LABSS INFORMATION PAPER INFO44

SAP 10 – Guidance for Verifiers

Section 6 – Energy

Applicable to Domestic Buildings

This information paper has been produced by the Scottish Building Standards Hub (SBSH) on behalf of Local Authority Building Standards Scotland (LABSS).

Disclaimer – The information contained within this document is for general information purposes only. The decision to accept or reject any proposal submitted as part of a building warrant application rests with the relevant Local Authority Verifier**.**

Document Version Control.

Version:	Date:	Notes:
1.0	19.01.2026	Author SBSH (SB and DC)

Purpose

To provide Scottish Building Standards verifiers with practical guidance when reviewing SAP10 submissions for new dwellings.

This paper outlines the key verification checks, highlights recent changes introduced by SAP10, and directs users to where supporting information can be found within SAP outputs.

It is intended as a general reference document and not a checklist.

Official guidance, conventions, and approved software listings are available at: https://bregroup.com/sap/sap10

Background Information

SAP 10 became the official methodology for assessing the energy performance of dwellings in Scotland on 1 February 2023, replacing SAP 2012. It introduced updated conventions, revised energy and emissions factors, harmonised U-values across all software packages, and made airtightness testing mandatory for every new dwelling.

Verifiers must ensure submissions use SAP version 10.2 or higher and software approved for use in Scotland. The applicable compliance metric and permitted heating types depend on the building warrant application date:

- **TER/DER** applies to direct emissions systems (e.g. gas, oil, solid fuel). Heat networks are excluded. ***Note: direct emissions heating (other than biomass, as noted below) has been prohibited since 1 February 2023, so TER/DER only applies to warrants submitted before this date.***

- **TDER/DDER** applies to non-direct emission heating systems (e.g. heat pumps, district/block heating), which do not emit greenhouse gases on site. ***Note: TDER/DDER became the applicable compliance metric for all new dwellings with building warrant applications submitted from 1 February 2023 onwards, in line with the New Build Heat Standard.***

Bioenergy and peat heating systems are recognised in the January 2025 amendment as exceptions under Clause 6.11. While bioenergy is considered renewable and potentially net-zero, peat is permitted due to its cultural importance in rural and island communities.

Where biomass or peat is selected as the primary heating source, the target benchmark (TDER) is modelled using a mains gas boiler system.

Direct emission heating systems may still be used for emergency or secondary heating (e.g. wood-burning stoves), which are not subject to Standard 6.11. For more complex systems, refer to Clause 6.11.2.

Verifiers should always check the warrant application date, any relevant ministerial directions, and the current Technical Handbook before determining which metric (DER/TER and/ or DDER/TDER) and fuel treatment applies (Note1st Feb 2023 to 31st March 2024, it was both if you had a direct emissions heating system.

Key Review Criteria

To support a thorough review of the SAP submission, please refer to Annex A, which details the key items for consideration.

Further Considerations

- The New Build Heat Standard (NBHS) and SAP 10 are closely aligned. Verifiers should remain vigilant for future amendments from the Scottish Government, particularly concerning bioenergy and peat exemptions.
- The transition from sample airtightness testing to mandatory 100% testing necessitates early engagement with applicants.
- SAP software outputs may differ depending on the provider. Verifiers should focus on the accuracy and completeness of data rather than its presentation format.

Conclusion

SAP 10 has introduced a more transparent and consistent approach to assessing dwelling energy performance.

Verifiers should confirm that submissions use approved software, apply the correct metric for the warrant date, and present complete and coherent data consistent with design information.

Applying these checks will support consistent national interpretation and improve confidence in Section 6 compliance.

End.

Annex A

<table>
<tr><th>ID</th><th>SAP Data - Items for Consideration</th><th>Where to look</th></tr>
<tr><td>1</td><td>Are the following SAP10 report sections provided in the SAP10 submission:

a) Compliance Report
b) Full SAP Calculation
c) Printout Summary for Input Data
d) Thermal Bridging

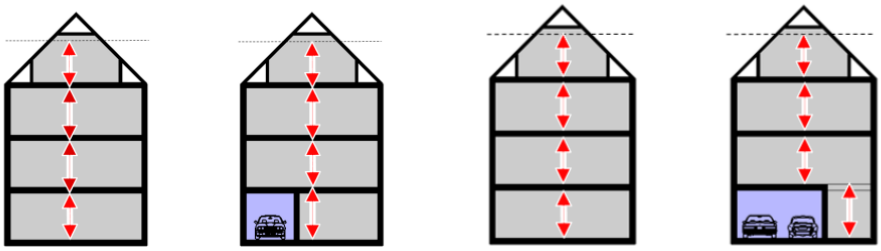
1) The actual titles used for the different sections may vary slightly between the different SAP10 software providers, but you should still be able to identify each relevant section.

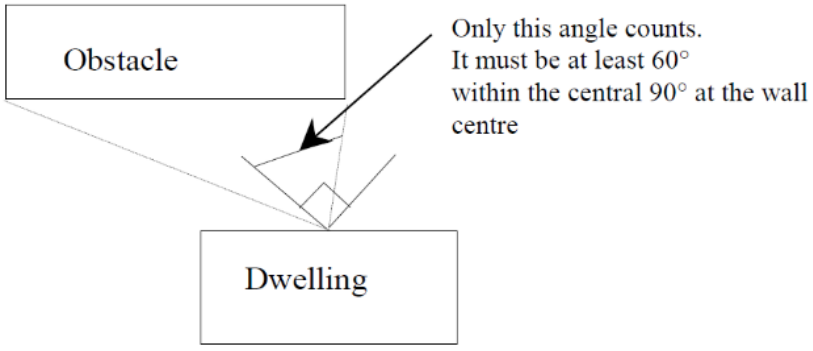
2) Note all these sections should have the same “Issued on date,” as they should reflect the same printout.</td><td>At the top of the first page of each report section</td></tr>
<tr><td>2</td><td>The software must be approved for SAP 10 in Scotland. Follow the link to the BRE home page and select Current list of approved SAP 10 software Standard Assessment Procedure SAP 10

