

PROJECT TECHNICAL SUBMISSION DOCUMENT

Contract Name: Design House, Manchester

Contractor: Thomason

Contract Ref: NV369

Technical Sub No: NV369-TQS-SUB-0001 **Revision:** 1



For the Attention of: THOMASONS

Equipment Specifying Schedule ☐ Builder's Work Requirements ☐

Manufacturer's Data ☒ Assembly / Installation Details ☒

Design Check Calculations ☐ O & M Manuals ☐

Certified Performance Data ☐ Reports ☒

Submission Details: Ash and Lacy System

- AX2 Technical Guide V1.0
- CWCT-LineAL-F C8429rpt18098
- Lineal-F_2mm_Alum Portrait-Generic (AX2)
- pdf.iss2.Ash and Lacy Class Report AxiAL Supporting System Issue 2
- pdfiss3.Ash and Lacy Class Report PPC Aluminium Issue 3

Issued By: Levi Wright

Date Issued: 24.11.23

Position: Senior Façade Design

For: Novo Facades Ltd

APPROVED:

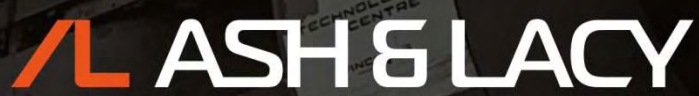
REJECTED:

Signed By:

Date:

Position:

For:



Technical Resource

Technical Guide
AxiAL AX2 Support System

Technical Resource

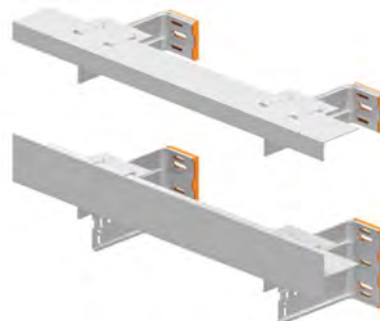
Version: 1.0 / Last Updated: 21.04.2022

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System Overview

AX2 is an aluminium horizontal supporting system which is suitable for mechanical face fixing of cladding elements by means of rivets or screws. AX2 can provide the support for most of Ash & Lacy façade systems, such as, VariAL-TF, VariAL-CF2/3, LineAL-X/F metal cladding and Mechslip & NaturAL-X brick cladding. The systems also can be used to support a wide range of third-party cladding boards and materials.



There are a wide range of brackets in the system to accommodate the cladding zones (from 45 mm to 425 mm). The brackets can be also installed on A&L standard top hats which can extend the cladding zone 50 mm further.

The brackets and rails are manufactured by using 6063T6 aluminium which provides good strength and corrosion resistance. A nylon P66 thermal pad is installed with the bracket to reduce the thermal bridging effect and creates a good corrosion interface between the bracket and substrate.

The ratio of single to double brackets, the max bracket and rail centres and the max mullion cantilever (distance from last fixing connected mullion to bracket to the end of the mullion) all vary depending on the dead load and wind load applied to AxiAL support system. These figures should be determined based on project-specific static calculations.



VariAL-CF2 installed on AX2



VariAL-CF3 installed on AX2



VariAL-TF installed on AX2



LineAL-X installed on AX2

Product Specifications

Single Brackets

Dimension: width 80 mm; base 50 mm long, and leg 40–360 mm.

Material: 6063T6 grade aluminium used for bracket, Nylon P66 used for pad

Configuration: two configurations for bracket leg less than 60 mm and over 90 mm respectively.

Application: Single brackets are typically used as to support the wind load only in the AX2 system. They can also be used to support the dead load in some cases, but this is subject to the loading conditions and should be determined by our engineers via static calculations.

