VALCAN

The Defining Standard

CERAMAPANEL® A1 INSTALLATION GUIDE

ceramapanel®

Compressed Fibre Cement Facade

Contents

ABOUT THIS MANUAL

This manual has been developed to effectively assist designers and architects to work with Valcan's Fibre Cement Panel: Ceramapanel® A1.

Due to the uncontrollable conditions and methods of job scope, as well as the variable skills and judgment of users/installers and the quality of equipment, tools, etc., the suggestions and recommendations contained in this manual are provided as guidance only and without warranty

The term "designer" within this document refers to the 'project architect and/or façade engineer / designer, or other responsible party' who is detailing and signing off the final façade system

All information (including any drawings, designs or specified materials) set out in this document is provided for guidance only. We do not accept any liability for it and do not warrant or take responsibility for its accuracy. The document does not take into account the requirements of your project and should not be relied upon. All information contained in it should be verified and approved by a qualified professional to ensure it meets your requirements and the requirements of your project.

The information and recommendations contained herein are believed to be correct at the time of publishing 08/03/2023. Valcan reserves the right to revise the contents of this manual.

1 Ceramapanel® A1 panels

Valcan produces Ceramapanel® A1 fibre-cement flat panels for use as external and internal cladding for walls and ceilings. The panels bear CE and UKCA marking compliant with the UNI EN 12467 harmonized standard.

This manual refers only to the use of Ceramapanel® A1 panels for vertical facade cladding.

The panels are made of fibre cement – a cement matrix mixture with mineral adjuvants, with the addition of organic fibres.

For the latest information on available finishes and treatments, visit our website at https://valcan.co.uk/product/Ceramapanel®

Ceramapanel® A1 panels for ventilated facade cladding can be purchased in standard sizes or smaller dimensions cut to customer specifications. They are available in thicknesses of 8, 10, and 12 mm.

The edges of the panels are rectified and their surface is smoothed to ensure their geometry as per the UNI EN 12467 harmonized standard. The smoothing direction follows the direction of the fibres, and is visible on some of the available finishes. This has a great impact on the aesthetic appearance of the facade. These aspects should be taken into due consideration by the designer and installers of the ventilated facade.

During production, the fibres in the panels are oriented running the length of the panel, which allows for greater strength in the longitudinal direction.

The non-uniformity of color and the presence of small markings on the surface of the panels are part of what makes the product unique.

2 Ventilated facades with Ceramapanel® A1

Ventilated facades with Ceramapanel® A1 panels provide a multi-layer system for cladding the external walls of buildings, using components joined by mechanical assembly. They are called ventilated facades because a cavity is created behind the cladding to allow natural and continuous airflow between the supporting wall and the inner surface of the cladding.

This document deals exclusively with Ceramapanel® A1 panels used for vertical external cladding of facades with open joints, with or without layers of insulating material between the panels and the building masonry. In addition, it only considers ventilated facades made by mechanical assembly operations.

Fibre cement is not suitable for outdoor installation using glues or adhesives of any kind. We do not recommend the use of any fibre cement in a bonded installation method

3 Components of a Ceramapanel® A1 façade – specification and considerations

3.1 Responsibility

Without prejudice to the responsibilities established by the laws in force and by the technical standards (national and international) applicable in the location where the ventilated facade is to be installed, the designer is responsible for the facade design, the requirements of all the components it is made of, its installation, and maintenance.

These requirements must be defined by taking into account the specifications and condition of the load-bearing structure that the facade will be mounted on, along with the environmental and climatic properties of the site (operating temperatures, aggressiveness of the environment, etc.).

The products referenced within this manual are offered as guidance only and as far as applicable, the designer is responsible for all matters concerning the choice, sizing, calculation, installation, and maintenance requirements of:

- the cladding panels
- the subframe components and system
- the fixings required to create the finished facade and to anchor it to the supporting structure
- components designed to ensure the durability and functionality of the ventilated facade over time (e.g. insulation layer, elements to be used to protect the joints, etc.)

When designing the ventilated facade, the designer must also consider the stresses which it may be subjected to during the intermediate stages of construction, such as the possible effects caused by the expected climatic conditions likely to be experienced on the project, these should include:

- Wind loads
- Temperature extremes
- Humidity
- Atmospheric salt deposits

Based on those assumptions, the designer must prescribe everything needed to ensure proper and safe execution, including in the intermediate assembly stages, up until the final project configuration/installation has been completed.

The designer is also responsible for the document establishing the requirements for maintenance of the ventilated facade, if such a document is required legally or contractually under the terms established with the facade client.

Without prejudice to the responsibilities established by the laws in force and by the technical standards (national and international) applicable in the location where the ventilated facade is to be installed, it is the installer's responsibility to check the specification and condition of the load-bearing structure which the ventilated facade will be fitted onto, to note any differences in respect of the design assumptions and requirements, and to communicate this to the designer so that they may take note and modify the design.

The installer is responsible for the assembly and installation of the facade, including its anchoring to the building, in accordance with the project architect and/or façade engineer / designer's instructions.

Valcan provides guidance derived from operational practices, but this cannot and must not be interpreted in any way as a substitute for design planning and the relevant building regulations.

3.2 Cladding Subframe

The cladding subframe of a ventilated facade with Ceramapanel® A1 fibre-cement flat-panel cladding is a multi-layer system typically composed of:

- Metal brackets that are mechanically installed to the load bearing wall
- Vertical metal profiles which are mechanically attached to the brackets
- Fastenings connecting the brackets and profiles

The purpose of the cladding subframe is to support the cladding panels and transfer all the distributed and concentrated stresses to the building that the facade withstands during its installation and working life. These stresses may be:

- Mechanical, from pressure and depression stresses due to wind
- The may result from occasional impacts in public areas
- Thermal, for example due to heat expansion and changes in atmospheric humidity

There are two main types of brackets:

- Brackets designed to support predominantly vertical loads (e.g. the cladding's own weight) also known as "load-bearing brackets"
- Brackets designed to support predominantly horizontal loads (e.g. the stresses transmitted by the cladding) also known as "sliding brackets".

