CREATING BRIGHT FUTURES

Specifiers' Guide to Aluminium Curtain Walling

Curtain Walling

Choosing the correct aluminium
Curtain Walling system for your project

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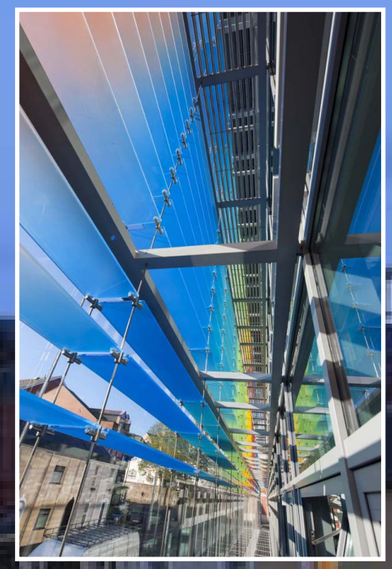
Background

The creation of curtain wall glazing created an entirely new way architects could shape our built environment. **For the first time in history, it was possible to express the inner life of our buildings and share them with world outside the window.**

During the day they literally illuminate the life of its occupants, give expansive views and banish gloomy interiors. At twilight and night, they come to life sharing their secret inner life with the city. They change the way we perceive space and form.

Architect Ludwig Mies van der Rohe believed that architecture should embody a continuous flow of space, blurring the lines between interior and exterior. It isn't an exaggeration to say that glass, plus aluminium has literally built our cities in the latter half of the 20th Century.

AluK are proud of the part we play in helping architects shape that world...



A Brief History of Curtain Walling

The separation of envelope and structural frame was pivotal in the creation of the world's first curtain walled buildings – in Liverpool, 16 Cook Street by Peter Ellis Architect 1864-66 was one of the first examples. The extensive glass walls allowed light to penetrate further into the building, utilizing more floor space and reducing lighting costs. The Bauhaus School designed by Walter Gropius in Dessau, Germany, completed in 1926 was a tour de force in the expression of the façade as a lightweight independent functional way to maximise daylight – an expression of functionalism at its purest. The rest, as they say, is history.

The nature of your project will dictate system choice

It is important to consider how your building will be designed to accommodate the optimum façade and curtain wall system. Curtain walling requires integrated thinking in design to successfully combine with the structural system in use, appropriate thermal insulation, etc.

The integrity and inbuilt tolerances of your building's structure are key to the lifespan of any curtain walling specified. Curtain walling can be fixed to the building structure in a variety of ways, each with its own implications, whether it is between floor slabs, over floor slabs, onto edge beams.

Some important factors to consider:

- Location and layout of site during construction.
- Provision of on-site storage and protection*.
- Height of the building.
- Area to be covered.
- Distance between floor slabs.
- Required span of each panel.
- Regulations and standards

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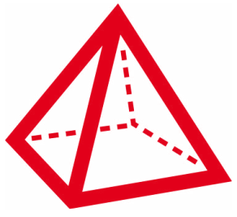
The height of the building and the area to be covered are the most important factors, but also distance between floor slabs and the required span of each panel.

Provision of on-site storage and protection for the curtain walling material

When specifying unitised systems, the storage space will need to be much larger and weatherproof.

Curtain wall design factors 1: When to use it?



Area Shape

Large areas of glazing and complex 3-dimensional shapes

Height

Exceeds 3000mm high, and on multiple storeys. Two systems:

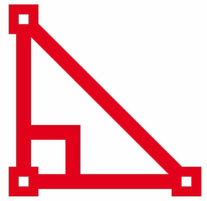
- Stick systems - low to medium rise.
- Unitised systems – high rise

Attachments

Externally fixed attachments (e.g. double skin facades, Brise soleil/solar shading, access walkways and signage)

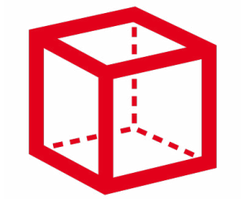
- Aluminium Curtain Walling is the perfect solution for large expanses of glazed façade both horizontally and vertically.
- Particularly when glazing exceeds 3000mm in height and/or spans multiple floors.
- Versatile in accommodating three-dimensional complexity due to the way glass is retained and flexibility of the weatherproof gaskets.
- As a general rule, higher glass to metal content provides better overall U-values, as glazed units are more thermally efficient.
- Slimmer profiles will often improve the overall glazing package U-value calculations over a standard window systems.
- Because of its structural strength, Aluminium Curtain Walling also allows external components to be easily fixed to the system. This includes solar shading, signage, double skin facades and external walkways.