Part Number	Length
	mm
AXL-HB040S-TP	40
AXL-HB060S-TP	60
AXL-HB090S-TP	90
AXL-HB120S-TP	120
AXL-HB150S-TP	150
AXL-HB180S-TP	180
AXL-HB210S-TP	210
AXL-HB240S-TP	240
AXL-HB270S-TP	270
AXL-HB300S-TP	300
AXL-HB330S-TP	330
AXL-HB360S-TP	360



Single Bracket with length ≤ 60 mm



Single Bracket with length ≥ 90 mm

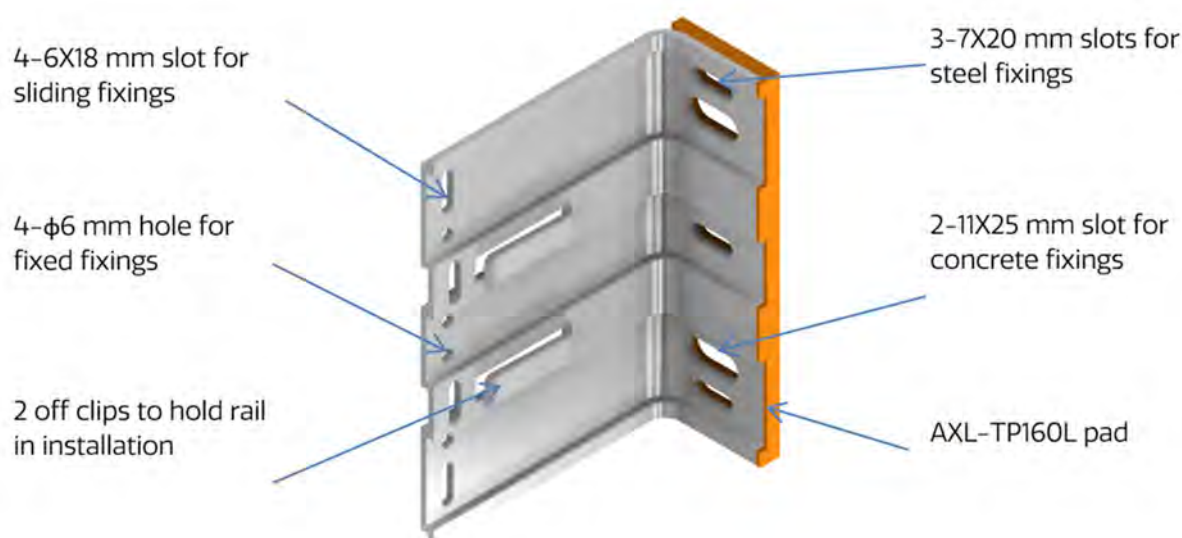
Double Brackets

Dimension: width 160 mm; base 50 mm long, and leg 90–360 mm.

Material: 6063T6 grade aluminium used for bracket, Nylon P66 used for pad

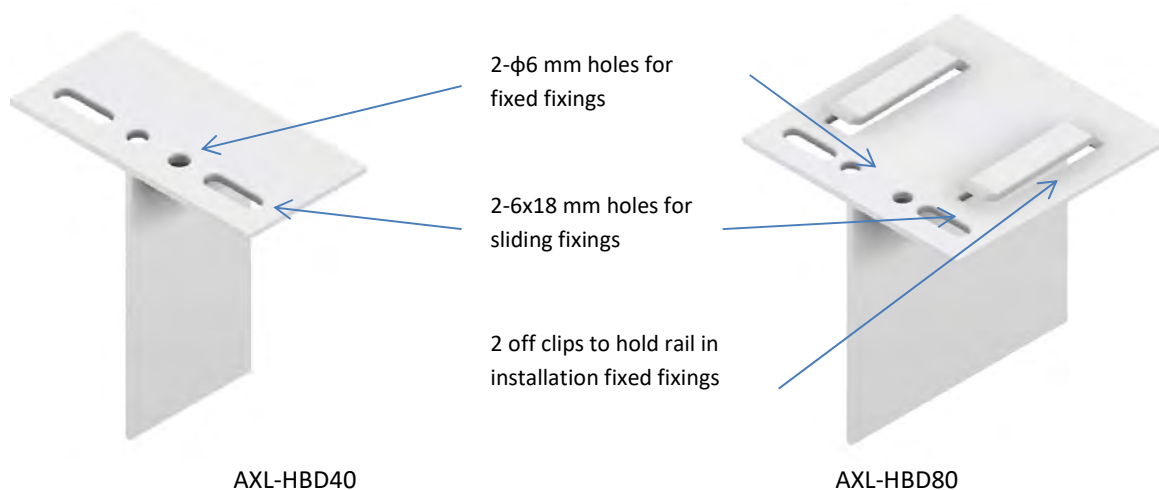
Application: rails comprised of entirely double brackets are primarily installed to support the dead load of the façade. Some cases may also require multiple rails of double brackets to support higher loads.

