

**Disclaimer**

This sheet is intended for designers, specifiers and other members of construction project teams wishing to reuse this building material or product. It is part of a collection of sheets aimed at bringing together the available information to date that is likely to facilitate the reuse of building materials and products.

This sheet has been produced by Rotor vzw/asbl within the framework of the Interreg FCRBE project - Facilitating the Circulation of Reclaimed Building Elements, supported by the entire project partnership. Sources of information include the experience of reclamation dealers and involved project partners, lessons learned from exemplary projects, available technical documentation, etc.

The sheets have been produced between 2019 and 2021. As the reclamation sector is evolving, some information, notably regarding pricing and availability, may change over the time. When the text refers to European standards, it is up to the project team to refer, if necessary, to their national implementations and local specificities.

It is important to note that the information presented here is not exhaustive or intended to replace the expertise of professionals. Specific questions are always project related and should be treated as such.

The complete collection of sheets (including the introductory sheet) is freely available from different reference websites (a.o. opalis.eu, nweurope.eu/fcrbe, futureuse.co.uk).

Non-exhaustive directories of dealers in reclaimed building materials are available on www.opalis.eu and www.salvoweb.com.

Interreg FCRBE partnership: Bellastock (FR), the Belgian Building Research Institute / BBRI (BE), Brussels Environment (BE), the Scientific and Technical Center of Building / CSTB (FR), Confederation of Construction (BE), Rotor (BE), Salvo (UK) and University of Brighton (UK).

The information contained in this document does not necessarily reflect the position of all the FCRBE project partners nor that of the funding authorities.

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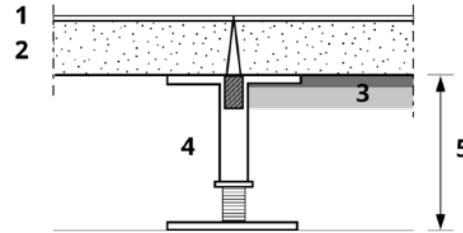
Raised access floor

Product description

Raised access floor systems, also called “false floors” or “raised floors”, are designed from regular sized modular coverings, placed on a substrate made up of fixed pedestals or height-adjustable jacks (self-supporting floor) that can be connected to each other by reinforcing crossbars (cross-braced floor). The technical void between the ground and the raised floor (= plenum) allows the routing of cable networks (electrical, IT, telecommunications) and piping for heating, air conditioning and ventilation networks.

Unlike hollow floor systems, which are not the subject of this sheet, modular coverings are removable, interchangeable and allow easy access to the plenum. This light-weight design promotes flexibility in the layout of the premises and facilitates the reclamation of elements. Most of the time, only the coverings are reused. Their re-installation then requires the use of a substrate of compatible new elements. Due to their structural character, it is often necessary to properly assess the technical performance of reclaimed raised floors, in order to ensure their fitness for use. Particular attention should therefore be paid to the traceability and uniformity of the recovered batches. To our knowledge, the sector is currently under-developed, but significant progress has been made in recent years.

→ **Types.** Reclaimed coverings are mainly made of a core of high density fibreboard (HDF) or calcium sulphate (gypsum) reinforced with fibres. Depending on the model, they are fully or partially encapsulated in an aluminium or galvanised steel sheet. The



Anatomy of a raised access floor

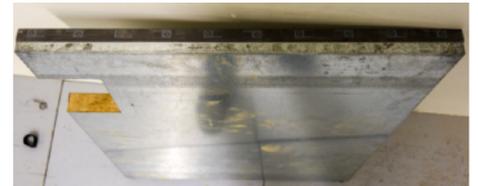
upper face (visible face) is raw (uncoated) or covered with a factory finish (see finish). The edges are protected by the folded sheet or by self-extinguishing and antistatic PVC strips.

→ **Formats.** The dimensions of the coverings are generally 500 mm × 500 mm or 600 mm × 600 mm and their thickness is in the order of 16 mm to 44 mm. Most of the time, the edges are chamfered to facilitate installation and removal.

