

## Notice

The energy conservation requirements of the Building Regulations were revised in 2006. SWA Fact Sheet 2 is in course of revision to reflect these changes. Meanwhile the broad thrust of this 2002 edition remains valid. Steel-framed windows and glazed doors can still be shown to comply with the new Approved Documents L1a, L1b, L2a and L2b. Please consult our member companies for appropriate data on specific projects.



**Steel Window Association**

# Fact Sheet

2

THE STEEL WINDOW ASSOCIATION, 42 HEATH STREET, TAMWORTH, STAFFORDSHIRE, B79 7JH

## Energy Conservation – Building Regulations Part L



The revised edition of Approved Document L, which came into effect on 1 April 2002, deals with the Conservation of Fuel and Power Requirements contained in the Building Regulations 2000 for England and Wales. Similar requirements for Scotland expressed in the Technical Standards to Part J became operative in March 2002.

The Approved Documents are published as two separate volumes, part L1 for dwellings, part L2 for buildings other than dwellings.

Not only do they prescribe insulation improvements for windows, doors and rooflights of some 50%. They also extend the scope of the Regulations to replacement windows in existing buildings, whether or not there has been a material change of use. A relaxation for work on historic buildings is significant for steel windows.

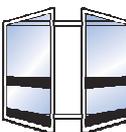
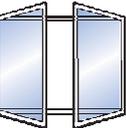
**Historic buildings** include -

- listed buildings,
- buildings in conservation areas,
- buildings of architectural and historical interest, referred to as a material consideration in a local authority's development plan,

- buildings of architectural and historical interest within national parks, areas of outstanding natural beauty, and world heritage sites.

The need to **conserve the special characteristics of such historic buildings** needs to be recognised. In such work, the aim should be to improve energy efficiency where and to the extent that it is practically possible, always provided that the work does not prejudice the character of the historic building, or increase the risk of long-term deterioration to the building fabric or fittings.

In arriving at an appropriate balance between historic building conservation and energy conservation, it would be appropriate to take into account the advice of the local planning authority's conservation officer. Particular issues relating to work in historic buildings that warrant sympathetic treatment and where advice from others could therefore be beneficial include **restoring the historic character** of a building that had been subject to previous inappropriate alteration, eg replacement windows, doors and rooflights.



### DWELLINGS

**L1.** Reasonable provision shall be made for the conservation of fuel and power in dwellings by limiting the heat loss through the fabric of the building

Requirement L1 for Dwellings will be met by the provision of energy efficiency measures which:

- limit the heat loss through the roof, wall, floor, windows and doors etc by suitable means of insulation,
- permit the benefits of solar heat gains and more efficient heating systems to be taken into account; and
- limit unnecessary ventilation heat loss by providing building fabric which is reasonably airtight.

#### Work on existing dwellings

Where windows, doors and rooflights are to be replaced, the requirement will be met by providing new draught-proofed ones either with an average U-value not exceeding 2.2W/m<sup>2</sup>K, or with a glass centre-pane U-value not exceeding 1.2 W/m<sup>2</sup>K.

The replacement work should comply with the requirements of Parts L (energy conservation) and N (safety glazing). In addition the building should not have a worse level of compliance, after the work, with other applicable Parts of the

Building Regulations. These may include Parts B (fire safety - means of escape), F (ventilation - trickle vents in habitable rooms) and J (combustion appliances - keeping an adequate airflow).

#### Showing compliance

Compliance can be demonstrated through the Fenestration Self Assessment scheme FENSA, which conducts random inspections of self-certified installations, as an alternative to Local Authority Building Control.

#### Alternative methods for new dwellings

Three methods are shown for demonstrating reasonable provision for limiting heat loss through the building fabric:

- an Elemental method;
- a Target U-value method;
- a Carbon Index method.

When using the **Elemental Method**, the requirement will be met for new dwellings by selecting windows, doors and rooflights, glazed in metal frames, with an area-weighted average U-value of no more than 2.2 W/m<sup>2</sup>K and by ensuring that the area of the windows, doors and rooflights together does not exceed 25% of the total floor area.