Software that has been approved for use in Scotland will have yes displayed under Building Regulations column S
<table>
<tr><th rowspan="2">Calculation Software
User Interface</th><th rowspan="2">Phase</th><th rowspan="2">Version</th><th colspan="4">Building Regulations</th><th colspan="4">EPC</th><th rowspan="2">Date of approval</th></tr>
<tr><th>E</th><th>W</th><th>S</th><th>NI</th><th>E</th><th>W</th><th>S</th><th>NI</th></tr>
<tr><td rowspan="5">Argyle Software ACE</td><td>1</td><td>1.x</td><td>Yes</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>04/07/2022</td></tr>
<tr><td>2</td><td>1.x</td><td>Yes</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>04/08/2022</td></tr>
<tr><td>3</td><td>1.x</td><td>Yes</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>22/08/2022</td></tr>
<tr><td>5</td><td>1.x</td><td>Yes</td><td>Yes</td><td>Yes</td><td>-</td><td>Yes</td><td>Yes</td><td>Yes</td><td>-</td><td>20/10/2022</td></tr>
<tr><td>6</td><td>10.2.2.x</td><td>Yes</td><td>Yes</td><td>Yes</td><td>-</td><td>Yes</td><td>Yes</td><td>Yes</td><td>-</td><td>14/03/2023</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

The SAP methodology used must align with the version applicable to the building warrant application date. This is confirmed in the approved software documentation, typically shown in the footer near the page numbers.
Some software may have phased (partial) approval and are listed on the first pages of the approved software list which is published by the BRE.
Note: From 1 October 2023, the Stroma brand became part of Elmhurst Energy.
</td><td>The version of the software that is being used will be displayed in the footer of Summary for Input Data report and on the first page of the full sap calculation printout.</td></tr>
</table>

3	**Which SAP10 metric applies for Pass/Fail depends on the building warrant application date:** a) 01 Feb 2023 – 31 Mar 2024: • Direct emissions systems: Use DER vs TER – is DER less than or equal to the TER? and • Non-direct emissions systems: Use DDER vs TDER – is DDER less than or equal to TDER? b) From 01 Apr 2024: • Only Zero Direct Emissions Heating Systems (ZDEHS) allowed. • Use DDER vs TDER – is DDER less than TDER? c) From Jan 2025 (Tech Handbook update): • Bioenergy and peat systems are treated as non-direct emissions. (The Notional building model should be set as a mains gas boiler) and this will be compared with the biomass/peat used in the proposed dwelling. • Use DDER vs TDER – is DDER less than or equal to TDER?	For heating system: **Summary for Input Data report** (Item 24.0 Main Heating 1) For DER/TER DDER/TDER: **Summary for Input Data report** [at top of page]
4	Is the dwelling location shown correctly (displayed as regional options)	**Summary for Input Data report**
5	Is dwelling orientation correct and matches the location/site plans and elevations submitted? • Dwelling orientation is set by reference to the orientation of the main entrance door to the dwelling. • In blocks of flats the orientation is the direction faced by the entrance door to the individual flat being assessed, not the direction faced by the entrance door to the whole block.	**Summary for Input Data report**
6	Are the property type and detachment, correct? Note property type typically will be detached, semi-detached, end/mid terraced house, bungalow, flat, maisonette, park home. Additional data entry for flats Position of a flat – Basement, ground floor, mid floor or top Note-The lowest floor, normally ground floor of the building would be expressed as 0 Please note that for the house design known as a flat over a garage (FOG) the total number of stories in the block should be set as 1 as there is only one dwelling present so the notional amount of PV must be fully assigned to this dwelling	**Summary for Input Data report:** [Item 1.0 Property Type]
7	Is the number of storeys, correct?	**Summary for Input Data:** [item 2.0 Number of storeys]

8	Do average storey heights match the section drawings? • Single-storey dwellings or the lowest floor: measure from finished floor surface to ceiling surface. • Upper storeys: measure from ceiling surface to ceiling surface of the storey below. • Rooms with varying heights (e.g. room-in-roof): calculate an average based on volume and internal floor area (include floor thickness if relevant). • Suspended ceilings: ignore in all cases when determining storey height. For wall and roof area calculations, they are also ignored unless insulation is directly above. For volume calculations, the storey height is measured to the suspended ceiling if it is continuous and sealed, since infiltration and ventilation are assumed to act only on the habitable volume below. • Flats: measured differently in SAP assessments due to separating elements. The internal storey height should be measured from finished floor level to ceiling within the flat itself and should not extend through the separating floor or ceiling into adjacent dwellings. (See illustration below.) Refer to BRE Conventions 2.01, 2.02, 2.03, 2.08 and Appendix 4 for full guidance. You may use the diagram from the BRE Conventions table if properly referenced. Appendix 4. Dwelling dimensions The diagrams below show how to measure height of storeys. **(4.1) Multi-storey dwellings** (and for buildings with curtain walls) (a) Dwelling without a garage (b) Dwelling with a garage **(4.2) Blocks of flats** (NOT for buildings with curtain walls) Block of flats without a garage Block of flats with a garage 	**Full Summary for Input Data:** item 7.0 measurement and full **SAP Calculation** item 1

9	**Is the number of sheltered sides, correct?** Common examples of structures that provide shelter to a dwelling are party walls and adjacent buildings. Check the site plan for nearby buildings that may block wind. More exposure typically increases the DER/DDER. The number of sheltered sides (0 to 4) and is used in the air infiltration rate calculation. A side is considered sheltered if: • The obstacle is at least as tall as the ceiling of the top storey AND • The distance between the obstacle and the dwelling is less than five times the height of the obstacle. • It spans at least 60° within the central 90° when viewed from the middle of the wall facing it  For the proposed dwelling, the actual number of sheltered sides (ranging from 0 to 4) should be entered into the SAP calculation. If this information is unknown or not provided, the default worst-case value of 0 (no sheltered sides) must be used. For the notional dwelling, the same number of sheltered sides as the proposed dwelling is typically used, but must not exceed 2 sheltered sides, in accordance with SAP conventions." • Sheltered sides: A party wall to an adjacent dwelling is counted as a sheltered side. In flats, walls to internal corridors and stairwells are also classed as sheltered sides. • Impact: The sheltered effect can result in modified U-values for walls and entrance doors, as SAP accounts for reduced exposure compared to external elements.	**Summary for Input Data:** [item 4.0 Sheltered Sides] and full sap calculation item 2 (19)
10	Is overshading, correct? Note overshading describes the extent to which radiation is prevented from entering openings in a building and impacts on solar gains for heating and cooling, and for lighting. The overshading categories **are dependent on how much the view of the sky through the opening is blocked**. The 'average' category applies in many cases and can be used if the overshading is unknown. Very little is not appropriate for compliance calculations, if used the input data values should reflect average unknown. Very little may be used in EPC ratings only.	**Summary for Input Data report** [item 5.0 Sunlight/ Shade]

If heavy or more than average is used the designer should justify this on the submitted plans.