Curtain wall design factors 2: A shortlist of system considerations...



Mullion spans

Facade heights and widths

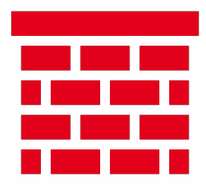


Glass pane dimensions and centres

- A number of factors influence the design of curtain walling systems. These include: facade heights and widths, mullion spans, structural

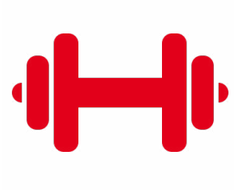
Installation conditions

support locations, building movement, glass type, site wind loading, installation conditions and U-value requirements.



Structural support locations

- These determine the structural design of the mullions and transoms. Referred to as Ixx and Iyy respectively.



Glass weights and types

- Along with the factors above, Building access, location, movement, will also determine the choice of system.

Curtain wall design factors 3: site, structure and loads

- Building movement, deflection and sway (B.Regs Part A1/2 section 3).
- Wind load and funnelling (B.Regs A1/2 section 3).
- Imposed loads – human barrier and impact loads (B.Regs Part K4/5)
- Site access and layout, especially for storage and installation.
- Aluminium Curtain Walling systems are base loaded from the building structure using a variety of fixings dependent on whether the structure is concrete or steel.
- Deflection is accommodated through fixings or split transoms/mullions.