The brackets are anchored to the building with fastenings, or anchors. Their sizing is the responsibility of the designer and is not addressed in this document.

Ceramapanel® A1 panels are suitable for vertical cladding. The flatness and verticality of the subframe must be prescribed by the designer and verified before the cladding is fitted.

The sizing of all the components of the subframe must be calculated and verified. Their arrangement on the facade and the reciprocal distances between the different elements must also be considered within the sizing procedure, in order to ensure the strength of the cladding system and obtain the desired aesthetic result.

3.3 Waterproofing, thermal insulation, and ventilated cavity

Layers of materials with different purposes (insulating and/or for water-tightness) can optionally be fitted on the outer surface of the load-bearing wall to improve the performance of the building.

If used, these materials must be sized according to the desired characteristics or contractual requirements that the cladded building must meet. The insulating and waterproofing layers must be fitted on the external surface of the building, fixed according to their manufacturer's instructions, if any, or according to the specifications dictated by the designer in order to avoid negative interference with the subframe elements and the free flow of air in the cavity.

Particular care must be taken in their selection and the way they are installed, in order to prevent any deformation over their working life that could reduce the ventilation chamber.

Using these materials can affect the total thickness of the subframe, and this should be taken into due consideration.

The cavity may be partitioned with suitable horizontal and/or vertical barriers in order to separate the air space contained inside it, and thereby confine any potential spread of a fire or the effects of wind. When doing so, care must be taken not to hinder air circulation.

An air cavity of 50mm (between the rear of the Ceramapanel® A1 sheet and the face of the insulation or wall (as applicable)) must be considered – this can be reduced by 50% (down to 25mm) where there are fire barrier locations.

4 Technical specification of Ceramapanel® A1 panels

The following tables outline the standard geometrical specifications of Ceramapanel® A1 fibre-cement flat panels. These specifications comply with the requirements of the EN 12467 standard.

Standard dimensions		
Length (mm)	**Width (mm)**	**Thickness (mm)**
2500	1200	8, 10, 12
2500	1250	8, 10, 12
3000	1200	8, 10, 12
3000	1250	8, 10, 12
3050	1200	8, 10, 12
3050	1250	8, 10, 12

Table 1 – Dimensions of the panels in standard format.

	Tolerances for standard dimensions Level 1 (as per UNI EN 12467)
Length	± 2 mm
Width	± 1 mm
Thickness	± 0.2 mm
Edge straightness	0.1%
Perpendicularity of edges	2 mm/m

Table 2 – Tolerance guaranteed by manufacturer. The geometric tolerances are Level 1 as per UNI EN 12467.

Thickness	**Weight (kg/m²)**
8	14.4
10	18
12	21.6

Table 3 – Unit weight of panels depending on their thickness

The classification as per the UNI EN 12467 standard of autoclaved and double-compressed Ceramapanel® A1 fibre-cement flat panels is as follows:

Panels	**Property**	**Classification as per UNI EN 12467**	**Notes**
All	Production technology	NT	"Non-asbestos" or even "Asbestos-free" technology
All	Weather resistance	Category A	For outdoor applications in severe climatic conditions (can withstand heat, high humidity levels, intense frosts)
Surface-treated panels	Strength	Class 4	Modulus of Rupture (MOR) ≥24 MPa
All	Geometric tolerances	Level 1	See the technical specifications table of the panels
All	Reaction to fire	A1	Non-combustible

Table 3 – Classification as per UNI EN 12467 standard

The following table shows the physical and mechanical specifications of Ceramapanel® A1 panels.

	Unit of measurement	Value
NOMINAL DIMENSIONS AND GEOMETRY		
Length	mm	2500 3000 3050
Width	mm	1200 1250
Thickness	mm	8, 10, 12
Dimension tolerances	Classification as per UNI EN 12467:2018	Level 1
Length	mm	± 2
Width	mm	± 1
Edge straightness	%	0.1
Perpendicularity of edges	mm/m	2
Tolerances for the thickness of smoothed panels	mm	± 0.2
Nominal weight	kg/m^2	14.4 (t=8mm) 18.0 (t=10mm) 21.6 (t=12mm)
PHYSICAL PROPERTIES		
Specific weight in dry state	kg/m^3	1600 ± 50
MECHANICAL PROPERTIES		
Modulus of elasticity E (ambient condition)		
- Longitudinal	GPa	14
- Transversal	GPa	10
Modulus of elasticity E (conditioned in water)		
- Longitudinal	GPa	10
- Transversal	GPa	8
Bending strength (wet)	MPa	≥ 18
Impact resistance (Charpy test)	As per EN 179-1:2010	
- Longitudinal	kJ/m^2	4.3
- Transversal	kJ/m^2	3.1
HYGROMETRIC PROPERTIES		
Humidity in its natural state	%	8 / 12
Maximum water absorption* (Hydro, HydroPlus, Spectra)	%	≤ 25
Humidity Behavior – Shifts from 30% to 90% humidity		
- Longitudinal	mm/m	1.3
- Transversal	mm/m	1.0
THERMAL PROPERTIES AND WATER VAPOR TRANSMISSION (UNTREATED PANEL)		
Vapor resistance factor, μ – as per EN 12572:2016	---	34
Thermal conductivity – as per EN 12664:2002	W/mK	0.36
Coefficient of linear thermal expansion – as per EN 10545-8:2014		
- Longitudinal	1/°C	1.71•10-6

	Unit of measurement	Value
- Transversal	1/°C	0.58•10-6
OTHER PROPERTIES		
Superior calorific value (through coloured)	MJ/kg	1.1
Reaction to fire	As per EN 13501-1	A1
Freeze-thaw resistance		RL ≥ 0.75
Durability class	As per UNI EN 12467:2016	Category A
Strength class (immersed in water 24 hours)	As per UNI EN 12467:2016	Class 4
CE and UKCA marked product according to	---	UNI EN 12467:2016

* dries in 24 hours in an oven at 100 °C and immersed in water for 24 hours

Unless otherwise specified, the tests are as per UNI EN 12467.