Part Number	Length mm
AXL-HB090D-TP	90
AXL-HB120D-TP	120
AXL-HB150D-TP	150
AXL-HB180D-TP	180
AXL-HB210D-TP	210
AXL-HB240D-TP	240
AXL-HB270D-TP	270
AXL-HB300D-TP	300
AXL-HB330D-TP	330
AXL-HB360D-TP	360



Adaptor

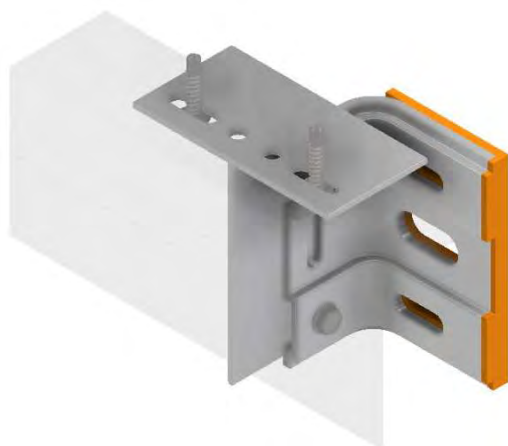
In AX2 system, two adaptors are available which are assembled with the bracket to provide the horizontal rail solution required in the project.



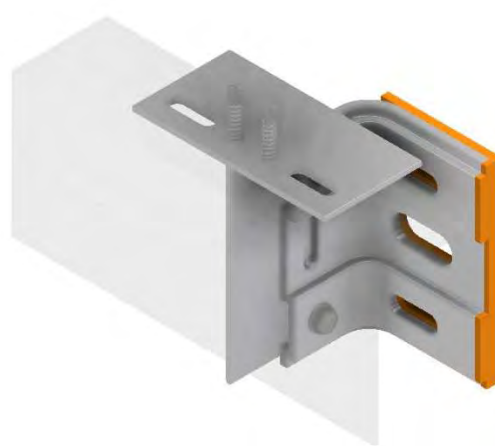
Fixings

As part of the AX2 system, stainless steel fixings are specified with A2 or A4 grades.

Part Number	Image	Description & Application
SS-LS22		4.8x22 mm stainless steel A2 fixing for brackets to rails
BM-LSHF50		5.5x50 mm stainless steel A2 fixing for brackets to substrate SFS with thickness ≤ 2.0 mm
BM-LS55		5.5x57 mm stainless steel A2 fixing for brackets to substrate SFS with thickness >2.0 mm
BM-HS55		5.5x55 mm stainless steel A2 fixing for brackets to substrate HRS with thickness 4.0-12.0 mm
R-FF1-10K080-A4		10x80 stainless steel A4 fixing with nylon shaft for bracket to concrete