Table 6d: Solar and light access factors

Overshading	% of sky blocked by obstacles.	Winter solar access factor (for calculation of solar gains for heating)	Summer solar access factor (for calculation of solar gains for cooling)	Light access factor (for calculation of lighting requirement in Appendix L)
Heavy	> 80%	0.3	0.5	0.5
More than average	>60% - 80%	0.54	0.7	0.67
Average or unknown	20% - 60%	0.77	0.9	0.83
Very little	< 20%	1.0	1.0	1.0

Notes

1. *The overshading category of "very little" is not appropriate for compliance calculations. In this case use 'average or unknown' even if 'very little' is selected. However, 'very little' can be used for EPC ratings.*
2. *A solar access factor of 1.0 and a light access factor of 1.0 should be used for roof windows/rooflights.*
3. *The same factor is used for all glazing in the dwelling (not a different factor for each orientation or each opening).*

11 **Solar Access Factors- checklist**

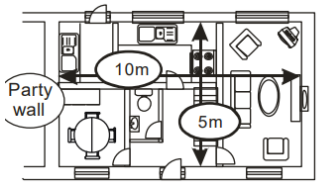
- Solar access factors (overshading values) range from 0 to 1, indicating how much solar radiation is prevented from entering the building:
  - 0 = no radiation enters
  - 1 = full radiation enters
- Application:
  - The same factor is used for all glazed openings regardless of orientation, (excluding rooflights).
  - Values are listed in Table 6d of SAP10 guidance.
- Typical Winter Values used for calculating solar gains for heating are:
  - Windows:
    - Average/Unknown overshading (20–60% sky blocked) → Factor: 0.77
  - **Rooflights**:
    - Always use **Factor: 1.0**, regardless of overshading

Note table 6d indicates that very little **should not be used for compliance calculations** for windows but can be used for EPCs.

Full SAP Calculation Printout Item 6 Solar gains column Access factor Table 6d

12 **Do internal floor areas match the plans for all storeys and the total floor area (TFA)?**

1. Internal Floor Area Dimensions:
   - These are the measurements from the inner surfaces of the external walls or separating walls, Internal partitions are ignored.



   - Check these for each storey: ground, first, second, and any additional levels.
2. Compare with Plan Drawings:
   - Ensure that the measured internal floor areas match what is shown on the architectural or construction plans.

The total floor area is a key input in SAP calculations, affecting energy use, heating demand, and compliance.

Summary for Input Data report: item 7.0 measurement and Full SAP Calculation Printout Item 1 Overall dwelling characteristics

13	**Living Area Fraction – Checklist** • Living Area: The room marked as the lounge/living room or the largest public room, including any open-plan areas (e.g. kitchen not separated by walls) and is limited to one storey. • Living Area Fraction: = Living area floor area ÷ Total floor area	**Summary for Input Data report:** Item 8.0 living area

14	**Openings – Number, Area & Orientation**
	• Actual Building:
	All openings (windows, doors, rooflights) must have their orientation specified at the as-designed and as-built stages.
	• Notional Building (Target): Uses the same number, type, and orientation of openings as the actual building, but the total glazed area is capped at 25% of the total floor area.
	
	Note: In SAP2012, the notional building orientation was always east–west. SAP10 now aligns orientation with the actual dwelling (front door position), making solar gain calculations more representative.
	
	The proposed building can exceed 25% glazing, but its performance will be assessed against a notional (target) building which is limited to 25% glazing, as per Technical Handbook 6.1.2.
	
	• SAP10 Definitions for Glazed Doors:
	  • Solid door: glazed area < 30%
	  • Semi-glazed door: glazed area 30–60%
	  • Window: glazed area > 60%
	
	Note: If all doors are classified as windows (glazed area > 60%), SAP10 may list only windows under section 13.0. This is a classification issue, not a design error.
	
	Note when checking thermal bridges Summary for Input Data report ITEM 17, the length of the sill of fully glazed doors is deducted from the E3 because it will be counted in E5 floor to external wall junctions, at upper levels this will be counted into E6 intermediate floor junction.
		Summary for Input Data report item 13.0 Openings

15	**U-Values – Consistency Check**
	• Ensure U-values in the specification, U-value calculations, and SAP10 submission all match.
	• Technical Handbook Table 6.2 sets maximum area-weighted U-values. Localised poorer-performing areas are allowed if compensated elsewhere, but must not exceed:
	  • 0.7 for walls and floors
	  • 0.35 for roofs
	  • 3.3 for glazing
	• BRE 443 (2019) provides detailed guidance on U-value calculations, including adjustments for elements adjoining unheated spaces (e.g. stairwells) to reflect sheltering effects.	

a	Floor(s) U-value(s)?	**Summary for Input Data report** Item 9 to 12 Check that the u values entered match u value calculations and declared areas for each element. **Compliance Report** 6.2 Building Insulation Envelope
b	Wall(s) U-value(s)?	
c	Roof(s) U-value(s)?	
d	Windows and doors U-values, G-values, Frame Factors and Low-E? When reviewing the Compliance Report, Section 6.2 – Building Insulation Envelope, the SAP assessor may choose to demonstrate compliance using **Option 2a: Space Heating Demand Limit Approach**. If this method is selected, the fabric U-values will be shown as **'N/A'**. **It is common for assessors to mistakenly submit calculations showing fabric values as either "pass" or "fail", which can lead to the incorrect assumption that the SAP assessment should be rejected. This is typically a submission error. When using the trade-off method, the assessor should have selected Option 2a, which is based on the calculated space heating demand limit.**	

	Windows, Roof Windows, Rooflights & Doors – Key Data Considerations
	All relevant data should be carefully checked, as entries are manually entered.
	
	1. U-value (Thermal Transmittance)
	• Measures heat loss; lower values indicate better performance.
	• Should apply to the whole window unit, not just glazing.
	• Prefer method manufacturer-specific U-values over generic GGF (Glass and Glazing Federation) averages.
	• BFRC (British Fenestration Rating Council, or other approved certification body for fenestration) - rated windows: use values from the certificate or simulator report.
	• If no test/calculated data, use SAP10 Table 6e defaults (usually higher than tested values).
	