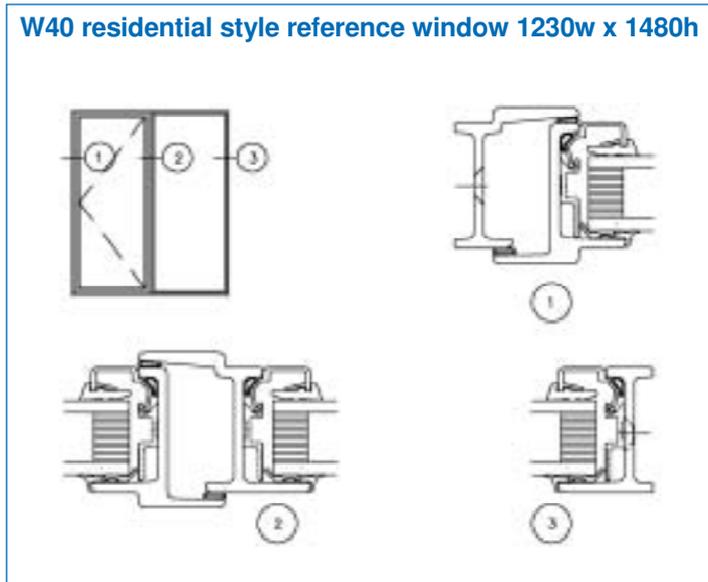
### Residential style standard reference window for dwellings: calculated U-values W/m<sup>2</sup>K

4/16/4 igu centre pane	W40 whole window	6.4/12/6.4 igu centre pane	W40 safety whole window	4/6/4 igu centre pane	W20 whole window
a) 1.7	2.7	a) 1.9	2.9	a) 2.7	3.5
b) 1.4	2.5	b) 1.6	2.7	b) 2.5	3.4
c) 1.1	2.3	c) 1.2	2.4	c) 2.0	3.1

Typical dual seal insulating glass units with aluminium spacers a) air-filled hard low-e, b) air-filled soft low-e, c) argon-filled soft low-e

These U-values for a standard reference “residential” window for dwellings, using typical steel framing systems and glass types, have been calculated by an authoritative and independent source (\*see end note).

#### W40 residential style reference window 1230w x 1480h



#### Trade off between construction elements

The Target U-value method offers various ways of compensating for higher U-value windows:

- improve the U-value of roof and ground floor.
- use insulated doors.
- reduce the total area of windows (but not below 17% of the total floor area which might provide inadequate day lighting).
- allow for solar gains. The Target U-value equation assumes equal distribution of glazed openings on North and South elevations. Increase the proportion of glazed openings on the South elevations to that on the North, and the benefit of solar heat gains can be taken into account to ease the target U-value. For dwellings whose windows have metal frames, moreover, the Target U-value can be increased by a factor of 1.03, to take account of the additional solar gain due to the greater glazed proportion.
- specify a higher performance heating system. Where the proposed boiler has a SEDBUK (Seasonal Efficiency of a Domestic Boiler in the UK), that is better than the tabulated value, (eg 78% for mains natural gas), the Target U-value can be eased proportionately.

Although they do not comply directly by the Elemental Method, window U-values up to 2.4 could usually be allowed by averaging them with two insulated doors U-value 1.0. Otherwise acceptability of steel windows can be shown via the **Target U-value method**.

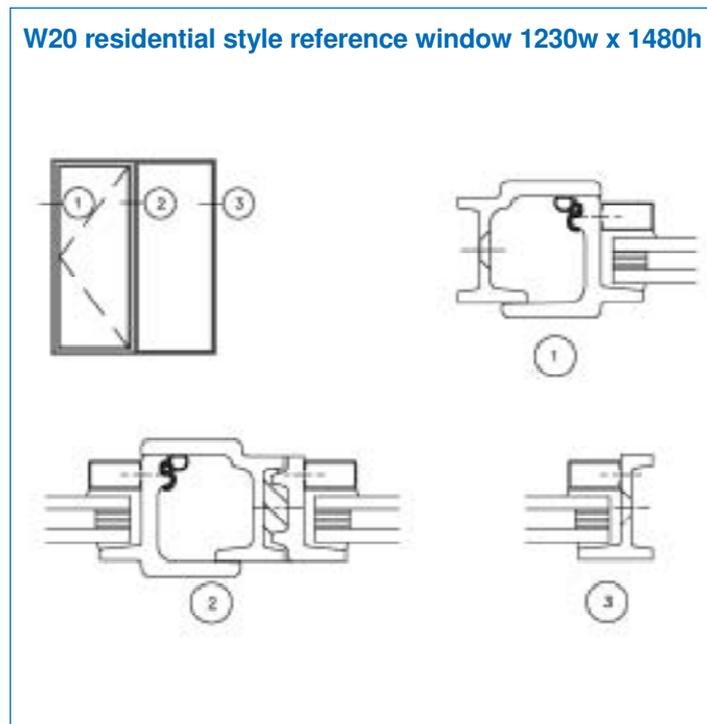
#### Target U-value method for new dwellings

This method allows greater flexibility than the Elemental Method in selecting the areas of windows, doors and rooflights, and the insulation levels of individual elements in the building envelope, taking into account the efficiency of the heating system and enabling solar gain to be addressed.

