Smart Disassembly & Circularity Instructions

For Aluminium Window and Door Systems

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Company: Smart Architectural Aluminium

Compliance: BS 8213-4:2016, ISO 20887:2020

Contents

Scope

This guidance is designed for:

- Product users and building owners
- Recycling and waste management authorities
- Third-party collection or recovery services
- Demolition or deconstruction teams
- Architects, specifiers, and sustainability consultants

This document provides **general guidance for the responsible extraction, disassembly, recovery, and reprocessing** of aluminium windows and doors at end-of-life. It is intended to support stakeholders engaged in the **circular management of built assets**, and to promote the reuse and recycling of valuable materials in line with evolving sustainability goals.

Where feasible, **refurbishment should be considered prior to full disassembly**. Replacing components such as gaskets, glazing units, and hardware can significantly extend the service life of the product and reduce environmental impact by deferring material recovery.

The guidance herein reflects **typical practices** for standard product configurations. However, due to the diversity of project-specific requirements, local regulations, and material combinations, **alternative approaches may be necessary** in certain contexts.

As materials technology, disassembly tools, and regulatory frameworks continue to evolve, **recovery processes should be periodically reviewed** to reflect the latest industry developments and best practices.

This document also supports the principles of **ISO 20887:2020**, which encourages:

- Designing with **reversible connections** and **accessible fixings**
- Minimising the use of **inseparable composite materials**
- Providing clear documentation to support **safe, non-destructive disassembly**
- Enabling **adaptability and refurbishment** throughout the product's lifecycle

Aluminium's Circular Strength

Aluminium is an exceptionally **durable material for windows and doors**, offering a long service life with minimal maintenance. Unlike timber, it does not rot, swell, or warp when exposed to moisture. Unlike steel, it is **highly resistant to rust and corrosion**, even in coastal or industrial environments. And unlike certain plastics, aluminium will not become brittle, discolour, or degrade under prolonged UV exposure.

Its inherent strength and stability ensure that aluminium frames maintain their structural integrity and aesthetic appearance for decades — making them a reliable, low-maintenance choice for both residential and commercial applications.

Aluminium is one of the most **sustainably recyclable materials** in use today. Its unique metallurgical properties allow it to be **recycled indefinitely without any loss of quality or performance** — making it a cornerstone of circular construction.

Key Sustainability Facts:

- **Infinitely recyclable**: Aluminium retains its structural integrity and appearance through repeated recycling cycles.
- **High recovery rates**: Over **75% of all aluminium ever produced is still in use today**, thanks to robust global recycling systems.
- **Energy efficiency**: Recycling aluminium uses **up to 95% less energy** than producing primary aluminium from raw bauxite.
- **Global impact**: Each tonne of recycled aluminium saves greenhouse gas emissions equivalent to driving 40,000 miles in an average car.
- **Europe leads the way**: The EU achieves an aluminium **Recycling Efficiency Rate of 81%**,

"Aluminium is by nature circular and fit for multiple recycling: it can be recycled over and over again without losing its original properties."
— European Aluminium, Circular Aluminium Action Plan

"Recycling aluminium from end-of-life and production scrap uses only 5% of the energy required for primary production."
— *European Aluminium via CORDIS project RecAL*

"The aluminium industry has the potential to be a key driver in achieving Europe's ambitions for a climate-neutral and circular economy."
— *European Aluminium, Circular Economy Strategy*

"Aluminium is central to a sustainable future, because of its unique combination of lightness, strength, durability, and recyclability."
— *International Aluminium Institute*

Façade Design Life

Assessment of reference service life and performance classification in accordance with BS7543 to provide assistance in estimating building service life planning to BS 15686-1.

Reference	Service Life	Design Life 1	2	3	4	Effects of Failure A	B	C	D	E	F	G	H
Façade													
Smarts extruded aluminium profiles	**Indefinite**	☐	☐	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐
Smart ironmongery, locks and handles	**25 Years**	☐	☐	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐
Surface Finishes													
Smarts Anodised Finish	**60 Years**	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐	☐	☐
Smart powder coating adhesion	**60 Years**	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐	☐	☐
Smart Powder coating finish gloss retention and colour fastness	**40 Years**	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑
Weathering													
Smart Sealants	**25 Years**	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐
Smarts glazing gaskets	**40 Years**	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐
Infills													
Insulating glass units	**25 Years**	☐	☑	☐	☐	☐	☑	☐	☑	☐	☐	☑	☐

Design Life BS 7543:2015 Table 1		
1	Short Term	*Shorter life than the building and readily replaceable.*
2	Replaceable	*Shorter life than the building and replacement can be envisaged at design stage.*
3	Maintainable	*Last with periodic treatment, for the life of the building.*
4	Lifelong	*Lasts for the life of the building*