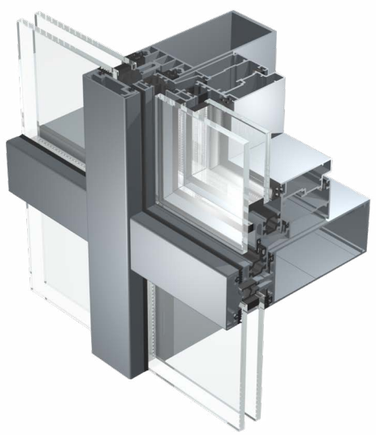
Two systems of curtain walling

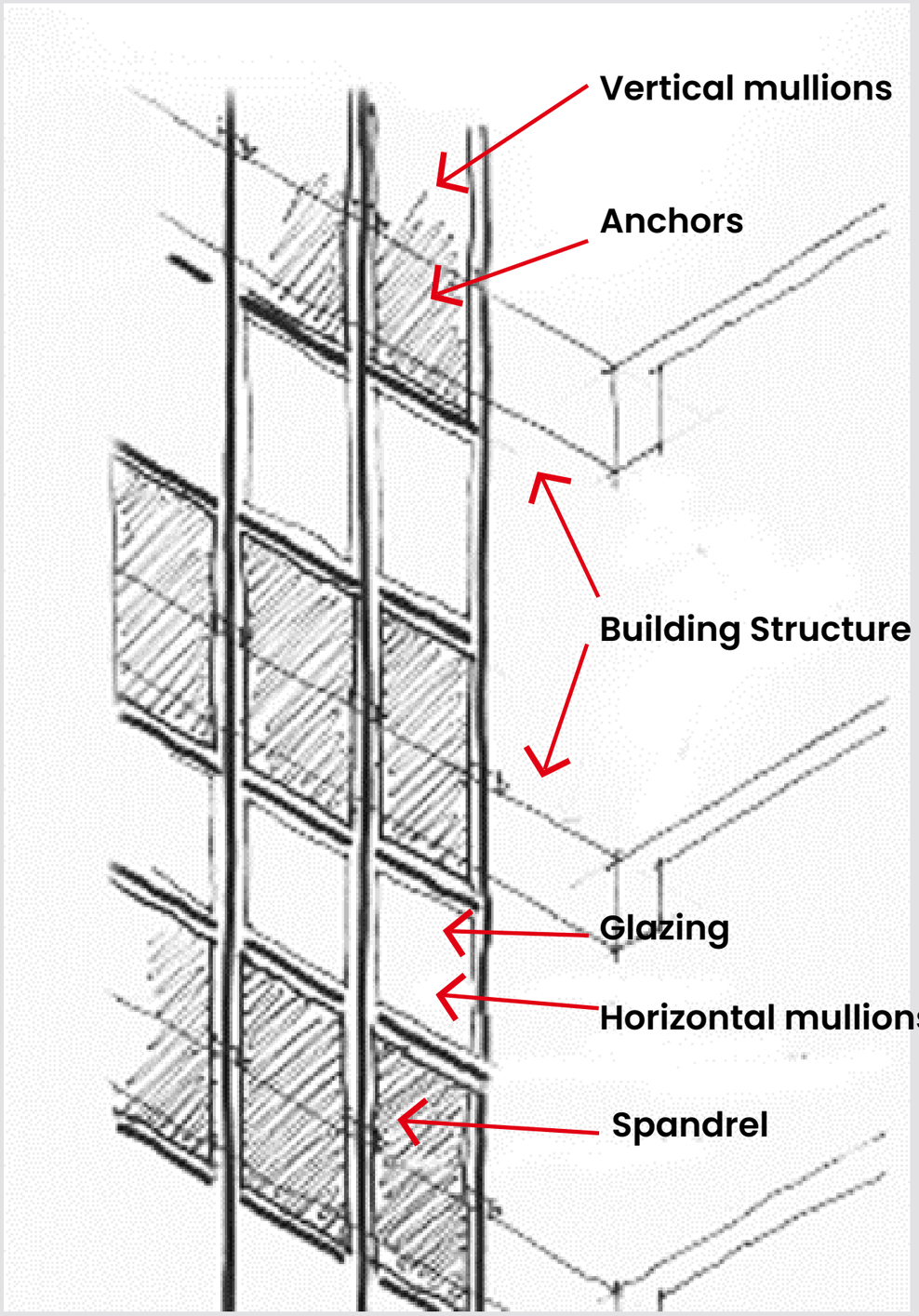
Fundamentally, there are two types of aluminium curtain walling – ‘Stick Systems’ or ‘Unitised Systems’.