	2. G-value (Solar Energy Transmittance)
	• Scale from 0 (no solar gain) to 1 (full solar gain).
	• Typical G values:
	  • Double glazing: ~0.7
	  • Triple glazing: ~0.5
	  • Solar control glass: ≤0.3
	• Climate and orientation considerations:
		Summary for Input Data report Item 12,13 &17
		
		Compliance Report 6.2 Building Insulation Envelope
		
		For U-values, G-values, Frame factor and Low-E: Summary for Input Data

	• high G-value for north-facing windows (maximise solar gain). • low G-value for south-facing windows (minimise solar gain and reduce overheating). • BFRC G-values include frame factor (set to 1 in SAP); usually <0.5. • Important for overheating risk (see Mandatory Standard 3.28); not directly assessed in SAP10. **3. Frame Factor** • The **frame factor** is the glazed fraction of a window, expressed as a number between 0 and 1, for example, a frame factor of 0.7 means that 70% of a window area is glazed. The frame factor is important as solar gains provides a significant part of heating requirements in new dwellings **4. Emissivity** • Indicates heat absorption/reradiation (0 = reflective, 1 = fully absorptive). • Low-E coatings improve thermal performance: • **Soft coat**: better efficiency, used in homes. • **Hard coat**: more durable, used commercially. • SAP10 emissivity values: 0.05 (best) to 0.2 (worst); defaults: soft = 0.1, hard = 0.2 **5. Pane Gap Size** • Optimal gaps are between 12–16mm. Smaller gaps reduce insulation because conduction dominates, while larger gaps (above ~18mm) can allow convection currents to form, which lowers performance. • Best practice: Many modern sealed units use ~16mm gaps (often argon-filled) as the sweet spot for thermal efficiency and acoustic control **6. Gas Fill** • Affects U-value: • Air < Argon < Krypton < Xenon (best, but costly and rare in homes). **7. Spacer Bars** • Improved designs reduce U-values. **8. Data Sources** • Use certified ratings or manufacturer declarations. • Include U-value, G-value, and frame factor. • Prefer consistent sources; if G-value is missing, use defaults.	[12.0 Opening Types]
e	**Roof Windows – U-values, G-values, Frame Factors, Low-E & Inclination** 1. The definition of a Roof windows in accordance with (BRE 443) are framed glazed units installed in-plane with sloped or horizontal roofs (typically ≥15° pitch). 2. U-value & Inclination • U-values are tested vertically; inclined installation increases heat loss and will have a higher u value. • Adjustment required unless tested at actual angle: • Unknown angle: Use SAP10 Table 6e Note 1. • Known angle: Use SAP10 Table 6e Note 2.	**Compliance Report** 6.2 Building Insulation Envelope **AND** For U-values, G-values, Frame factor and Low-E:

	Example: A double-glazed roof window has a U-value of 1.3 W/m²K, quoted for vertical installation. When installed in a roof pitched at 35°, an adjustment is required. According to SAP10 Table 6e, Note 2, for inclinations greater than 30° and up to 40°, an addition of 0.4 is applied. Adjusted U-value = 1.3 + 0.4 = 1.7 W/m²K Note that the limiting U-value for roof windows in Table 6.2 in the Technical Handbook is 1.4W/m2K, assessed and reported in the vertical plane. As such, the roof window in this example complies with Table 6.2 (as the manufacturer quoted 1.3W/m2K for a vertical measurement) but note that the SAP calculation will show the corrected-for-inclination U-value of 1.7W/m2K. **Additional Notes** • G-values and Frame Factors follow standard window rules. • Low-E coatings (soft/hard) affect emissivity and thermal performance. • Inclination affects solar gain and heat loss—accurate data is essential for SAP.	Summary for Input Data [12.0 Opening Types]

f **Rooflights U-values, G-values, Frame Factors and Low-E?**

BRE 443 describes x2 main types of rooflights:

Sun-pipes: These are not counted as roof lights in SAP assessments. They are excluded from calculations of glazed area and solar gains, as they function purely as daylighting devices rather than thermal openings.

a) **Out-of-plane rooflights (rooflights on upstands or kerbs)**

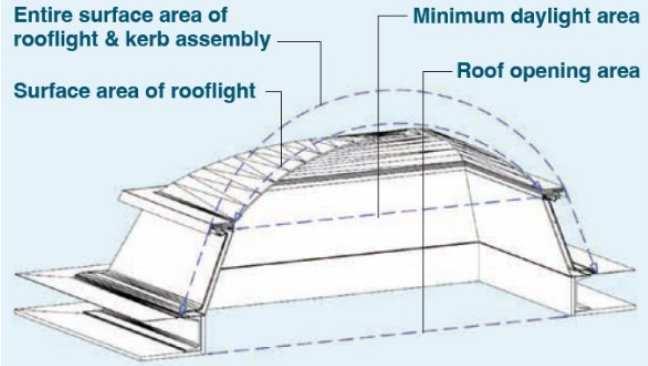


Diagram reproduced from The Rooflight Association

Out-of-Plane & In-Plane Rooflights – U-values, Kerbs & Guidance

1. Types of Rooflights
   - Out-of-plane rooflights sit above the roof surface, mounted on kerbs or upstands. These may be integrated or separate components and offer improved watertightness. The roof opening is typically smaller than the full rooflight and kerb assembly as illustrated above.
   - In-plane continuous rooflights are translucent sheets fitted flush with profiled roofs (e.g. metal or fibre cement). Often single-skin and typically do not have suitable thermal properties to serve heated or cooled buildings.

2. U-values & Testing
   - Rooflight U-values are tested/calculated in the horizontal position.
   - The limiting U-value in Table 6.2 of the Technical Handbook is 2.1 W/m²K, also based on horizontal orientation.
   - No adjustment is made between vertical and horizontal positions for out-of-plane rooflights (BRE 443).

3. Technical Handbook Requirements (Table 6.2)
   - U-values (Ud-values) must be based on the developed surface area of the rooflight, which is often larger than the roof opening. (See note 4 c below)
   - The 2.1 W/m²K limit also applies to integrated kerbs if a combined Ud-value is provided by the supplier.
   - Site-built upstands must not exceed 0.35 W/m²K.