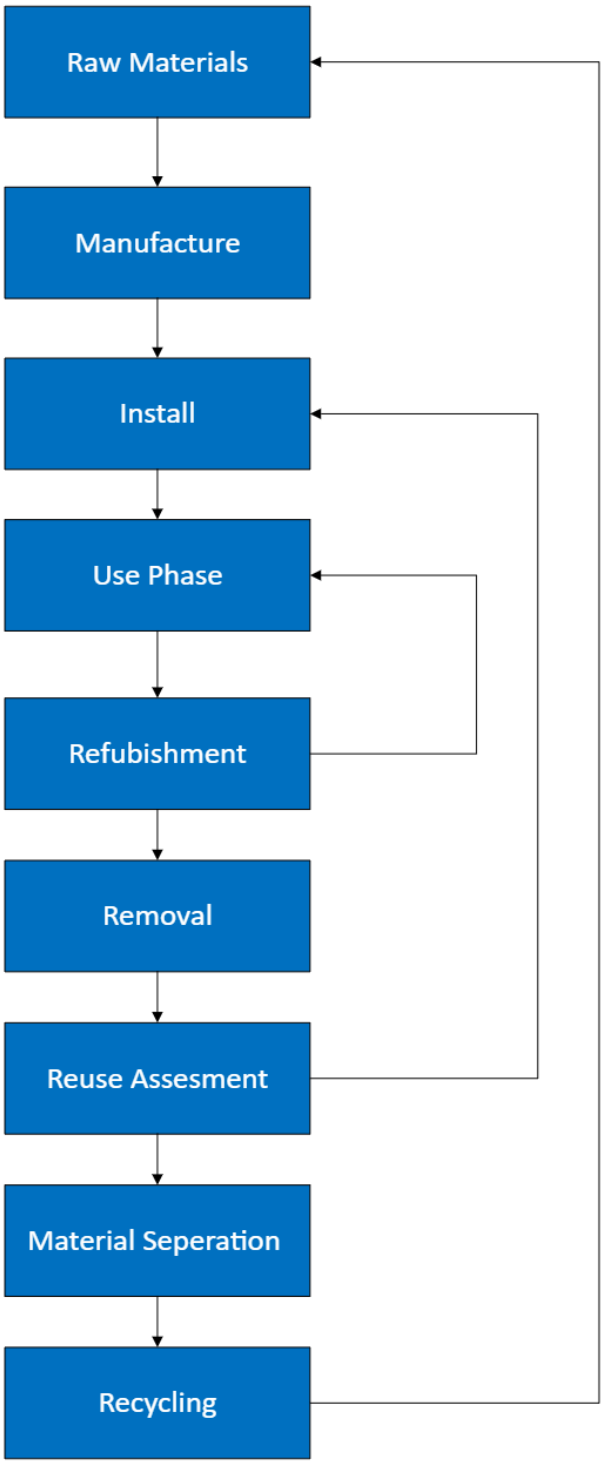
Effects of failure BS 7543:2015 Table 2			
A	Danger to life	**E**	Costly because repeated
B	Risk of injury	**F**	Interruption to building use
C	Danger to health	**G**	Security Compromised
D	Costly Repair	**H**	No exceptional problems

Reference

Service Life to BS7543 reference service life. Based on known life expectancy for a reference set of particular 'in-use' conditions collated from publically available sources. Service life expectancy is based on correct maintenance and specific environment conditions. The reference environment is external class C3 (urban industrial, coastal low salinity) and internal environment Class C1 (normal heated). Note life expectancy of IGU does not include breakages due to nickle sulphide inclusions. This document is for guidance on expectations and does not constitute any form of guarantee or warranty but does provide valuable information for service life planning.

BS 7543:2015.	Guide to durability of buildings and building elements, products and components.
ISO 15686-1	Buildings and constructed assets -- Service life planning -- Part 1: General principles and framework
EN ISO 12944-2	Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments

Flowchart – Circularity of aluminium windows and doors



Refurbishment Opportunities

Where feasible, refurbishment should be prioritised before full disassembly, in line with circular economy principles and ISO 20887:2020 guidance on adaptability and extended service life. Aluminium window and door systems are designed with **removable fixings and modular components**, allowing for straightforward replacement of worn or outdated elements:

- **Hardware replacement**: Handles, hinges, and locking mechanisms can be removed by unscrewing fixings and replaced with compatible alternatives. Standardised hardware interfaces support interchangeability.
- **Glazing replacement**: Insulated glass units (IGUs) can be removed by carefully extracting glazing beads and gaskets.
- It is recommended to **replace gaskets** during reglazing to ensure long-term weather performance.
- Always use **glazing packers** and follow correct setting block placement to maintain structural integrity and drainage paths.

These interventions can significantly **extend the operational life** of the product and reduce the need for full replacement.

Reuse Considerations

Where components remain in good condition, reuse may be a viable option:

- **Aluminium frames and hardware**: May be redeployed in **retrofit projects**, **temporary structures**, or **non-critical applications**, subject to dimensional compatibility and performance verification.
- **IGUs**: Can be reused if **intact, undamaged, and properly sealed**. Visual inspection and edge seal integrity checks are recommended.
- **Gaskets and seals**: May be reused if pliable and free from cracking or compression set, though replacement is generally preferred for long-term performance.
- **Fixings and brackets**: Stainless steel or zinc-coated fixings may be salvaged for reuse if corrosion-free and structurally sound.