→ **Finish.** The upper face of the coverings can be provided with a factory finish (laminated, PVC, vinyl, carpet, linoleum, rubber, etc.) or be uncoated, i.e. designed to receive a cladding finish after their installation. In the case of reclaimed coverings, there may be traces of glue. The type of finish is a major contributor to the performance of the coverings and raised flooring system.

→ **Jacks and crosspieces.** Rarely reclaimed, these substrate elements are generally made of galvanised steel. The jacks consist of a threaded rod (+ nut) allowing height adjustment, a base plate ensuring fixing to the ground and a support head fitted with steel, aluminium or synthetic lugs, and serving as a support for the floor coverings. Certain models of jacks include a device intended for the attachment of an earthing strap.

1. Coating
2. Covering (with chamfered edge)
3. Crosspiece (optional)
4. Adjustable jack
5. Plenum



Incomplete covering, uncoated, based on chipboard, encapsulated in a galvanised steel sheet. Half of the edge is provided with a self-extinguishing PVC strip.

The crosspieces must be compatible with the jack model and are either clipped or screwed to them. They reinforce the stability of the system by distributing the horizontal forces and contribute to waterproofing when they are provided with a PVC top cladding.

→ **Accessories.** Many specific accessories generally accompany raised floor systems and can occasionally be reclaimed. These are elements integrated into the coverings (for example: connection boxes, cable glands, ventilation grilles, perforated coverings, etc.) or separate (for example: specific structural elements, closing cheeks, steps, risers, guard-rails, etc.).



Raised floor with braced framework. Laminate coated coverings.



Self-supporting raised floor. Agglomerated wood-based coverings, with a textile covering (carpet tiles).



Covering with factory finish (textile). 2% chamfered edge.

**Product reclamation**

Raised floors are often found in buildings housing technical installations and/or requiring a certain flexibility in terms of layout (office buildings, computer rooms, hospitals, museums, etc.). Often easily removable, they are good candidates for reclamation, either on-site or through the professional channels of products resellers. Their interest in these items will depend essentially on the model, the quantities and the general condition of the batch.

→ *Evaluation of potential.* An "expert eye" generally makes it possible to estimate the potential for reclamation during an on-site visit or based on photos and technical information relating to the model, manufacturer, quantities, dimensions, etc. The points of attention are among others:

- general condition: do the coverings have a factory finish? If so, what is its state of wear? Is the cladding layer glued? Is it easy to remove? Are fibreboard coverings warped due to excess moisture? Do the metallic parts show traces of corrosion? Do we suspect a significant residual deflection that could call into question their reclamation?
- the available documentation (technical sheets, declaration of performance, etc.) and the assessment of the conditions of use.
- Commercial interest, depending on model, quantity, resale potential, ease of maintenance, etc.;
- logistical arrangements, including deadlines, handling, organisation of transport, etc.

→ *Removal.* Careful dismantling should aim to ensure the integrity of the coverings and workers' safety. After having removed all the surface elements of the floor, and proceeded to de-energise the electrical networks connected to the floor, it is advisable, if necessary, to remove the finishing cladding. The accessories (cable glands, ventilation grilles, connection boxes, etc.) must be carefully removed if their reclamation is envisaged.

In order to guarantee the uniformity of the batches, it is advisable not to mix the various covering models, and to carry out if necessary a separation of similar elements if their original application differs. Self-checking procedures can be put in place during removal.

The coverings are generally removed using a suction cup. The use of screwdrivers or any other blunt tool is to be avoided. For the safety of the workers, it is preferable to proceed with the simultaneous dismantling of the jacks and the crosspieces. Once dismantled, the coverings are sorted by type and format, and deformed or doubtful-looking elements are discarded. Incomplete coverings (edging coverings or those that have been cut) can be recovered separately and correctly identified.

The coverings are stacked horizontally on pallets (avoiding spillover) and strapped or banded. The number of stacked coverings will be determined according to their specific mass (generally 10 to 15 kg/covering depending on the model), the stability of the pallets and the load capacity of the evacuation exits. As far as possible, it is advisable not to walk with heavy loads on the floor to be dismantled.