Compliance Report
6.2 Building Insulation Envelope

AND

For U-values, G-values, Frame factor and Low-E: Summary for Input Data [12.0 Opening Types]

	4. Additional guidance on rooflights is available in the Technical Documents of the Rooflight Association at www.rooflightassociation.org, and in particular: a) Rooflighting best practice Quick guide 09SC b) Quick guide 03 - Understanding rooflight U-values. (REVIEW PENDING) **c)** Rooflight Association NTD02 - Assessment of thermal performance of out of plane rooflights and roof light kerb. The true U-value should be quoted by manufacturers, or the secondary U_r-value or U_{rc}-value quoted along with the ratio of the developed surface to area of the roof aperture, and converted using: $$True\ U\text{-}value = (U_r \text{ or } U_{rc}) \times \frac{developed\ surface\ area}{roof\ aperture\ area}$$	
g	**Is the conservatory thermally divided from the dwelling?** If **yes**, it is **excluded** from the SAP calculation. If **no**, it **must be included** in the SAP calculation, as it forms part of the heated envelope.	Summary for Input Data [14.0 Conservatory

16	**Is the Thermal Mass Parameter (TMP) breakdown calculation provided, and correct?**
	
	The **Thermal Mass Parameter (TMP)** reflects a building's ability to store heat and is calculated using the **heat capacity per unit area** (denoted by the Greek letter **κ**, or kappa) of each building element.
	
	• **κ-values** represent how much heat an element can store and are defined in **SAP10 Table 1e**.
	  • **Lightweight elements** (e.g. timber frame external walls) have low κ-values (e.g. **9**).
	  • **Heavy elements** (e.g. dense block cavity masonry walls) have high κ-values (e.g. **190**).
	
	Thermal Mass Parameter (TMP) = the sum of (individual area x individual κ-value) for all elements, divided by total floor area.
	
	Note:
	The elements to be included are walls, floors and roofs, including all internal and separating walls and floors, windows and doors have negligible capacity, they are excluded from the TMP calculation.
		Summary for Input Data [6.0 Thermal Mass Parameter - Precise calculation]
		
		AND
		
		Full SAP Calculation Printout section 3 heat loss parameter (35)

17	**Non-Repeating Thermal Bridging – Evidence & Calculation** 1. Is a breakdown of non-repeating thermal bridges provided and accurate? All data must be supported by evidence and should be submitted and form part of the proposed drawings and specification package. 2. Non-repeating thermal bridges occur at junctions and openings. Heat loss is calculated using linear thermal transmittance values (Ψ-values PSI), typically between 0 and 1 (lower is better).	Summery for input data Item 17 Full SAP Calculation Printout

The transmission heat transfer coefficient (Htb) is calculated as:
Htb = Σ (junction length × Ψ-value)

Ψ-value Sources

- Default values from SAP10 Table K1
- User-supplied values, which may be mixed with defaults:
  - From validated construction details.
  - Calculated by qualified professionals per BR 497 (see Annex 6.C.5.
  - Calculations supported with details to a suitable scale should be submitted for non-repeating thermal bridges that are user supplied.)

section 3 heat loss parameter

Note:
As of 2023, the Scottish Government has not released any updated construction details. Instead, reference should be made to recognised industry publications that provide independently calculated and validated examples.

Sources may include (but are not limited to):

Accredited Construction Details (ACD) - previously published ACD sets may still be used where a specific junction is representative of a proposed junction.	APA Constructive Details handbook
BRE Certified Thermal Details	CBA Details
LABC Registered Construction Details	

3. **Alternatively**, for a specific dwelling design, SAP 10 allows the use of a pre-calculated global y-value (see Appendix K of the SAP 10 technical guide). This y-value must be derived from individual Ψ-values using either Option 1 or Option 2, and documentary evidence of the calculation must be provided. The resulting y-value is valid only for the dwelling of the same size, configuration, and construction for which it was calculated. In this case, the heat loss from non-repeating thermal bridging is calculated as:

H_{tb} = y x sum of (the total area of external elements)

Note:
For Target Dwelling Emission Rate (TDER) calculations, the thermal bridging factor (Y-value) should be set to the default value of 0.05.
For Dwelling Design Emission Rate (DDER) calculations, the Y-value must be individually calculated based on the specific thermal bridges and their corresponding Ψ-values (psi-values).
Default Y-values are not permitted in Scotland for DDER assessments — detailed thermal bridge data must be provided to ensure accuracy and compliance.

18 **Point Thermal Bridges**

Is a thermal bridging breakdown calculation provided for any point thermal bridges?

Full SAP Calculation Printout [36a]

Point thermal bridges occurs at the intersection of linear thermal bridges or where insulation is discretely penetrated. **The heat loss for point thermal bridges is usually insignificant and can be ignored**, so most point thermal bridges can be omitted from the SAP10 calculation. However, significant point thermal bridges (for

	example, metal balcony supports bridging insulation layers) should be taken into account. The heat loss calculation for point thermal bridges requires point thermal transmittance values (which uses the Greek letter χ for chi): **H_{tb} = sum of (χ-values)**		
19	**For the ventilation (and air conditioning) system:** • Where a specific ventilation system is specified, details in the DDER calculation are drawn directly from the Product Characteristics Database (PCDF). • The specification notes must exactly match the calculation, including the UKPD six-digit reference code. • Ensure that the system type, performance data, and reference code are consistent between the design specification and SAP input. • Any mismatch between specification notes and PCDF data will invalidate the calculation.		
	A	**Is the system detailed correctly?** Note as an example: dMEV (continuously running decentralised mechanical extract ventilation) with background ventilators to habitable rooms.	Summary for Input Data [19.0 Mechanical Ventilation]
	B	**Is the Specific fan power and heat recovery detailed correctly?** SFPs (Specific Fan Power, in W per l/s) is a measure of the electric power needed to drive a fan (or collection of fans), relative to the amount of air that is circulated through the fan(s).	Look for "Pass" under Compliance Report, [6.6 Mechanical ventilation and air conditioning]
	C	**No of chimneys and flueless gas fires, correct?** Note: A chimney is defined as a vertical duct with a diameter of 200mm or more. When a log-burning stove with closable doors is installed and connected to the chimney, it operates as a flue. In SAP 10 software, a dedicated pull-down menu exists for recording this—please ensure the correct option is selected.	Full SAP Calculation Printout (Dwelling emissions): [6 and 7, including letters a, b, c, etc.]
	D	**Number of open flues, correct?** Note that vertical ducts with diameter less than 200mm should be counted as flues.	
	E	**Number of intermittent fans?**	
	F	**Number of Passive Vents** • Passive Stack Ventilation (PSV) is an alternative to traditional electrically powered systems. • PSV systems comprise extract grilles connected by ducts to ridge terminals. • Air bricks or trickle vents are not passive vents and should not be counted. • Verification should also confirm that:	