The requirement would be met if the calculated average U-value of the dwelling does not exceed the Target U-value, determined from an equation given in the Approved Document. Example calculations for determining Target U-values and average U-values are given in Appendix E of that document.



#### W20 residential style reference window 1230w x 1480h



#### Carbon Index method

The aim in this method is to provide more flexibility in the design of new dwellings whilst achieving similar overall performance to that obtained by following the Elemental Method. The Carbon Index adopted in this method is defined in the SAP (the Government’s Standard Assessment Procedure for energy rating), and the requirement would be met if the Carbon Index for the dwelling (or each dwelling in a block of flats or converted building) is not less than 8.0. (See Appendices F & G of Approved Document L1 for a detailed explanation.)

## BUILDINGS OTHER THAN DWELLINGS

**L2.** Reasonable provision shall be made for the conservation of fuel and power in buildings or parts of buildings other than dwellings by

- (a) limiting the heat losses and gains through the fabric of the building;
- (d) limiting exposure to solar overheating.

Requirement L2(a) will be met by the provision of energy efficiency measures which:

- limit the heat loss through the roof, wall, floor, windows and doors etc by suitable means of insulation, and
- permit the benefits of solar heat gains and more efficient heating systems to be taken into account; and
- limit the heat gains in summer; and
- limit heat losses through unnecessary air infiltration by providing building fabric which is reasonably airtight.

Requirement L2 (d) will be met by the appropriate combination of

- passive measures, such as limiting the area of glazing which is not shaded and providing external building fabric that limits and delays heat penetration, with
- active measures, such as night ventilation, so that the effects of solar heat gains are kept within limits that are reasonable in the circumstances.

### Work on existing buildings

Reasonable provision where undertaking replacement work depends on the circumstances and would need to take account of historic value. Ways of meeting the requirements when windows, doors and

rooftlights are to be replaced include providing units that meet the requirements for new buildings, or that provide a **glass centre-pane U-value no worse than 1.2 W/m<sup>2</sup>K**.

The replacement work should comply with the requirements of Parts L (energy conservation) and N (safety glazing). In addition the building should not have a worse level of compliance, after the work, with other applicable Parts of the Building Regulations. These may include Parts B (fire safety - means of escape), F (ventilation - trickle vents in habitable rooms) and J (combustion appliances - keeping an adequate airflow).

### Alternative methods of showing compliance in new buildings

Three methods are given for demonstrating that reasonable provision has been made for the conservation of fuel and power.

- an Elemental Method
- a Whole-Building Method for offices, schools and hospitals
- a Carbon Emissions Calculation Method

### Elemental Method

A minimum level of performance should be achieved in each of the elements. Some flexibility is provided for trading off between different elements of the construction, and between insulation standards and heating system performance. The requirement will be met if the thermal performances of the windows, roof windows and personnel doors (area weighted average for the whole building), when glazed in metal frames, are no worse than 2.2 W/m<sup>2</sup>K



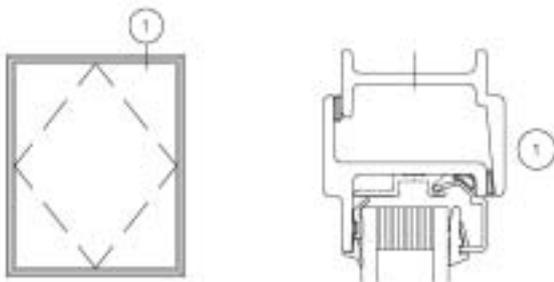
### Commercial style standard reference window for buildings other than dwellings: calculated U-values W/m<sup>2</sup>K

4/16/4 igu centre pane	W40 whole window	6.4/12/6.4 igu centre pane	W40 safety whole window	4/6/4 igu centre pane	W20 whole window
a) 1.7	2.5	a) 1.9	2.7	a) 2.7	3.4
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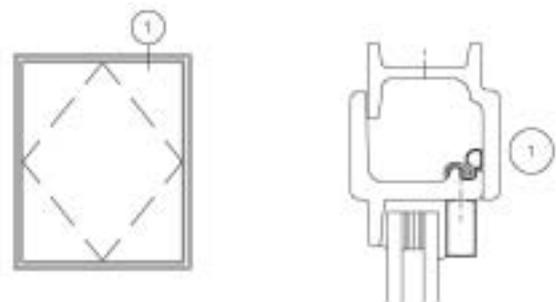
Typical dual seal insulating glass units with aluminium spacers a) air-filled hard low-e, b) air-filled soft low-e, c) argon-filled soft low-e

These U-values for a standard reference "commercial" window for buildings other than dwellings, using typical steel framing systems and glass types, have been calculated by an authoritative and independent source (\*see endnote).