In some cases, it is preferable to insert spacers between the coverings to prevent them from sticking together. It is strongly recommended to label each pallet at the time of removal to ensure product traceability.

Marking

Coverings often have a reference on the underside or on the edge. This reference can be used to find the product sheet and obtain information relating to the date of manufacture, the load resistance class and the fire resistance class at the time of the initial installation.



Residual glue on the upper face of the coverings.



Deformed or non-compliant coverings, not recovered.



Jacks not recovered, significant glue residue.



Removal of the coverings using a suction cup



→ **Treatments.** To be laid without complications, the coverings must be cleaned of the remains of glue on the surface and on the edges. This operation is generally carried out in the workshop, manually and using an industrial belt sander. Coverings with a steel edge are also checked and stapled if necessary. Once cleaned, the coverings are again stored on a pallet, strapped or banded, protected through shrink wrapping and labelled.

→ **Performance evaluation.** Given the possibility of coming across batches of large uniform surfaces, batches of floor coverings are one of the rare reclamation products that can be accompanied by a performance certification (for example: admissible load class, deflection class, reaction to fire, acoustic performance). In this case, the professional operator calls on a laboratory or a certified body to establish representative sampling and carry out characterisation tests.

→ **Storage.** It is recommended to store the floor coverings at room temperature (15° C to 25° C), away from humidity and dust (recommended relative air humidity from 40 to 65%). Metal components and particle boards are particularly sensitive to variations in humidity.

→ **Transport and delivery.** The necessary precautions must be taken during transport and delivery in order to minimise breakage (strapped, shrink wrapped pallet, etc.).

It is advisable to involve specialised professionals to ensure the smooth running of these operations.

"[...] Large-scale development projects that are accompanied by a demand for large quantities of recovered products are an excellent way to strengthen and expand the existing reclamation market. In some cases, a large-scale operation can help support new investments in research and development, machinery and services. It can even lead to the creation of a new business. The Pulse project, in the Paris region, is the perfect example. A unique demand for 22,000 m² of recovered technical flooring has enabled the company Mobius to develop a new business model around this product, which was rare on the reclamation market until then. In response to this demand, the company has extended its services in relation to these materials. They now offer their customers product guarantees and carbon footprint assessments."

[Excerpt from A Guide to Identifying the Reclamation Potential of Construction Products] FCRBE.



Storage of coverings to be cleaned © [Mobius](#) - Marie Moroté



Cleaning uncoated coverings © [Mobius](#) - Marie Moroté



Applications and laying

Reclaimed raised floor coverings can be used for applications subject to moderate stress (office) or more intense (laboratories, computer server rooms, etc.). The choice of coverings and substrate parts must, however, take into account the expected stresses (see “characteristics and fitness for use” below). In all cases, reference should be made to the usage standards (EN 12825:2013) and to the state of the art in force (or implementation standards).

The implementation of fully sorted and cleaned reclaimed raised flooring is no different from that of new flooring. It raises the same points of attention, in particular: choice of materials (coverings, substrate, finishing cladding, specific accessories, etc.), method of laying the finishing cladding (laid or glued), properties and condition of the support, floor height, layout and fixing of the jacks (using anti-vibration glue, screwing or welding), thermal and acoustic insulation, fire resistance and, compartmentalisation, airtightness, protection against electric shock and overcurrent, expansion joints, reinforcements and tie rods, diagonal crosspieces in seismic regions, peripheral profiles and precautions, horizontality and flatness of the floor, prevention of humidity risks, minimum ceiling height, maintenance procedures, installation lead times, costs, etc.

To facilitate laying, the specifier will take care to use batches with a certain degree of uniformity in terms of the following characteristics:

→ **Batch composition.** The batch must consist of panels of the same type and same format. Ideally, coverings from the same batch have the same origin, which to some extent ensures that they have been subjected to similar loads.