Reuse should always be assessed on a case-by-case basis, considering the condition, age, and performance requirements of the receiving application. Where refurbishment

and reuse is not an option old windows and doorsets and other debris should always be stored and recycled where possible.

Removal and Disassembly

The following procedures are aligned with **BS 8213-4** (Annex A – Safe Removal Techniques) and support the principles of **ISO 20887** for Design for Disassembly.

Aluminium windows and doorsets are typically designed as modular assemblies with mechanically fixed components, enabling safe and efficient removal at end-of-life.

General Disassembly Procedure

- Remove glazing beads, sashes, and infill panels using non-destructive tools.
- Unscrew or unbolt frame fixings from the structural opening.
- Separate seals, gaskets, and hardware by material type for appropriate recovery.

Removal Methods Based on Installation Type

a) Frames Fixed into Timber Sub-Frames or Directly into the Aperture

1. Remove all glazing from fixed lights and detach opening lights from the frame.
2. Locate and remove screws securing the metal frame.
3. If present, remove the timber sub-frame in accordance with guidance for timber windows and doorsets (see A.2.2 of BS 8213-4).

b) Frames Set Directly into Brickwork or Concrete Using Fixing Lugs

1. Remove opening lights using an angle grinder or hacksaw.
2. Cut through transoms and mullions to allow sectional removal.
3. Remove frame fixings by drilling out screw heads or driving them through the frame with a suitable punch.
4. Cut through each side of the frame with an angle grinder and carefully lever the frame away from the wall, taking care not to damage surrounding finishes.

Sills and Embedded Components

Sills — and occasionally heads, windowboards, and mullions — may be horned into the surrounding structure, concealing damp proof courses (DPCs) and complicating removal.

- Take extra care when cutting or levering these elements to avoid damaging plaster, render, or brickwork.

- If the DPC is exposed and damaged, it must be replaced. In some cases, localised repair may be possible depending on the material.

Tools & PPE Requirements

- Glass handling: All operatives must wear appropriate PPE, including safety footwear, eye protection, and hand/wrist protection.
- Power tools:
- Use 110 V mains-powered tools, or
- Battery-operated tools, or
- 240 V tools with a 30 mA residual current device (RCD), especially in damp conditions (see BS 7671:2008+A3, Section 604).
- Access: Provide a safe working platform to ensure secure access to structural openings.

Health & Safety Considerations

The removal of windows and doorsets involves inherent risks. All operations must comply with current health and safety legislation, including:

- Risk assessments: Required prior to work commencement. May identify the need for enhanced protective measures.
- Hazardous materials: Survey for potential risks such as asbestos (see Control of Asbestos at Work Regulations).
- Working at height: Follow the Work at Height Regulations. Additional guidance is available in the GGF Code of Practice – Working at Height.
- For further information, consult the Health and Safety Executive (HSE).

Material Recovery & Recyclability

Component	Est. Mass %	Recyclable Pathway
Aluminium profiles (with thermal breaks)	75–85%	Sent to authorised recyclers equipped with **shredding**, **eddy current separators**, and **X-ray sorting systems** to separate aluminium from polyamide or PVC thermal breaks. Recovered aluminium is remelted into billet form with minimal purity loss.
Glass (IGU)	10–15%	Crushed to cullet or recycled aggregate (if clean and uncontaminated)
Hardware (steel/zinc)	~5%	Ferrous and non-ferrous material recovered through magnetics and induction sorting
EPDM seals & gaskets	1–3%	Waste-to-energy or elastomer-specific recovery depending on region

Note: Thermal break materials such as polyamide are separated mechanically post-shredding to ensure aluminium purity. Coated finishes or adhesives may need separation depending on local processor requirements.

Documentation Access

Manuals, datasheets, and component lists and assembly instructions are available via: www.smartsystems.co.uk

Regulatory Notes and Reference Standards

Applies throughout the **UK and EU**. Outside these regions, consult local regulations or contact our compliance team. All guidance to compliant with relevant standards including:

- **BS 7543:2015.** Guide to durability of buildings and building elements, products and components.
- **ISO 20887:2020** – Disassembly and Adaptability
- **ISO 15686-1** Buildings and constructed assets -- Service life planning -- Part 1: General principles and framework
- **EN ISO 12944-2** Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments
- **UK Waste Regulations**
- **EU Waste Framework Directive** (2008/98/EC)
- **REACH, RoHS, and Construction Products Regulation** (EU No. 305/2011)
- **BS 8213-4:2016** – Code of Practice for Installation/Removal of windows and doors
- **BS EN 13920** – Aluminium Scrap
- **PAS 104** – Recycled Glass Aggregate