Table 4 – Physical and mechanical specifications of Ceramapanel® A1 panels

5 Fixings for installation of the façade system

The fastenings referred to in this paragraph for facades with fibre-cement cladding are visible type fixings, hidden fixings that can be used with this type of facade are not addressed within this manual.

There are 3 main types of fixings to be used in the overall façade system:

- **Level 1**
  - Fixings to anchor the subframe brackets to the load-bearing wall of the building
  - Fixings and their sizing are not covered in this document.
  - The type and dimensions of these fastenings also depend on the specifications of the load-bearing support and must therefore be chosen and sized by the subframe system provider
  - For more information on Level 1 fixings, see Valcan's Vitrafix product range - https://valcan.co.uk/product/vitrafix
- **Level 2**
  - Fastenings connect the vertical profiles of the subframe to the brackets fastenings can be screws and rivets
  - The type and dimensions of these fastenings also depend on the specifications of the load-bearing support and must therefore be chosen and sized by the subframe system provider
  - For more information on Level 2 fixings, see Valcan's Vitrafix product range – https://valcan.co.uk/product/vitrafix
- **Level 3**
  - Fixings that connect the cladding panels to the subframe
  - Fixings recommended for Ceramapanel® A1 panels are Vitrafix A4 stainless steel rivets, the specific sizes is defined by the panel thickness – see table 5 below. The Vitrafix rivets can be colour matched to the Ceramapanel® A1 colour

Thickness (mm)	Rivet reference
8	Vitrafix Rivet, 4.8x20mm, A4 Grade, 200/box (5-13mm grip range)
10, 12	Vitrafix Rivet, 4.8x26mm, A4 Grade, 200/box (13-21mm grip range)

Table 5 – Vitrafix A4 Stainless Steel rivets

The fixing points of the panels (Level 3 fastenings) can be two different types:

- "Fixed" point – these are designed to withstand vertical loads, such as the panels' own weight
    - When using the Vitrafix A4 stainless steel, the fixed point is expected to be 4.9mm
- "Sliding" point – these are designed to withstand horizontal loads and allow the panels to adapt to changing thermo-hygrometric conditions.
    - When using the Vitrafix A4 stainless steel, the sliding point is expected to be 9.5mm

The diameter of the holes must be taken into careful consideration for both fixed and sliding fastenings, in order to prevent errors during installation, the above dimensions are guidance only and should be checked by the designer for suitability for the specific projects expected climatic conditions, the subframe system material be used and fixing being used.

Ceramapanel® A1 panels can be laid with the longitudinal axis positioned vertically or horizontally. The strength of the panels, however, depends on the direction of the fibres. The designer must therefore take this into consideration when sizing the fixings and the distances between the Level 2 and Level 3 fixings, to ensure that the facade can withstand all anticipated stresses, such as mechanical, chemical, hygrothermal, etc.

6 Accessory elements

To complete the ventilated facade system, other components are also required in addition to the main components indicated above. We refer to these additional components as "accessory elements". Their purpose is to improve the overall durability of the facade system or some of its parts, and to maintain the effectiveness of the ventilated cavity to ensure that the air flow through it is not impeded over time.

Profiles used to seal the horizontal joints between the joints used to hide the subframe are widely available, however, it is best if the facade can be left with open joints, without sealing profiles to allow the façade system to correctly work.

Should a horizontal joint closure be required, they must enable the panels to move in response to thermo-hygrometric stress, ensure there are no "steps" on the profile behind the panel (i.e. rail tape should be run up to the profile and stopped either side) ensure correct and effective water runoff, and guarantee proper ventilation at all times. Grilles, sheets, and flashings

To complete the facade and protect the ventilated cavity, ventilation grilles and/or protective grilles should be used to protect against insects and rodents, as well as coping flashings on the roof and sealing sheets along the windows or entrances.

These components, made with metal or plastic profiles, are widely available – when choosing the material for any additional components, applicable fire regulations should be considered.

The designer is responsible for assessing their use and installation in accordance with the installation and working life requirements of the facade system as a whole. They will need to adequately protect the panels, while ensuring air flow. Where perforated grilles are required, the size of the holes must allow sufficient air passage.

6.1 Gaskets to protect the subframe

A gasket of suitable thickness and width must be installed on all the profiles of the subframe to protect them from rain, condensation, minimise picture framing affect and to isolate alkali and aluminum materials being in contact.

The thickness of the gaskets must be considered when sizing the length of the fastenings – the Vitrafix Rail Tape is a self-adhesive product that eases application and installation, this is 1.0mm thick

7 Ventilated façade system with Ceramapanel® A1

Ventilated facades are, in general, non-structural systems for external cladding of buildings. The term “non-structural” means – as per the Construction Products Regulation – that they do not contribute to the fulfillment of Basic Requirement 1 of “Mechanical strength and stability” for construction works. Nevertheless, they must withstand the loads and stresses which they are subjected to during their working life and during installation.

7.1 Subframe – general information

The subframe of a ventilated facade with Ceramapanel® A1 fibre-cement flat-panel vertical cladding generally comprises of:

- Metal brackets
- Vertical metal profiles which are fixed to the brackets
- Fastenings between the brackets and profiles

The group of profiles form the vertical support surface for the ventilated facade cladding. They can be made from either steel or aluminum

The verticality and flatness of the external surface created by the profiles (and designed to form the supporting surface of the cladding panels) must be guaranteed during installation. Verticality and flatness assessments must be performed and, if necessary, prescribed by the project architect and/or façade engineer / designer.

