size (no solar panel) or medium size (solar panel present) with 50 mm factory-applied insulation and cylinderstat.

Heating upgrades

An improvement to a heating system by adoption of any of the following measures:

I, J, K, L2, M, R, S, T

is taken as extending the main heating system to the whole dwelling where that is not the case in the existing dwelling. Thus when implementing any of the above measures, the number of heated habitable rooms is to be set equal to the number of habitable rooms. This rule affects the results where there are unheated habitable rooms and no identified secondary heater. If there is an identified secondary heater, the secondary heater remains throughout the sequence of calculations of improvement measures. Also, in the case of measure T upgrading storage heaters to a condensing gas boiler, if the secondary heating has been given as portable electric heaters the secondary heating becomes none after the upgrade.

In the case of measure T, if the existing heating is storage heaters or off-peak underfloor electric heating (401, 402, 404, 408, 421, 422) change the electric meter to single.

Heating upgrades when there are two main systems

In the case of measure I (upgrade boiler, CPSU or range cooker, same fuel) where both systems each use the same fuel, apply the improvement to both boilers as applicable (i.e. boiler is non-condensing) as a single step. If the result attains the SAP increase criterion make the recommendation on the EPC using the improvement text applicable to main system 1 if both boilers are being upgraded.
In the case of any other combination of main heating systems, apply the improvement to system 1 only. This includes measure I where that is relevant to main system 1 but not main system 2, as well as consideration of measures J, K, L2, M, R, S and T.

Heating control upgrades when there are two main systems
Apply the improvement to the controls on system 1 only, except apply improved controls to both boilers if both replaced.