→ **Appearance.** Slight variations in colour are possible for factory coated coverings (e.g. carpet covered coverings). These variations are mainly due to the original exposure and use. It is therefore advisable to mix the coverings when laying.

→ **Condition.** Reclaimed coverings may show signs of deterioration such as signs of surface wear, stains, knocks. In the case of uncoated coverings, these aspects will generally be camouflaged by the application of a finishing cladding.

→ **Declared performances.** In the case of split batches, it should be ensured that the declared performance is similar and compatible with the requirements needed.

→ **Quantity.** Some suppliers may include surplus when the product is delivered if they are not able to guarantee the absolute uniformity of the characteristics mentioned above. This surplus can also be applied in the case of an on-site salvage scenario. It is also advisable to provide a surplus of coverings for subsequent replacement and repairs.

Most professional suppliers are able to ensure that delivered batches meet these requirements.

Design tip!

To increase the chances of meeting the offer available on the reclamation market, the specifier can choose to accept several different batches and distribute them in an organised manner in the building. For example, plan a uniform batch of raised floor coverings per space or per floor.

Think reversible!

For equivalent performances, the choice of a flexible cladding such as carpet tile/PVC non-adhesive or not glued is preferable. Easier to remove, it promotes the reclamation of unclad floor coverings.



Re-installation of raised floor coverings and new jacks (FR). © Mobius - Marie Moroté



Re-installation of raised floor coverings and new jacks (FR). © Mobius - Marie Moroté



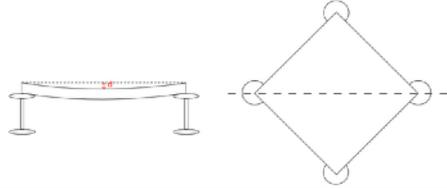
Characteristics and fitness for use

To date, there is no harmonised European standard that deals with raised floors. However, the national standards in force (NBN EN 12825 in Belgium, NF EN 12825 + NF EN 1366-6 + NF DTU 57.1 in France, PSA MOB PF2 / SPU and BS EN 12825 in the United Kingdom, NEN EN 12825 + NEN EN 1366-6 in the Netherlands) establish the relevant characteristics (depending on the context) in order to determine their fitness for use. Although detailed for new products, these characteristics may prove useful in considering the specific case of reclaimed raised flooring.

It should be emphasised that a raised floor should be seen as a *system* of separate elements (coverings, jacks, crosspieces, cladding, etc.) whose individual performance contributes to the overall performance of the system. As such, the performance of the finishing cladding (not detailed here) is just as decisive in meeting the desired requirements (see specific sheet on carpet tiles).

Depending on the requirement level and the floor area to be reclaimed, the use of laboratory tests is a relevant option to determine the essential performance of reclaimed raised floors. This assessment is interesting for the reclamation of batches on site or from external sources. In addition, some professional dealers are able to provide a series of certified performances accompanying batches of uniform coverings (for example: load class, deflection class, reaction to fire, acoustic tests, etc.).

The use of the original technical data can also be considered for elements not exceeding the reference lifespan (generally 25 years for fibre-board coverings). However, uncertainties may remain as to the evolution of their performance over time and as to non-compliance with usage requirements, which may adversely affect the performance of the original product.