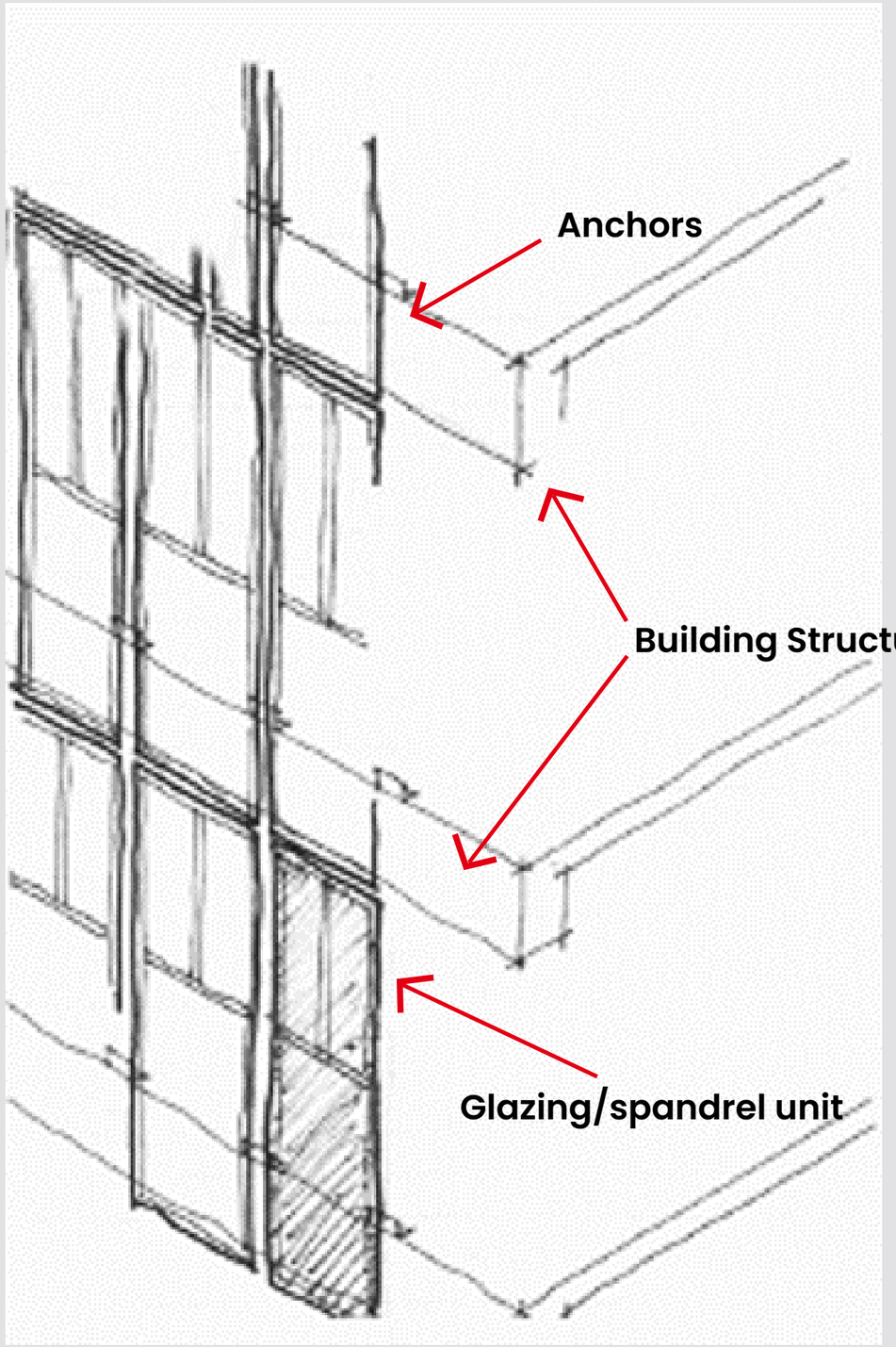
Stick systems

As the name suggests, Stick systems **are delivered to site as a series of individual components and ‘sticks’ which are in turn assembled and glazed onsite.** They are economical, require shorter fabrication periods and simpler access requirements. But they do typically have longer site installation time and construction subject to site conditions.

Stick systems are ideally suited small areas of glazing or panelling, industrial, commercial and residential applications for heights of around three stories or less. They require scaffolding and take between four and five months for site delivery from order, **installation is usually around 50 m2 per week per installer.**





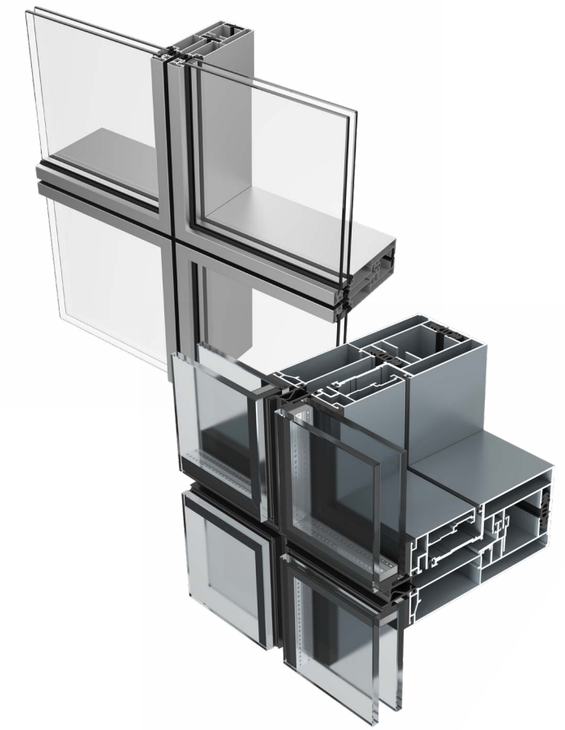


Unitised systems

Unitised systems are installed as a series of pre-assembled, pre-glazed frames which interlock during site installation. They offer factory sealed weather tightness, shorter site installation and improved health & safety. But they need more complex access requirements, have larger frame sightlines, less flexible installation. They also require longer lead times and increased cost.