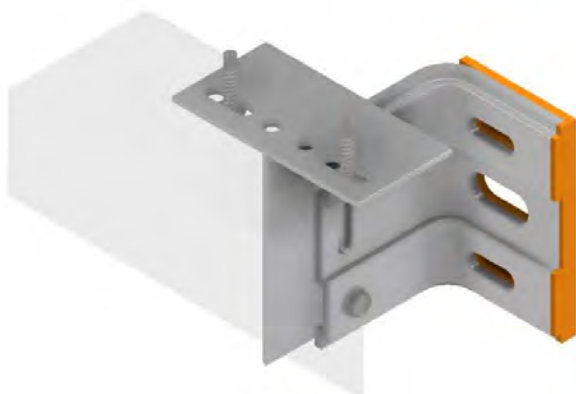


Fixing Arrangement on A Sliding Adaptor

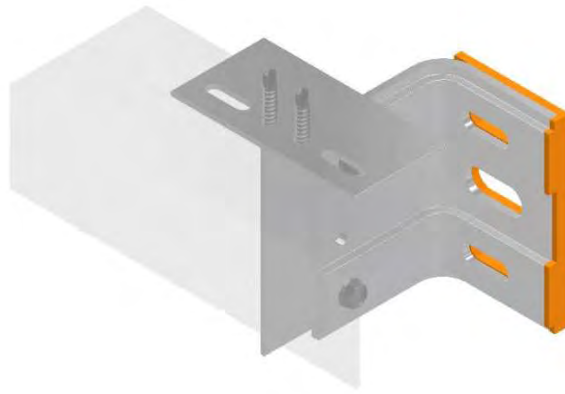


Fixing Arrangement on A Fixed Adaptor

Rail Fixing Arrangement for AXL-HB040-TP+AXL-HBD40

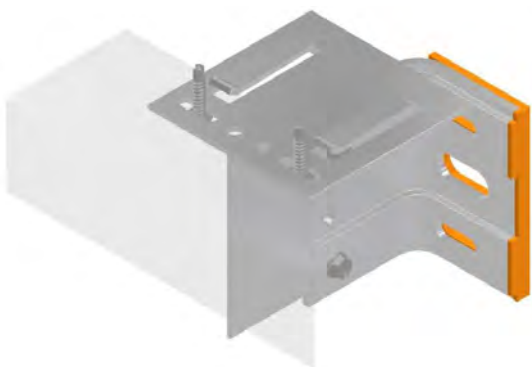


Fixing Arrangement on A Sliding Adaptor



Fixing Arrangement on A Fixed Adaptor

Rail Fixing Arrangement for AXL-HB060-TP+AXL-HBD40



Fixing Arrangement on A Sliding Adaptor



Fixing Arrangement on A Fixed Adaptor

Rail Fixing Arrangement for AXL-HB060-TP+AXL-HBD80

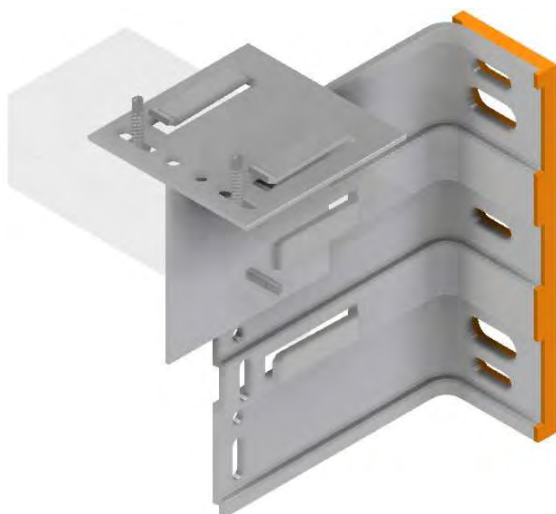


Fixing Arrangement on A Sliding Adaptor

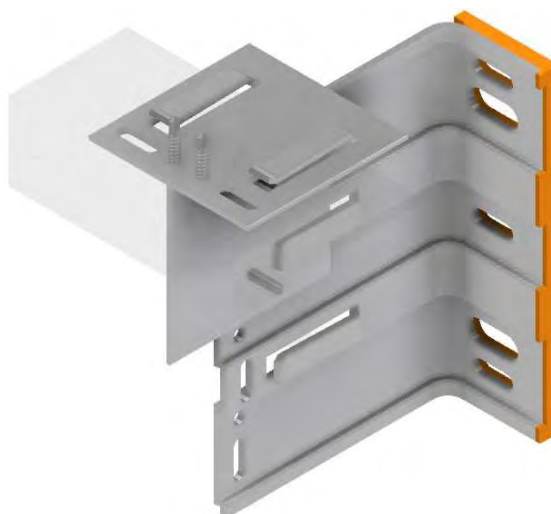


Fixing Arrangement on A Fixed Adaptor

Rail Fixing Arrangement for Single Brackets with Length Over 90mm



Fixing Arrangement on A Sliding Adaptor



Fixing Arrangement on A Fixed Adaptor