The designer must size the vertical profiles of the subframe and the brackets with consideration for the legal requirements and, more generally:

- the stresses arising from the load on the cladding and the external forces which the ventilated facade will be subjected to during its working life and assembly
- the materials, specifications, and conservation status of the walls which it will be anchored to
- the environmental properties where the facade will be built and located, as its durability may be affected (e.g. temperature and humidity, degree of aggressiveness of the environment, and any durability requirements that the facade may have)

The facade system must be designed, built, and maintained in such a way that the stresses it is subjected to when installed and throughout its useful life can be discharged onto the structure of the building it is anchored to.

For example, aspects such as the distance between the elements of the subframe and their sizes, as well as the sizing of the anchors on the load-bearing wall, must be addressed and designed in such a way so that the subframe is able to support its own weight, the weight of the facade cladding panels, and the force transmitted to the ventilated facade by wind and other atmospheric agents. In addition, the subframe must be able to transfer these stresses to the load-bearing wall.

Furthermore, the subframe must absorb the stresses arising from the settling of the elements of the ventilated facade of the cladding, which are induced by hygrothermal variations. Particular care must be taken in the choice of subframe components and anchorage methods to the load-bearing wall where a suitable thermal bridge management is required, if defined.

The geometrical and material specifications, as well as the dimensions of the components of the subframe and of the ventilated facade described in the following paragraphs, should be considered as general indications, and therefore minimum or maximum values that the designer must verify. Where necessary, the values given here must be amended in line with the specific calculations in question, so as to ensure that each component and the facade as a whole can withstand the stresses, both during construction and throughout its working life.

Vertical ventilated facades, clad with Ceramapanel® A1 fibre-cement flat panels, may also be designed and manufactured with subframes, fixings, and accessory materials other than the ones indicated here, provided that they have – as appropriate and applicable – chemical, physical, mechanical, and functional specifications that guarantee they are suitable for use and compliant with the laws and technical standards applicable in the location where the facades will be installed.

The following sections provide general guidance on the sizing of the subframe.

7.1.1 Brackets – instructions independent of the material

Brackets must be chosen with specifications ensuring that they remain elastic and that the maximum deformation under vertical load is compatible with the cladding specifications.

The vertical span between the brackets must be determined in accordance with the rules in force in the location where the facade will be installed. This will depend on the permanent and variable loads which the facade is subjected to.

Regardless of the material they are made of, the brackets can be two types:

- load-bearing brackets, which for the purposes of the calculation are considered to primarily support the facade's own weight
- sliding brackets, which for the purposes of the calculation are considered to primarily support the horizontal stresses which the cladding panels and ventilated facade are subjected to overall. These brackets are also used to allow the subframe to absorb positive or negative expansion due to changes in temperature and humidity

In general, unless the designer determines otherwise, a support bracket must be used for each individual profiles' component. Attention must also be paid to the distribution of the load-bearing brackets on the facade so that the deformations induced by thermo-hygrometric conditions during its working life can be absorbed without creating hazardous stress accumulation points. For this reason, it is advisable to align the bearing brackets of adjacent profiles horizontally.

In addition, in order for the subframe to perform better over its working life, it is good practice to arrange the brackets so that they are secured to the profiles alternately on either side.

Unless otherwise necessary and justified, the position of the load-bearing bracket(s) should be in the center of the profile.

The designer must check that the maximum permissible deformations for the subframe are compatible with the Ceramapanel® A1 cladding panels.

7.1.2 Metal profiles & expansion joints – instructions independent of the material

As a whole, the profiles of a subframe must form a vertical plane for laying the cladding. The flatness and verticality of the surface, made up by the profiles and designed to support the cladding panels, can be guaranteed by adjusting the length of the brackets during installation.

When installing, it is advisable to check the verticality and coplanarity of the beams between adjacent profiles. The designer will determine which checks must be carried out, both during and after installation, prescribing for example the maximum permissible deviation between adjacent profiles.

The value of the horizontal span between the vertical components of the subframe is normally limited to a maximum value of 600 mm however, the designer applicable should carry out wind load checks and calculations to determine project suitability. This span determines the maximum deformation of the cladding panels and must also be calculated taking this aspect into account.

Verifications of the loads for each specific application, such as the vertical loads and horizontal wind loads (both positive and negative) may require a reduction in the span distances compared to the maximum recommended values.

Depending on their width, the cladding panels can be secured on two or more vertical profiles. The whole length of the vertical profiles will be visible if they are positioned along the joints. They will be hidden by the panel if they are positioned between the open vertical joints.

As a rule, the maximum length of the vertical profiles should generally be the same length as the story height; however, it is the project architect and/or façade engineer / designer's responsibility to provide this specification taking into account the different expansion coefficients of the individual materials.

Expansion joints must be fitted between one vertical profile and the next. They must be positioned along the horizontal joints of the cladding.

The size and specifications of the horizontal and vertical joints must be calculated and prescribed by the project architect and/or façade engineer / designer, taking into account the characteristics of the material chosen for the subframe, however, it is recognised by the CWCT that the joint should be 8-10mm to allow the system to work correctly as a ventilated rainscreen.

To protect the vertical profiles from atmospheric agents, a gasket made of suitable material must be applied. The width of the gasket must be wide enough to cover the entire vertical profile.

If the load-bearing structure has expansion joints, the facade must be designed so that no panels are fixed across those joints.