### W40 commercial style reference window 1230w x 1480h



### W20 commercial style reference window 1230w x 1480h



## Insulating the building fabric

The building fabric should be constructed so that there are no significant thermal bridges or gaps in the insulation layers within the various elements of the fabric, at the joints between elements, and at the edges of elements such as those around window and door openings. Appropriate details are illustrated in "Limiting thermal bridging and air leakage: Robust construction details for dwellings and similar buildings" TSO 2001.

Wall cavities, typically 75 to 100mm wide, need to be bridged by a softwood or proprietary closer, overlapped at least 30mm by the window frame. Wall insulation and finishes must return to the frame, which may impose alternative trickle ventilation solutions to the usual slotted head. The frame should have sealant applied to both front and back.

### Maximum area of openings unless compensating measures are taken

Building type	Windows & doors % area of exposed wall
Residential buildings	30
Places of assembly, offices and shops	40
Industrial and storage buildings	15

Provision should be made to limit the rate of heat loss through glazed elements of the building. One way of complying would be to limit the total area of windows, doors and rooflights so that they do not exceed the values given above unless compensated for in some other way.

### Trade-off between construction elements

In order to provide greater design flexibility, the U-values of construction elements and the areas of windows, doors and rooflights may vary from those prescribed in Approved Document L2 provided that suitable compensating measures are taken.

Compliance with the provisions of Part L would be achieved if the rate of heat loss from the proposed building does not exceed that from a notional building of the same size and shape that does meet elemental U-value and maximum area of opening criteria.

\* Report 23694/X/01 of 26 June 02 by Dr Richard Harris of Sandberg Consulting Engineers is available from member companies to specifiers of named projects. It conforms with prEN ISO 10077-2: 2001 "Thermal Performance of windows, doors and shutters - Calculation of thermal transmittance Part 2: Numerical methods for frames", BRE 443: 2002 "Conventions for U-value Calculations", and GGF Glazing Manual Part 2.2: 2002 "Window and Door System U-values: Provision of Certified Data".

The Steel Window Association represents the great majority of UK steel window manufacturers, ranging in size from the smallest of craft-based companies that specialise in replacement and repair work, particularly on windows for Heritage buildings, through to large, multi-site companies that manufacture and install windows in literally every type of building. There is not a single steel window project of any description, anywhere in the UK, that one of the SWA members cannot handle.

All windows produced by SWA members in hot rolled steel sections to BS.6510 are protected by the hot dip galvanizing process in accordance with BS.729. Cold formed steel section windows are also available and all steel section windows can be supplied with a decorative finish available in a range of colours. This process, in which polyester powder is electrostatically applied then heat fused under factory controlled conditions to BS.6497, gives a high quality, attractive and durable finish with a life expectancy of at least 15 years.

The Steel Window Association supports its member companies with a wide ranging service relating to product development, market research and promotion and the SWA helps ensure that each member operates to the highest industry standards. Every contract undertaken has the personal attention of senior management and SWA member companies operate established and flexible services in window design, manufacture, installation and repair and refurbishment.

### Maximum allowable area of glazing

Orientation of opening	Opening area (%)
N	50
NE/NW/S	40
E/SE/W/SW	32
Horizontal	12

### Avoiding solar overheating

Ways of meeting the requirement would be through:

- the appropriate specification of glazing, and
- the incorporation of passive measures such as shading, and
- the use of exposed thermal capacity combined with night ventilation.

A way of achieving compliance for spaces with glazing facing only one orientation would be to limit the area of glazed opening as a percentage of the internal area of the element under consideration to the values above.

In order to allow greater design flexibility, there can be a trade-off between the average U-value of the envelope and the carbon intensity of the heating system.

### The Whole-building Method

To show compliance following the Whole-building Method, the carbon emissions or primary energy consumption at the level of the complete building have to be reasonable for the purpose of the conservation of fuel and power.

Reference is made to BRE, DfEE and NHS Estates guides on Carbon Performance Rating of offices, schools and hospitals.

### The Carbon Emissions Calculation Method

To show compliance using the Carbon Emissions Calculation Method, the calculated annual carbon emissions of the proposed building should be no greater than those from a notional building of the same size and shape designed to comply with the Elemental Method. This approach allows more flexible design of the building, taking advantage of any valid energy conservation measure and taking account of useful solar and internal heat gains.

Steel Window Association  
42 Heath Street, Tamworth  
Staffordshire, B79 7JH  
Telephone: 0844 249 1355  
Fax: 0844 2491356  
Email: info@steel-window-association.co.uk  
Website: www.steel-window-association.co.uk