		• Background ventilators are provided to supply make-up air. • Airtightness levels (q50) are consistent with PSV design assumptions — very low infiltration may limit effectiveness. • The PSV specification matches SAP inputs, including duct routes, stack height, and terminal details.	
20	**Are suitable air permeability (air-tightness) details provided?** Air permeability values are used to calculate the dwelling infiltration rate (along with number of sheltered sides and numbers of chimneys, flues and fans). 1) **For design values:** From Table 6.1 in the Technical Handbook, the air permeability value used in SAP10 for the notional building is 5m³/h.m² at 50Pa. The default design air permeability value used in SAP10 for proposed dwellings typically is also 5m³/h.m² at 50Pa (see note 2) c) below). 2) **For the as-built dwelling**: a) From 01 Feb 2023, the Technical Handbook requires that **all new dwellings should be tested for airtightness**, using one of the following methods: 1) The fan pressurisation **blower door method**, which pressurises or depressurises the envelope to 50 Pascals = AP50 In SAP 10, the resulting air permeability is converted to infiltration rate using the formula: **AP50 ÷ 20**. 2) The **low-pressure pulse (LPP) method**, which uses a release of a measured amount of air (a pulse) to give a lower level of pressurisation of 4 Pascals = AP4 **Annex 6.D – Domestic Technical Handbook** Pre-Completion Airtightness Testing Guidance This Annex replaces the previous guidance from Sound and Air-tightness Testing and reflects the move away from sample testing to mandatory testing of all new dwellings. **CIBSE TM23** is now the recognised methodology for airtightness testing, including both traditional blower door and low-pressure pulse (LPP) methods, **Pulse Testing** Testing should follow the methodology in **CIBSE TM23**. Additional guidance is available from **ATTMA**: https://www.bcta.group/attma/. SAP10 formula for pulse method: Air infiltration = $0.263 \times AP_{4.0}^{0924}$ **Testing Protocol** • Tests must follow recognised methods in **TM23**. • Testing must be conducted by a **qualified and registered professional** authorised to perform and verify results. **Ventilation Strategy** New dwellings often achieve air permeability below **5 m³/h·m² at 50 Pa**. As per **Table 3.5a**, ensure the ventilation strategy suits the measured airtightness.	Summary for Input Data [22 Pressure testing]

Ventilation type	Suitable for infiltration rate:
Natural ventilation (with intermittent mechanical extract)	≥ 5 $m^3/h.m^2$ at 50Pa
Continuous mechanical extract ventilation	≥ 3 $m^3/h.m^2$ at 50Pa
Continuous mechanical supply & extract ventilation	Any

Annex 3A Domestic Ventilation Guide of the Technical Handbook also details remedial air-tightness procedures.

21	a	**Main Heating System – Selection and Compliance** **• Where a specific heating appliance/system is specified, details in the DDER calculation are drawn directly from the Product Characteristics Database (PCDF).** **• The specification notes must exactly match the calculation, including the UKPD six-digit reference code.** **• Ensure that the system type, efficiency data, and reference code are consistent between the design specification and SAP input.** **• Any mismatch between specification notes and PCDF data will invalidate the calculation.** **Is the correct 'Main Heating 1' selected, and do the details match the specification?** Check manufacturer, model, efficiency, and controls. **1. Building Warrant Dates** • **01 Feb 2023 – 31 Mar 2024**: Direct emissions heating systems (DEHS) or zero direct emissions heating systems (ZDEHS) permitted. • **From 01 Apr 2024**: Only ZDEHS allowed; fossil fuel systems no longer permitted. • **From 01 January 2025 peat and biomass** permitted **2.** Heating System Controls – Fossil Fuel & Biofuel check the following where relevant: • **Boiler interlock** • **Heating zones** (space and water; water zones not needed for combi boilers) • **Time and temperature controls**, such as: • Room thermostat • Programmer or time switch • Thermostatic Radiator Valves (TRVs) • Cylinder thermostat • Weather or load compensators • Zone controls **Key points:** • Boiler interlock is a control strategy, not a physical device. It ensures the boiler only operates when there is a demand for heat.	Look for "Pass" under Compliance Report, [6.3 Heating System] **AND** Summary for Input Data [24.0 Main Heating 1]

- A system without a cylinder thermostat or room thermostat cannot achieve boiler interlock and therefore does not meet compliance requirements.
- **TRVs alone are insufficient**—at least one separate room thermostat must be installed to satisfy control standards.

3) Use of Product Characteristics Data File (PCDF):

SAP assessors use the PCDF from BRE to input performance data for heating and other systems in SAP10. The database is updated monthly.

- **Download the PCDF:** https://www.ncm-pcdb.org.uk/sap/download
- **Search for product data:** https://www.ncm-pcdb.org.uk/sap/searchpod.jsp?id=17

4. Data Entry in SAP10

- Preferred entry by **exact make/model** from PCDF.
- If unavailable, use **SAP10 Tables 4a–4g** and select the correct system description