7.1.3 Subframe system

The subframe system must be made of vertically arranged aluminum profile elements secured to the load-bearing wall (which will be cladded) using brackets made of the same material – the table below refers to Valcan's Vitrafix VF1 subframe system

For load bearing walls that are constructed of steel stud (or similar), a horizontal U Rail is used to allow the façade brackets to be installed in isolation of the stud locations should panel layout require this

Type	Material	Geometrical specifications (mm)	Subframe elements
Fixed and sliding brackets	Aluminum (6063/T6 or 5251/H22) + isolation pad	Width: single = 80mm Double = 160 mm Height: 50 – 350 mm	Vitrafix VF1
Vertical L profile	Aluminum (6063/T6)	50 x 50 x 2.0 mm	Vitrafix VF1
Vertical T profile	Aluminum (6063/T6)	100 x 50 x 2.0 mm	Vitrafix VF1

Type	Material	Geometrical specifications (mm)	Subframe elements
Horizontal U Rail	Galvanised Steel or Aluminium (5251/H22)	174mm x 3m length 90mm x 3m length	Vitrafix VF2 U rail

Table 6 – Geometrical specifications of the subframe elements as per the Vitrafix VF1 system

During installation, the verticality and flatness of the external surface of the profiles (which will support the cladding panels) must be guaranteed.

7.2 Ventilated cavity

A ventilated cavity must be created between the outer wall of the building and the rear surface of the cladding. An air barrier is formed in the cavity which, fed by the lower openings of the facade, moves upward in the direction of the openings that must be provided at the top, as part of the facade's coping. The air flow in the cavity is designed to restrict moisture resulting from any rainwater that enters behind the cladding, and from condensation of water vapor that reaches the ventilated chamber from inside the building. In order for the air in the cavity to work effectively, it must be ensured that:

- its section must **not** be restricted along the protruding elements (such as the profiles)
- its section must **not** be restricted by any insulating layers becoming deformed in varying hygrometric conditions, or because of incorrect installation, or selection of inappropriate materials
- any accessories used to vertically compartmentalise the air barrier must **not** prevent it from flowing freely
- the inlet and outlet of the ventilation openings (both lower and upper) must have sufficient surface area

To ensure proper ventilation, the width of the ventilated cavity must be correctly sized, the depth is set out in the CWCT recommendations as follows:

Joint type	Cavity depth
Open	50 mm
Closed	25 mm

Table 7 – Cavity sizes

An open joint system is one that has a horizontal gap between the panels allowing airflow into the cavity. A closed joint system will use a profile to 'close' the horizontal joints. Both systems will be usually closed on the vertical joints where a T profile is used.

The cavity is measured from the rear of the panel to the face of the substrate – the substrate is the next part of the buildup after the air gap, this could be a layer of insulation or the wall itself.

7.3 Level 2 and Level 3 fastenings

The designer of the ventilated facade must consider the stresses that the facade will be subjected to during its working life and installation when determining the Level 2 and Level 3 fastenings.

The fastenings used for a ventilated facade cladded with Ceramapanel® A1 fibre-cement flat panels must allow assembly to be completed entirely with mechanical operations.

7.3.1 Level 2 fastenings

In this document, Level 2 fastening are the ones connecting the profiles of the subframe to the metal brackets. In general, screws or rivets can be used for this purpose. The following table shows,

by way of example, the type of fastenings that should be used depending on the material that the profiles and brackets are made from.

Examples of Level 2 fastenings	Profile material	Bracket material	Fastening type
1	Steel	Steel	Stainless steel screw
2	Steel	Steel	Stainless steel rivet
3	Aluminum	Aluminum	Stainless steel screw

Table 8 – Level 2 fastenings

7.3.2 Level 3 fastenings

Level 3 fastenings are the ones that join the cladding panels to the profiles of the substructure. Vitrafix A4 Stainless Steel rivets are used for this purpose, these are available colour matched to the panels.

Ceramapanel® A1 fibre-cement panels must always be drilled before installation; they must never be fixed to the subframe profiles using self-drilling screws.

The following table shows, by way of example, the type of fastening that should be used to join the fibre-cement panels to the profiles of the subframe, depending on the material that the profiles are made from.

Examples of Level 3 fastenings	Panel on subframe made of	Fastening type
1	Aluminium	Stainless steel rivet
2	Steel	Stainless steel rivet

Table 9 – Level 3 fastenings

In general, the maximum distance between Level 3 fastenings must always be ≤ 600 mm, while the minimum distance must always be ≥ 300 mm.

In general, the distance between the fastenings must be calculated so as to limit the deformation of the panel between two fastening points to within 1/200 of their spans.

7.3.2.1 "Fixed point" and "sliding point" fastenings and their holes

Level 3 fastenings can be either "fixed point" or "sliding point". The fixed points are intended to withstand mainly vertical loads (e.g. the weight of the cladding panels themselves), while sliding fastenings are intended to withstand mainly horizontal loads (e.g. depression due to wind) and to allow the panels to deform in line with thermo-hygrometric variations. Their calculation should therefore be carried out under these assumptions.

The "fixed" point should preferably be located in the central area of the panel to ensure it remains in the intended position, and must allow dimensional variations to be distributed throughout the panel. For this reason, the diameter of the hole of a fixed point must be equal (considering the appropriate mounting tolerances) to that of the fastenings (screws or rivets).

The position of the Level 3 fixed point is dependent on the position of the subframe's sliding brackets: out of all the brackets supporting the profile, the fixed bracket must be the one closest to the fixed point.

If the geometry of the panel does not allow it to be maintained in the intended position, two fixed points can be made. These must be aligned and positioned on two adjacent profiles, but never on the same profile.