Characteristics	Comments
Maximum permissible load	This parameter determines the maximum load that can be supported by the coverings at a given floor height. It can be determined by measuring the breaking load by means of destructive tests on a sample (according to standard EN 12825). The result is expressed in kN and is necessarily greater than 4 kN. The maximum admissible load is then equivalent to the measured breaking load divided by a safety factor (2 or 3). The jacks must withstand 4 times the maximum allowable load.
Deflection	This characteristic describes the deformation (flexibility) of the covering under maximum admissible load. It can be determined in the laboratory, according to standard EN 12825. The most severe deflection class A corresponds to a maximum deflection of 2.5 mm. The residual deflection after 30 minutes should not exceed 0.5 mm. Coverings fully encapsulated by galvanised sheet steel are generally more rigid. Hard cladding strongly influences this parameter. When assessing a batch potential, it is advisable to estimate by sampling the residual deflection of the coverings. 
Reaction to fire	Specific requirements for the reaction to fire of claddings are determined by national regulations. These requirements depend, among other things, on the use of the premises (for example: private or community housing, emergency exits, terraces on flat roofs, etc.), on the height of the building (for the façade cladding) but also on the ability of users to evacuate the premises in the event of fire (senior citizens' residence, hospital, etc.). Classification of construction products according to reaction to fire is defined by European standard EN 13501- 1 (Euroclass) and is assessed in particular on the basis of a test carried out under the final application conditions, i.e. taking into account the entire raised flooring system. For example, coverings made from mineral materials (e.g. calcium sulphate) are most of the time classified A1 _{fl} or A2 _{fl} (incombustible) and those based on agglomerated wood particles are generally classified B _{fl} (low combustibility).
Fire resistance	At a European level, the classification of the fire resistance of different building elements is described in standard EN 13501-2. It is expressed by a period of time R _f (in minutes) during which a construction system satisfies the criteria of stability (R), flame tightness (E) and thermal insulation (I). Its application to raised floors leads to one of the following classifications: R 15, R 30, RE 30 or REI 30. The EN 1366-6 test standard is used to determine the fire resistance of raised floors. Coverings entirely encapsulated by galvanised steel sheet or in mineral matter generally have a higher fire resistance than coverings made of partially encapsulated agglomerated wood particles.



Characteristics	Comments
Electrostatic behaviour and electrical resistance	<p>This characteristic defines the capacity of the floor (cladding + covering + jacks + glue) to limit the accumulation of electrostatic charges (antistatic behaviour) and to ensure their evacuation (conductivity). It also helps prevent the risk of electrocution in the event of accidental contact with live circuits. In general, a raised floor must have a transverse electrical resistance of between 5.105 and 2.1012 ohms (EN 1081).</p> <p>In most areas of raised floor use, the choice of a finishing cladding not exceeding a load voltage of 2 kV is sufficient (performance related to the cladding according to EN 1815). Earthing resistance requirements are not justified for an entire building either, but only for very specific sectors (electronic or explosive environment). In this case, it is recommended to rely on a specialized office to correctly assess the expected performance. Earthing is generally done through an equipotential bonding braid network connecting a certain number of jacks together. The choice of jacks allowing this device is then recommended.</p>
Acoustic performance	<p>The acoustic performance of a raised floor depends on the covering's structure and the insulation of the system. Establishing it is complex and is generally the subject of laboratory tests in use conditions, according to standard EN ISO 10848-2. In general, the denser and more flexible the panels, the better the protection against impact noise. The other parameters influencing the lateral transmission of noise are in particular the height of the plenum, the type of finish cladding, the acoustic compartmentalization (above and in the plenum), etc.</p>
Dimensional tolerance	<p>Maximum dimensional variations of approximately 0.5 mm are acceptable, regardless of the dimension (thickness, length, straightness, squareness, etc.), in order to guarantee the interchangeability of the coverings. These characteristics are therefore closely linked to the quality of the original product, the degree of sorting of the reclaimed coverings and the uniformity of the batch. A visual or detailed examination of the batch is often sufficient to estimate them.</p>
Resistance to impact	<p>The system must be able to withstand the impact of soft and hard bodies without being deformed. The EN 12825 standard recommends a detailed test method to test this ability. This characteristic can be assessed according to the whole batch and the proportion of damaged and discarded coverings.</p>
Serviceability and moisture resistance	<p>This depends on the type of cladding and the type of covering. For example: components made from chipboard are liable to swell under the influence of water. Large-scale cleaning is therefore prohibited. In general, it is possible to refer to the precautions for use of equivalent new products.</p>
Slip resistance	<p>This characteristic is defined by the type of cladding on the raised floor.</p>
Thermal performance	<p>If the raised floor complex belongs to the compartment enclosure, it should be ensured that it meets the required thermal insulation requirements by determining its thermal transmission coefficient U (W/m²K).</p>