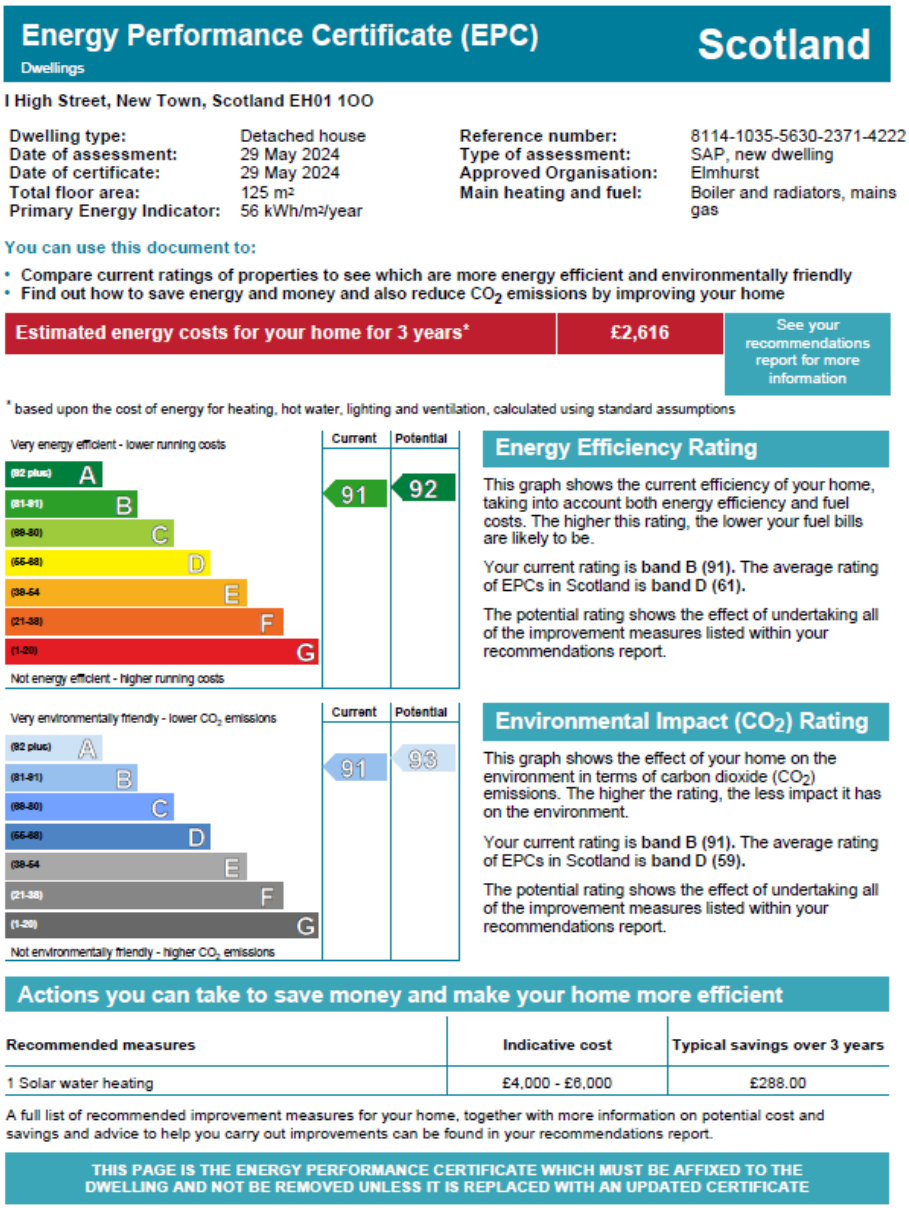
	b	Is the correct 'Main Heating 1' fraction (0 to 1) and the associated secondary/supplementary heating fraction stated?	Full SAP Calculation Printout (Dwelling emissions): Item 9a Energy Requirements I individual heating systems side note [201 and 202]
22	If applicable, is the correct 'Main Heating 2' selected and do the details and controls match the specification? See notes in 21. above.		Summary for Input Data [25.0 Main Heating 2]
23	If applicable, is 'Heat Networks' selected and do the details match the specification? See notes 21 **Note from the 11/07/2025 the distribution loss factor (DLF) for a heat network should be set to 1.0** **This information is reported within the Heat Network section of both the SAP 10.2 'summary for input data' as 'distribution loss value' and 'full SAP calculation printout' section 9b as 'distribution loss factor.**		Summary for Input Data [26.0 Heat Networks]
24	If applicable, is the 'Secondary Heating' detailed and matching in the specification? See notes in 21. above, and: Applications received between 01 February 2023 and 31 March 2024:,direct emission secondary heating systems such as stoves were permitted during this period. 1. Applications received from 01 April 2024: Direct emission secondary heating systems were not permitted under the New Build Heat Standard (NBHS), except in cases where fixed emergency heating was required for buildings with critical heating needs or those in remote and rural areas. 2. Ministerial Direction on 19 September 2024: The Scottish Government temporarily relaxed restrictions under the NBHS, allowing wood burners, bioenergy heating systems, and peat-based heating to be installed in new-build homes. This reversed the previous ban on direct emission heating systems. Additionally, as of January 1, 2025, the NBHS officially permits secondary heating systems in new buildings, meaning homeowners can install any type of secondary heating without restriction		Summary for Input Data [27.0 Secondary heating]
25	'Water Heating':		
	a)	Is the water heating, heat recovery, solar panel, bath count detailed and matching the specification? 1) If hot water is generated at the point of use (hot water code 907 or 909	Summary for Input Data [28.0 Water Heating and 29.0 Hot

		from Table 4a in SAP10), **the distribution loss in box [46] is zero**. For all other hot water systems, **the distribution loss is 0.15 times the energy content**, including for heat networks (whether or not a hot water cylinder is present). 2) Note if solar water heating is specified, a copy of the calculation used in Appendix H1 in SAP10 requires to be checked. 3) Where hot water is provided by a heat pump or micro-cogeneration (micro-CHP), see guidance in Appendix N in SAP10.	Water Cylinder] AND Full SAP Calculation Printout (Dwelling emissions): [46]
	b	If relevant, are instantaneous showers detailed and matching the specification? *1)* Where instantaneous showers are provided, see guidance in Appendix J in SAP10.	Summary for Input Data [28.1 Showers]
	c	If relevant, is the Waste Water Heat Recovery System correct? • **System A**: Pre-warmed water feeds both the shower and water heater. • **System B**: Pre-warmed water feeds the shower only. • **System C**: Pre-warmed water feeds the water heater only.	Summary for Input Data [28.3 WWHR System]
26	Lighting Selection and Efficacy Check • **Efficacy** measures how efficiently a bulb converts energy into light, expressed in **lumens per watt (lm/W)**. • In **SAP 10**, efficacy is measured in **lamp lumens per circuit watt**, which includes all electrical load—not just the lamp itself. • **Minimum requirement** for internal fittings: **75 lamp lumens per circuit watt**. Refer to **SAP 10 Appendix L** and **Section 13** of the Domestic Building Services Compliance Guide for Scotland (2022) for full details on internal and external lighting.		Summary of input data item 22 and Compliance Report, [6.5 Artificial and display lighting] Look for Pass