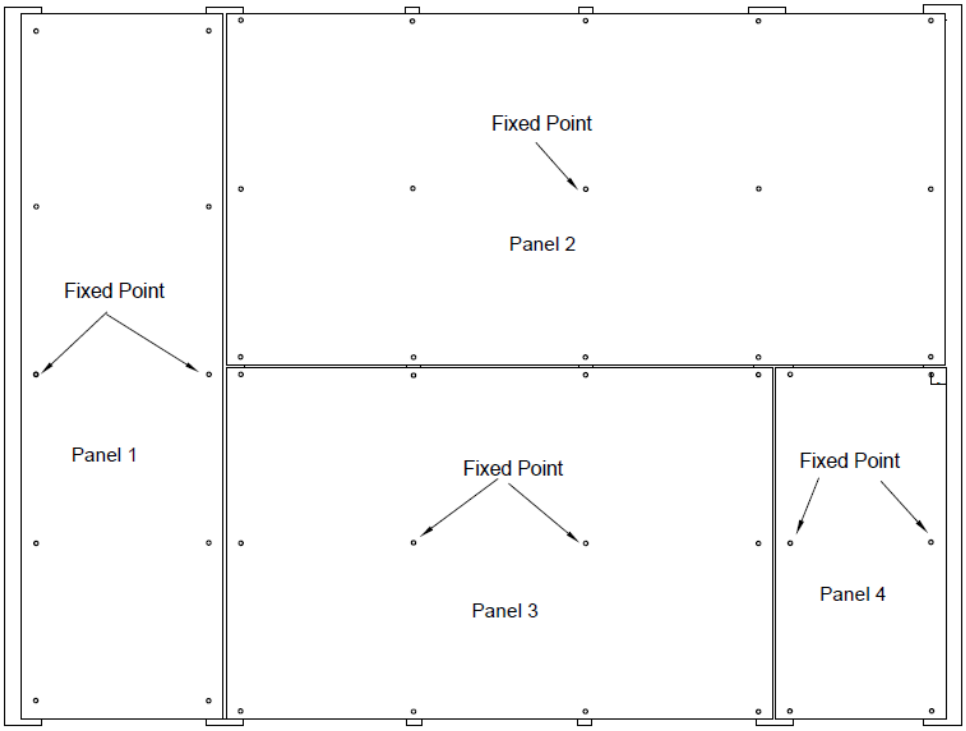

Image 1– Example of cladding with Ceramapanel® A1 fibre-cement panels. In some cases, the geometry of the panel and the facade layout may require two fixed points.

Ceramapanel® A1 panels can be laid with the longitudinal axis positioned vertically or horizontally. The strength of the panels, however, depends on the direction of the fibres. The designer must therefore take this into consideration when sizing the fixings and the distances between the Level 2 and Level 3 fixings, to ensure that the facade can withstand all anticipated stresses, such as mechanical, chemical, hygrothermal, etc.

Fibre direction of the Ceramapanel® A1 sheet runs the length of the uncut panel and can be noted by the 'smoothing lines' on the surface of the panel - fibre direction for panels in image 1 above run as follows:

1 - verticallly
2 - horizontally
3 - horizontally
4 - vertically or horizontally (depending on how panel is cut)

Typical recommendation for hole sizes are as below table 10 however, the diameter of the holes must be taken into careful consideration for both fixed and sliding fastenings, in order to prevent errors during installation, the dimensions are guidance only and should be checked by the designer for suitability for the specific projects expected climatic conditions, the subframe system material be used and fixing being used.

Fixing type	Hole diameter
Fixed point fixing	4.9mm
Sliding point fixing	9.5mm

Table 10 – Level 3 fastener hole size in panel when using 4.8mm diameter rivets

The designer can also require for all the holes to be made with the same diameter. If that is the case, the largest of the two diameters will be chosen, i.e. the one selected for “sliding point” fastenings. To reduce the diameter of the holes to the diameter set for the fixed points, suitable

metal bushings can be used (these should be manufactured from stainless steel rather than aluminium).

Rivets should be 25-50mm in from the edges of the panel measured across the panel fibres and 45-65mm from the edges measured with the fibres. The rivet should never be equidistance from the edges of the panel - see image 2 below

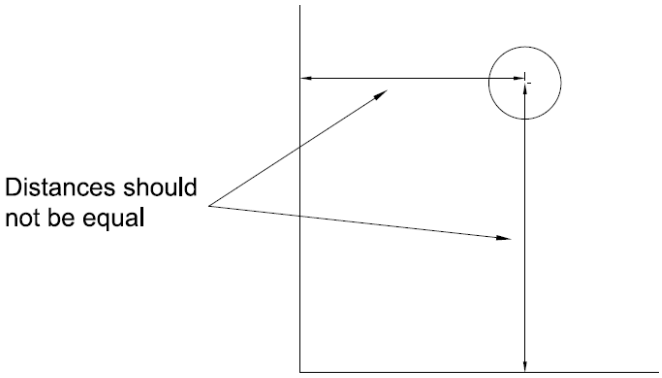

Image 2– distance to edges of panel should not be equal

The designer is responsible for confirming that the fixing hole is suitable (in terms of both size and positioning) for the requirements of the specific project

7.4 Cladding panels

Ventilated facade cladding with Ceramapanel® A1 fibre-cement panels is open-joint cladding. Open joints are vertical and horizontal spaces between the edges of adjoining panels and are created when the cladding is fitted.

The open joints allow atmospheric agents to pass through and improve the air flow of the ventilated cavity. Their width (whether horizontal or vertical) can vary from 8 mm to 10 mm.

The panels can be mounted with the longest side vertically or horizontally, with continuous or staggered joints.

The configuration for fitting the panels and the final layout of the joints must be decided by the project architect and/or façade engineer / designer, with due consideration that:

1. the panels have different resistances when stressed in parallel to the fibres or in an orthogonal direction to them – the fitters must also be duly informed of this
2. from a functional point of view, there must be proper rainwater runoff over the entire surface of the cladding, and localized stagnation must be prevented
3. the aesthetic appearance of the cladding also depends on the smoothing direction of the surface of the panels - this issue does not arise if the panels are from the Ceramapanel® Painted range

Each panel must be vertically fixed to a single profile of the subframe to allow the best possible distribution of deformations.
In terms of smoothing, the panels are smoothed in the same direction as the fibres along the length of the board. The smoothing direction can impact the appearance of the cladding so should be treated as directional when optimising for design.

8 Cladding a facade with Ceramapanel® A1

8.1 Typical installation details

Valcan have typical installation details available – the latest version is available on the product page under the download section https://valcan.co.uk/products/Ceramapanel®

These details are created as a guide and should be used by the project architect and/or façade engineer / designer

8.2 Transport, handling, and storage of Ceramapanel® A1 fibre-cement panels

8.2.1 Transport

Panels should be transported under a waterproof cover on level pallets securely strapped into place to prevent movement. Ensure that strapping is not tight enough to cause damage to panels.