Unitised systems offer more features albeit at higher cost compared to stick systems. But they offer increased installation speed, better accuracy in production tolerances, do not require scaffolding, and thus reducing overall costs compared to stick systems. They generally are not recommended for buildings of less than three stories, or for smaller projects. Unitised systems around five to six months delivery but be can be installed more quickly - 75 to 150 m2 per day per installer, depending on complexity.

High rise buildings and skyscrapers are almost exclusively clad in unitised systems. They require specialist designers, engineers, and contractors involved at the outset in their design and installation, often in form of third-party facade companies which may offer all three services.
When selecting a supplier for your curtain walling, make sure to look their design experience and track record, examples of their work and in-house resources and facilities.



The system design decision tree

The following flowcharts describe the selection process that specifiers can use to determine the most appropriate system for their project. The idea is to run through the decision tree and consider each section from strategic considerations to details and material choices.

01. Project and contract

Contract Type

- Is the project traditional Design & Build or Management Contract?
- Will the concept architect deliver the project as well?

Design

- Is the project a BIM project?
- Would the facade design benefit from engaging early with a specialist facade design team?

02. Design, construction and finishes

Colour and finish

- Are the aluminium frames powder coated or anodised?
- Is the inside the same colour as the outside?
- Is the building in a corrosive environment or by the sea?

Opening Elements

- Do the windows open? If so, in or out (refer to cleaning strategy)?
- Do any curtain walling screens require opening elements?
- Are swing doors or sliding doors required within the curtain walling screens?

Build programme

- When does the building start on site?
- What is the duration of the scheme?

03. Details and performance 1

Thermal requirements
- What is the glazing U value target?
- What are the sizes of your windows?

Cleaning
- Are the windows to be cleaned from the inside or outside?

DDA
- How many doors require low threshold?
- How many windows require a low handle height?

Ventilation
- Is the building naturally or mechanically ventilated?
- Is purge ventilation required?
- Are trickle vents required?

04. Details and performance 2

Fixing and brackets
- What structure will provide the load bearing fixing points?
- What is the project wind load?
- What are movement and tolerances of the building?

Testing required
- Do windows/doors fall within the manufacturer's tested system range?
- Does the façade need to meet CWCT/BS test criteria?
- Does the building programme allow for any extra testing required?

Security
- Are the windows/doors required to be Secured by Design?
- Does some or all of the glazing need to have an acoustic rating?

Acoustic requirements
- What are the RW + Ctr noise reduction requirements?
- Is there a flanking noise reduction required?

Rules, regulations and standards

Sound transmittance to BS EN ISO-717-1

Design wind pressure: Calculate in accordance with BS 6399-2

Powder coated finishes: To BS 6496

Anodised finishes: To BS 3987

Avoidance of condensation: To BS 6229, table A1

Additional regulations are applicable to curtain walling elements:

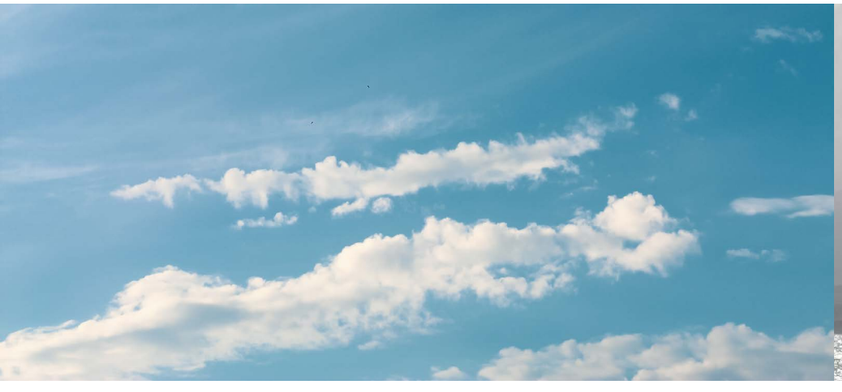
- BS-6399-2 details the methodology for calculating wind loads in the design of curtain walling.
- BS6229 table A1 outlines the requirements regarding condensation.
- BS EN ISO717-1 covers the requirements of sound transmittance and insulation in Aluminium Curtain Walling systems.
- BS6496 is the standard that covers powder coated finishes, whilst BS3987 relates to anodised finishes.

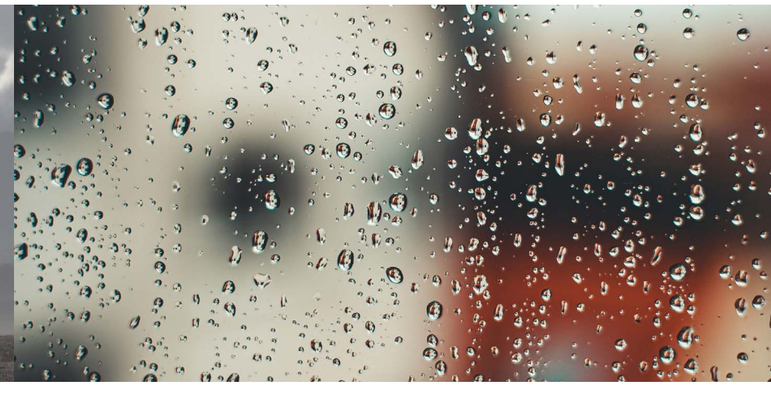
Curtain Walling Product and test standards:

There are three main standards which are applied to the design, construction and installation of curtain walling:

- BS standard 8200 - ‘Code of Practice for the design of non-loadbearing external vertical enclosures of buildings’.
- BS EN 13830:2015 – ‘Curtain walling - Product standards’
- The CWCT standard for curtain walling – ‘Centre for Window and Cladding Technology’.

Test standards 2:
Systems are tested against three criteria:





Air Permeability – Class 4 REQUIRED

- **BS EN 12152:2002** – Air Permeability – Performance requirements & classification
- **BS EN 12153:2000** – Air Permeability – Test Method

Maximum pressure Pmax (Pa)	Air permeability $m^3 / m^2 h$	Class	Notes
150	1.5	A1	
300	1.5	A2	
450	1.5	A3	
600	**1.5**	**A4**	**< Minimum CWCT Requirement**
600+	1.5	AE.XXX	

CWCT standard that covers air permeability or air leakage of the system.

- BS EN standards: require a minimum 150pa, or class A1 rating
- However, CWCT standards calls for a minimum 600pa, or class A4 rating.

Resistance to Window Load Required:
2400pa +/-(3600pa +/- safety

- **BS EN 13116:2001** – Resistance to window load Performance and safety
- **BS EN 12179:2000** – Resistance to wind load – Test method

Maximum pressure Pmax (Pa) SERVICEABILITY	Maximum pressure Pmax (Pa) SAFETY	Class	Notes
800	1200	A1	
1200	1800	A2	
1600	2400	A3	
2400	**3600**	**A4**	**< Minimum CWCT Requirement**

CWCT standard that covers air permeability or air leakage of the system.

- BS EN standards: require a minimum 150pa, or class A1 rating
- However, CWCT standards calls for a minimum 600pa, or class A4 rating.