27	**Are the correct Energy saving/generation technologies detailed**? Contributions can be from: *1)* PV generation, wind generation (small and micro wind turbines), hydro-electric generation (small-scale), all under Appendix M in SAP10. *2)* Micro CHP electricity generated, under Appendix N in SAP10. *3)* Special features that enable the calculation to make use of the characteristics of technologies that are not included in the published SAP10 specification. This procedure may only be used for technologies whose characteristics have been independently assessed and are described in the link www.ncm-pcdb.org.uk or a web page linked to it.		Full SAP Calculation Printout (Dwelling emissions): [233 to 235
28	**From the Full SAP Calculation Printout:** • Use the **Calculation of Dwelling Emissions** pages to check **DER** and/ or **DDER**. • Use the **Calculation of Target Emissions** pages to check **TER** and / or **TDER**. **Note:** This **ID 28 guidance** does not directly apply to **District Heat Networks**, as they use different box numbers in the final section of the SAP10 calculation. However, the **underlying principles remain the same**.		
	a	**TER/DER Emissions Calculations – Do the Energy and CO_2 Emission Factors Make Sense for the Submission?** **1Carbon Dioxide Emissions Calculation** CO_2 emissions are calculated by converting the energy used for key building services—such as **space heating** (Box 211), **water heating** (Box 219), **pumps, fans, and keep-hot functions** (Box 231), and **lighting** (Box 232)—into carbon emissions using **fuel-specific emission factors** from **Table 12 of SAP 10** **Formula:** **CO_2 Emissions = Energy × Emission Factor** The total annual emissions are then summed and divided by the **total floor area** to determine the **Target Emission Rate (TER)** and **Dwelling Emission Rate (DER)**, which are used to assess compliance. **2 Grid Electricity Emission Factors** SAP10 uses monthly average CO_2 emission factors for grid electricity, based on three years of historical data. These dynamic values may differ slightly from the static figures in Table 12, offering a more accurate reflection of grid performance.	Full SAP Calculation Printout (Dwelling emissions): [261 to 272]

	b	**Do the Energy Values Make Sense for the TDER/DDER Calculations?** 1. Delivered Energy vs. Primary Energy In Scotland, Delivered Energy is used to calculate the Target Delivered Energy Rate (TDER) and Dwelling Delivered Energy Rate (DDER) for Section 6 energy compliance. This differs from the rest of the UK, where Primary Energy is typically used. 2. Primary Energy Not Used for Compliance Although Primary Energy is calculated (by applying the conversion factors from Table 12 in SAP10 to Delivered Energy), it is not used in determining TDER/DDER values in Scotland. 3. Location of TDER/DDER Values The TDER/DDER figures appear at the end of the Primary Energy section in the SAP output. However, the Energy (kWh/year) column shown there reflects the Delivered Energy values from earlier in the calculation. 4. How TDER/DDER is Calculated The Delivered Energy values for: • Space heating (see Box 211), • Water heating (Box 219), • Pumps, fans, and keep-hot facility (Box 231), • Lighting (Box 232), are summed to give the total Delivered Energy. This total is then divided by the total floor area to produce the TDER/DDER values used for compliance.	Full SAP Calculation Printout (Dwelling emissions): [275 to 286]

ID	SAP10 Completion checklist		Yes
a	For the completed dwelling, does the submission include: 1) A SAP10 submission (see ID 1. above). 2) An air permeability report (see ID 20. above). 3) An EPC (see Checking EPCs below). Often the SAP assessor will include a **SAP Strategy Report** (or similar title), which will summarise the strategies used (typically for Fabric, Ventilation, Space and Water heating, Lighting, Renewable and EPC). This report can often highlight specific factors that are crucial in helping the SAP10 performance (for example an MCS certificate, or the area of a heat exchanger in a hot water cylinder), or the EPC achieve a high band rating (for example, the heat pump model installed). The report can often conclude with an as-built declaration from the developer, confirming that the technical details and strategies have been achieved for the as-built dwelling.		
b	Does the as-built SAP10 for the completed dwelling pass the checks detailed SAP10 Data Verification and Completion Checklist above?		
c	From the completion inspection:		
	1	Has the Total Floor Area (TFA) and/or the living area fraction altered?	
	2	Does the insulation envelope, including thermal bridging, match the submission?	
	3	Does the glazing match the submission?	
	4	Are the space and water heating systems and control correct?	
	5	Is the ventilation system correct? **Note the ventilation system has normally been chosen to suit the air permeability, check summery of input data report item 22**	
	6	Does the lighting match the submission?	
	7	Do the Energy saving/generation technologies match the submission?	
	8	Does the **air permeability** match **summery of input data report item 22**	
d	EPC Correspondence • Verifier's role: Building Standards must check that the submitted EPC corresponds to the SAP10 submission. Their responsibility is to confirm that the EPC reflects the approved design specification and that there are no discrepancies between the compliance documentation and the as-built dwelling. Where inconsistencies are found, the verifier may require further evidence or clarification. • SAP assessor's role: The assessor should already have ensured that the EPC and SAP10 calculation are aligned. This means the EPC must be generated directly from the SAP10 submission, with all system specifications (heating, ventilation, glazing, etc.) correctly entered and matching the design. If discrepancies arise, the assessor is expected to investigate and, where necessary, raise an Assessment of Work (AoW) to demonstrate whether the dwelling has been built in accordance with the design inputs.		

ID	Checking EPCs	Yes
1	For EPCs for new dwellings where a building warrant is applied for from 01 February 2023 to 31 March 2024, typically a direct emissions heating EPC will look like this: 	
2	According to the Energy Performance Certificates: guide, an EPC provides information about how energy efficient a building is and how the efficiency could be improved. a) EPCs can only be produced by EPC assessors who are members of Approved Organisations. A list of EPC assessors is available on the Scottish EPC Register assessor search. b) The validity of an EPC can be checked on Scottish EPC Register using the Report Reference Number (RRN) listed on the EPC.	

3	From 6.9.2 in the Technical Handbook, an EPC must display the following information: a) The postal address of the building for which the certificate is issued. b) A unique reference number. c) The date of the assessment. d) The date of the certificate. e) The dwelling type. f) The type of assessment used for certification. g) The conditioned floor area of the building. h) The main heating and fuel type. i) A primary energy indicator. j) The current and potential energy efficiency rating expressed on the following bands of running costs; A to G, where A = excellent and G = very poor. k) The current and potential environmental impact rating expressed on the following bands of carbon dioxide emissions; A to G, where A = excellent and G = very poor. l) A list of the top applicable recommendations for cost-effective improvements. m) A statement indicating that more detailed information on the recommendations made in the EPC is contained in the recommendations report. n) A statement to the effect that the EPC must be affixed to the building and not to be removed unless it is replaced with an updated version. The recommendations report, which must accompany the EPC, but which does not have to be affixed to the building.	
4	For EPCs for new dwellings where a building warrant is applied for from 01 April 2024, due to only having ZDEHS (zero direct emission heating systems) heating, the environmental impact rating detailed in 3. k) above will not be relevant.	