When unloading panels from delivery vehicles, panels should be unloaded on pallets rather than individual sheets. Unloading should be done using suitable forklifts, if a crane is to be used, ensure that the weight is equally spread to prevent slipping and wide straps are used to assist in spreading loads.

8.2.2 Handling of panels

Panels should be lifted off one another rather than moved across each other as scratching may occur. For carrying panels, stand them up on the long edge and lift panels with a person at each end, ensuring that the face is away from any risk of scratching.

Wear suitable protective gloves when handling the Ceramapanel® A1 as required by site specific risk assessment.

8.2.3 Storage of panels

Panels should be stored flat on pallets in dry indoor conditions with covers retained on the pallets to protect from weather and other works being carried out. Stacks of sheets should be no more than 500mm and no more than 2 stacks on top of each other. Panels should only be delivered to the site when ready for imminent installation, if delivery to the site is required ahead of installation, panels should be stored in a suitable, internal dry location.

Pallets should be stacked to allow ventilation, condensation within the packaging can be an issue when ambient conditions are warm and packaging/storage conditions do not allow for ventilation – if moisture is allowed to penetrate and stay between sheets, permanent efflorescence staining may occur, on Painted panels, this may occur in the form of paint blisters.

If sheets are removed from pallets, these should be stored flat on bearers spaced no more than 300mm to give correct ventilation. Panels are delivered with foam sheets between sheets and this should not be removed until panels are to be processed - always ensure after processing that the foam sheet is replaced between sheets when panels are being stored or transported. If panels have been fabricated with secret fix brackets (not covered within this manual) on and are re-stacked on pallets prior to installation, the panel should be fully supported by polystyrene (or similar) blocks rather than using the brackets as spacers/packers.

8.3 Preparing panels for assembly

8.3.1 General information

It is possible to fabricate Ceramapanel® A1 panels in both on site) or off site in factory controlled conditions. Valcan have partnered with tooling specialists to develop off site fabrication tooling

to give the best possible cuts – information can be found on the fabrication guidance page – https://valcan.co.uk/fabrication-guidance.

The information contained within this section are offered for guidance only and do not constitute a guaranteed performance. Each machine will have its own characteristics and maximum performance guidelines as stated by the manufacturer which should be adhered to over and above the settings offered as guidance below.

8.3.2 Health & Safety

Site specific risk assessment should be carried out to ensure correct PPE and health and safety requirements are met, as a minimum however it is recommended that when cutting Ceramapanel® A1 boards, dust masks with a performance rating of FFP3 should be worn.

Subject to specific risk assessment, it is recommended that an extraction system should be used with a Class M, HEPA filtration system.

Additional PPE requirements according to site specific risk assessment should be followed.

8.3.3 Fabrication

Sometimes work and operations need to be carried out on individual panels before installation, such as drilling and cuts for resizing. The following instructions allow this to be completed correctly.

- All work on the panels, such as resizing and drilling, must be carried out on the panels before assembly
- The work surface that the cuts or holes are made on must be flat, continuous, and clean, so that the panel is not subjected to tension due to incorrect positioning
- The panels must be placed on the worktop with care and must be worked on individually with suitable equipment, taking care not to damage the surface or edges
- When Ceramapanel® A1 fibre-cement panels are mechanically processed (cutting, drilling), dust is released that can be harmful to health. For this reason, appropriate precautions must be taken before carrying out all work, using suitable equipment and wearing suitable protection (PPE). These mechanical operations must be carried out in suitably ventilated rooms. See the product safety data sheet for details
- All work must be carried out dry, without tools using water or other liquids
- The tools used must be equipped with an adequate suction system
- Adhesive tape and/or labels must not be applied on the visible surface, nor any writing or engraving, as this would irreparably damage the panel

Ceramapanel® A1 (like all fibre cement panels) absorb a certain amount of moisture, on the Natural range of panels, this can breathe through the face/rear of the boards. The Natural+ panels have a coating on the panel that resists graffiti, this coating also prevents moisture ingress and subsequently egress – it is important that once panels are cut or drilled, the sealant should be applied to the cut/drilled faces as moisture ingress that can not get out the panel will cause dark spots in the panels.

For the latest fabrication guidance on Ceramapanel®, see Valcan's fabrication guidance page – https://valcan.co.uk/fabrication-guidance

8.3.3.1 Tooling

When cutting using saw blades, the blade should extend approximately 5mm below the panel. Guidance for blades is as below

Blade diameter	Blade thickness	Saw Speed
160 mm	2.4 mm	4000 rpm
190 mm	3.2 mm	3200 rpm
225 mm	3.2 mm	2800 rpm
300 mm	3.2 mm	2000 – 2500 rpm
400 mm	3.2 mm	2000 – 2500 rpm

Table 11 – Cutting blade guidance

Other blades may also be suitable and results may vary depending on tooling and machine used, the table above is offered as a guide and it is recommended that the fabricator checks their machines to ensure correct tooling is used.

It is possible to cut Ceramapanel® on CNC machines, guidance on tooling is available on Valcan's fabrication guidance page as noted above.

8.3.3.2 Cutting

Where possible, it is recommended that cutting should be carried out off-site. Only cut 1 sheet at a time and set the blade depth to 5mm below the panel, sheets should always be cut face down using a diamond tooth blade for fibre cement.

Once panels are cut, it is recommended to sand/chamfer the decorative edge/corner or the panels to remove sharp arris after - this reduces the possibility of damage and improves their appearance. Edges can be abraded using low grit sandpaper or similar. Once cut, cleaning must be completed with low-pressure air or using a clean microfibre cloth, without rubbing.

On the Natural+ range of boards, after cutting sealant should be re-applied to the cut faces of the boards.