Watertightness: 600 pa +/- required

- **BS EN 12154:2000** – Water tightness – Performance requirements and classification
- **BS EN 12155:2000** – Water tightness – Laboratory test under static pressure

Maximum pressure Pmax (Pa)	Class	Notes
150	R4	
300	R5	
450	R6	
600	**R7**	**<Minimum CWCT Requirement**
600+	RE. XXX	

There are two methods of testing for proving the design of a system for water penetration: Static Test & Dynamic Test

CWCT criteria relating to wind resistance. Wind loading test is also related to air permeability test.
Depending on results achieved in air permeability, this determines the maximum wind loading you are able to test for.
Example – to achieve class A1 in air permeability, only able to test to a maximum 800 Pascals, for A2 it is 1200 Pascals, for A3, 1600 Pascals and A4, 2400 Pascals (the Minimum requirement for CWCT).
NB - two types of pressures described:
Serviceability: relates to regular wind loading that is applied to the system and is tested with a cycle of 50 gusts at that particular pressure.
Safety: based upon extreme gust of wind once every 50 gusts, tested only once.

Part L is the building regulation section for the conservation of fuel and power. This has a major impact on the design of curtain walling. **Regulations have required increased and improved performance over time from glazing systems**. The regulations presently call for area weighted U-values:

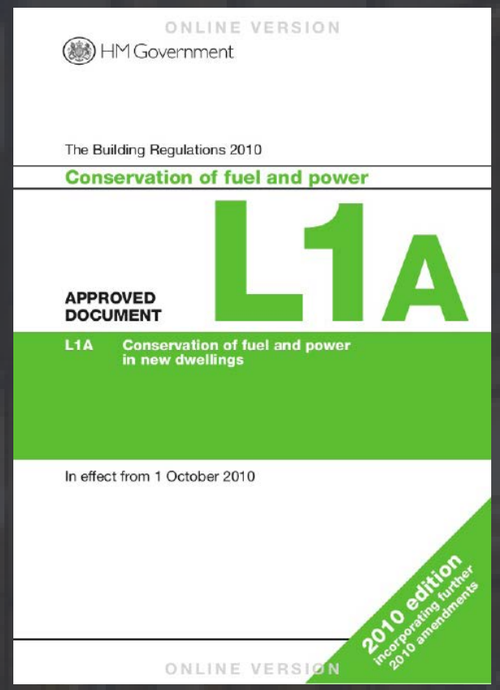
Document L1A - for new dwellings calls for a maximum area weighted average U-value of 2.0W/m2k for the entire glazing package of the building.

Document L1B - for existing dwellings does not detail any requirements relating to curtain walling.

Documents L2A and L2B- relate to buildings other than dwellings and are the most likely to apply to your project when using curtain walling.

Document L2A details a maximum area weighted U-value requirement of 2.2W/m2k in new buildings, which again relates to the entire glazing package and not just a single element.

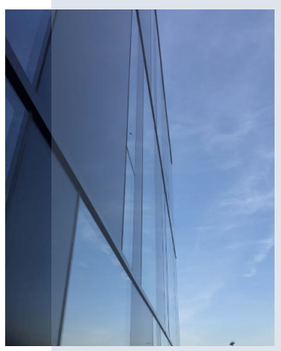
Document L2B however is slightly different, this specifically calls for the curtain walling element to achieve a maximum U-value of 1.8W/m2k.



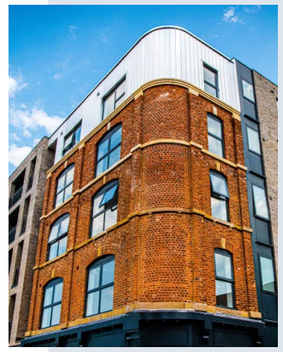
About AluK

AluK International is a global leader in the design and engineering of aluminium window, door and curtain walling systems. With more than 60 years' expertise and operations in major countries around the globe, our façade systems have been specified and installed in buildings as diverse as the RIBA Stirling Prize shortlisted Burntwood School in London and the Park Towers commercial complex in Dubai.

AluK prides itself on its ability to collaborate with clients and specifiers at every stage in the design, fabrication and installation of curtain walling. With the ability to offer a RIBA Stage 4 system design for it's clients, AluK adds value with advice and support which streamlines the process and frequently saves time and money for the build process.



Curtain Walling Systems



Window Systems

Sliding Door Systems

Entrance Doors and Ground Floor Treatment

Folding Door Systems