Hazardous substances and precautions

	<p>While calcium sulphate coverings emit little or no Volatile Organic Compounds (VOCs), coverings made from reclaimed chipboard particles are likely to release them, in particular formaldehyde, considered carcinogenic, mutagenic and reprotoxic. However, it is recognised that the risk of <i>formaldehyde</i> emission from particle board decreases significantly for materials produced after 1990 all the more so as their working life is long. The risk associated with the reclamation of raised floor coverings is therefore considered to be very low. In case of doubt, it is possible to carry out a laboratory test according to standard EN ISO 12460-3. It should be added that the quality of the indoor air will also be influenced by the type of cladding chosen and its means of installation.</p>
	<p><i>Pentachlorophenol (PCP)</i>. The use of this wood treatment agent (pesticide) has been regulated in Europe since the 1990s. However, there is a low risk of finding this persistent, toxic and endocrine disrupting pollutant in panels made from reclaimed wood particles. However, the absence of direct contact with the material limits the risk.</p>

- (1) Marutzky R. (2008) Opening and Thematic Introduction, Proceedings of the Technical Formaldehyde Conference, WKI, 13-14 March 2008, Hannover, Germany.
- (2) Indoor Air Pollution: An Evaluation of Three Agents – Formaldehyde, Exposure to Environmental Hazard, University of Minnesota, PubH 5103, fall semester 2003.



Availability

Raised floors are a very common product in the reclamation market. Few professional operators are currently able to offer a refurbishment and resale service despite the high opportunity potential. However, availability depends a lot on the quantities required. Sets of identical coverings up to 1000 m² are regularly available.

Indicative prices (Excl. tax)

Random sampling of the reclamation market in Western Europe (Belgium, France, Great Britain and the Netherlands) made it possible to extract some indicative prices. These vary depending on model, condition and quantities needed. It is generally necessary to calculate between 10 and 20 €/m² (raised floor coverings, without jacks or crosspieces), which seems to correspond to around 85% of the new price.

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Assessing the impact of reclaimed wood-based construction products on global warming is complex and difficult to generalize. The general principle is that construction timber can confine biogenic carbon. Reclamation is therefore a way of preserving these carbon stocks and preventing it from being released into the atmosphere (which would be the case if the wood was incinerated, for example). The overall environmental assessment of a reclaimed wooden element must, however, also take into account aspects such as the origin of the product and the distance travelled, etc. For more information, it is advisable to consult the specific paragraph devoted to this question in Sheet00_Introductory sheet. The data collected in the table below vary significantly depending on the analysis. In all cases, the reclamation of raised floor coverings makes it possible to prevent the production of CO₂ from the manufacture of new coverings.

Embodied carbon (Cradle to gate - production A1-A3)

	kg CO ₂ eq./m ²
INIES database (FR) - generic data (new MDF covering) - sustainable management *	42.7
INIES database (FR) - generic data (new MDF covering) - non-sustainable management *	79.3
INIES database (FR) - generic data (new mineral covering) - non-sustainable management **	95.5
MOBIUS (reclaimed MDF covering) - individual data ***	1.67
MOBIUS (reclaimed MDF covering) - individual data ****	1.05

* Indicative value for 1 m² of raised access floor coverings in agglomerated wood (MDF) 38 mm thick and steel pan, unclad, laid on jacks for a reference service life of 25 years.

** Indicative value for 1 m² of raised access floor coverings in mineral matter (calcium sulphate) 44 mm thick and steel pan, unclad, laid on jacks for a reference service life of 50 years.

*** Indicative value for 1 m² of reclaimed raised access floor coverings, unclad, placed on jacks ensuring a plenum of 300 mm, for a reference service life of 25 years.

**** Indicative value for 1 m² of reclaimed raised access floor coverings, with laminate cladding, placed on jacks making it possible to ensure a plenum of 300 mm, for a reference service life of 25 years.

The data relating to the life cycle analysis of these products are shown in the graph below (*Warning: comparison of products with different reference lifetimes!*).