On request, the panels can be supplied cut to size in the factory. In this case, the customer is required to provide Valcan with detailed dimensional drawings.

8.3.3.3 Drilling

The panels must be drilled before being fitted to the subframe. Below are some specific instructions for making further holes on site in addition to the ones made at the production plant.

- The holes must **not** be made using hole-punching tools
- The panels must be drilled starting from the visible side of the panel (face) and drilling through
- For Natural+ and Painted panels, whether the holes are made at the production plant or on site, they must receive a protective treatment as explained in section 9 "Operations to carry out on the panels after each additional machining"
- When drilling the holes, follow the distances indicated by the pro
- After the holes have been drilled, the dust must be immediately removed. If required, cleaning can be completed using a clean microfibre cloth without rubbing. Each hole should be treated as indicated in section 9 "Operations to be carried out on certain types of finishing", after any mechanical machining. Natural panels do not need to be treated

Panels should be drilled one at a time and it is recommended that the drill diameter is regularly checked too to ensure the abrasive characteristics of fibre cement panels on tooling is not resulting in reduced hole sizes.

For off site drilling, standard spiral fluted drill bits with a conical tip should be used, the diameter should suit the designed hole sizes on the project and run at around 3000rpm or lower where possible. Do not use straight cutters or flat-tip cutters as this can damage the rear of the panel.

Upon request the panels can be supplied pre-drilled. In this case, the customer is required to provide Valcan with detailed drawing showing size and positioning of the holes – only holes for through fixing can be drilled, holes for secret fixing can not be done in the factory.

9 Operations to carry out on the panels after each additional machining

After making cuts and/or holes, the cut edges and surfaces must be cleaned and, for certain types of product, protective treatment must also be applied.

For Natural+ panels, sealing should be completed with Ceramapanel® Edge Sealant

9.1 Cleaning the panels after cutting and/or drilling

Immediately after machining and before installing the panels, any cutting and drilling residues or dust must be removed. If they remain on the surface, they could irreparably damage the panel.

The cleaning procedure is as follows:

- remove any dust from the surface of the panel – this could be done by use of a standard vacuum cleaner
- if dust persists, blow with low-pressure air, or use a clean microfibre cloth without rubbing

9.2 Protective treatment of cut surfaces

For some finishes, a protective treatment must be applied after cuts have been made on site.

At the customer's request, Valcan can supply specific products which are suitable for the protective or aesthetic treatment of cut edges.

For Natural+ panels, sealing should be completed with Ceramapanel® Edge Sealant

9.3 Protective treatment of drilled surfaces

Moisture stains may appear around the holes over time. For Natural+ and Painted finishes, the sides of the holes must be treated with a special acrylic product supplied on request, whether they were drilled at the plant or on site.

10 Assembling and installing the fibre-cement cladding

During installation, the panels must be secured starting from the fixed point and moving towards the sliding points located at the periphery.

Where possible, the fixed point must be positioned at the central part of the panel (see section 6.3.2.1). Installation accessories as in table 12 are recommended to complete the façade and are available from Valcan's Vitrafix range:

Tool	Use	Image ref
Vitrafix Centralising Tool	Ensures the hole drilled in the subframe rail is centred in the floating hole on the Ceramapanel® A1 sheet	3
Vitrafix Nose Piece Adapter	Ensures that the rivet is not over tightened – these are specifically designed for the Vitrafix A4 Stainless Steel rivet profile	4

Table 12 – Vitrafix A4 installation accessories

Image 3 – Vitrafix Centralising Tool

Image 4 – Vitrafix Nose Piece Adapter to suit Vitrafix A3 stainless steel rivets

When caring out works on site, once the panels are installed, including those that require the use of glues, silicones, or sealants, care must be taken not to mark the Ceramapanel® A1 panels with such products, which would result in irreparable damage.

Note – scratches or marks to the face of the panels can not be touched up on Natural or Natural+ panels

10.1 Accessory operations and maintenance of facades using Ceramapanel® A1

After installation, if necessary, the facade can be washed using a low-pressure water hose. The surface of the panels must not be rubbed in any way. Pressure washer equipment should not be used as this can cause irreparable damage to the face if the Ceramapanel® A1 panels.

For panels treated with acrylic paint (Natural+ and Painted ranges), any graffiti on the panel can be removed using a light solvent.

The panels must not be cleaned during the hours when the facade is exposed to the sun or while the surface is still warm.

An annual inspection is recommended to check that the panels are in good condition and that the fastenings are holding properly.

11 Cleaning and maintenance

Ceramapanel® A1 boards don't generally require cleaning however after installation it is possible to remove dust from the surface of Natural, Natural+ and Painted panels with a low pressure compressor. Mud etc may be removed from panels using a normal wash without scrubbing the surface of the panels – do not use abrasives.

When Ceramapanel® A1 is used as an exterior cladding panel, this may accumulate atmospheric fall-out which may include soot and residual acids in industrial environments, automobile combustion, gum spotting, lichen and organic matter from neighbouring vegetation, bird fouling etc. – this will usually clean off during rain fall, should additional cleaning be required, dirt and grime should be cleaned off with a water blast or washed with a cloth and soapy water followed by a rinse with clean water.

NOTE: It is recommended that the soapy water solution should be tested in a discrete area. Cleaning should not take place in hot conditions or in direct sunlight.

No other cyclic maintenance/cleaning is needed or recommended.

12 Summary

In summary, the designer should note all relevant factors noted within this document including, but not limited to:

- The climatic weather conditions (temperature and humidity) predicted during the building life cycle.
- The affect of temperature and humidty in relation to the thermal movement (expansion and contraction) of each of the façade components and the wall system – this includes in particular, but is not limited to, the panel, carrier rails.
- Detailed quality checking of panels and façade system during fabrication work and installation
- Tolerances of each façade component (including, but not limited to, the panels and carrier system) for fabrication
- Any guidance from other suppliers of the system and how this may affect the over all system performance

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