Rail Fixing Arrangement for Double Brackets with Length Over 90mm

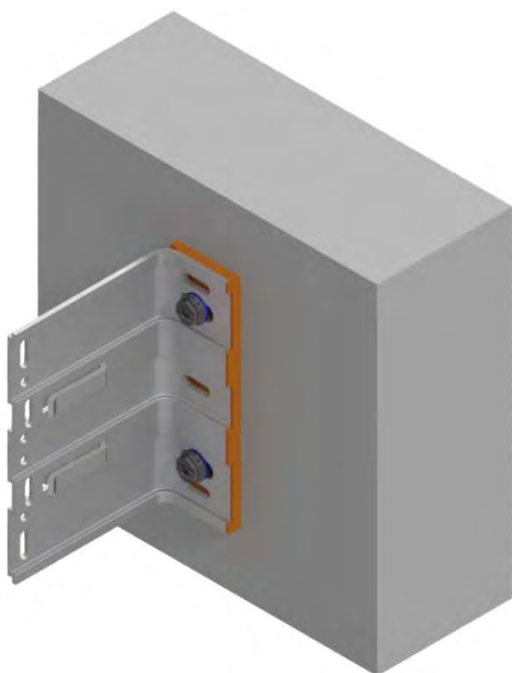


Based Fixings for A Single Bracket to Concrete



Based Fixings for A Single Bracket to SFS

Based Fixing Arrangement for AXL-HB Single Brackets with Length over 90 mm



Base Fixings for A Double Bracket on Concrete



Base Fixings for A Double Bracket on SFS

Based Fixing Arrangement for AXL-HB Double Brackets

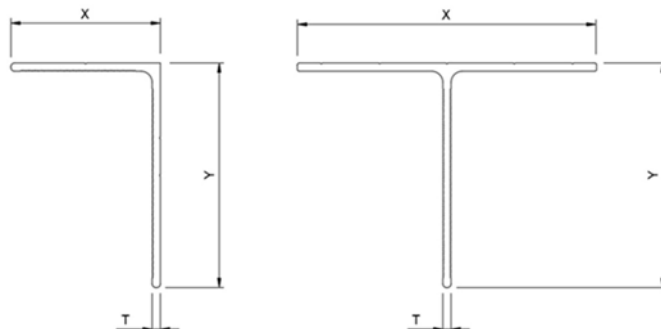
Rail Options

Dimension: L and T rail variants are available to suit different applications, with the dimensions summarised in the table below.

Part Number	Dimensions (mm)		Length Option (mm)		
	X	Y	T	4850	6000
AXL-L60X40X2.2	40	60	2.2	✓	✓
AXL-T40X100X2.2	100	40	2.2		✓
AXL-T60X80X2.2	80	60	2.2	✓	✓
AXL-T60X100X2.2	100	60	2.2	✓	✓
AXL-T60X120X2.2	120	60	2.2	✓	✓
AXL-T60X140X2.2	140	60	2.2	✓	✓

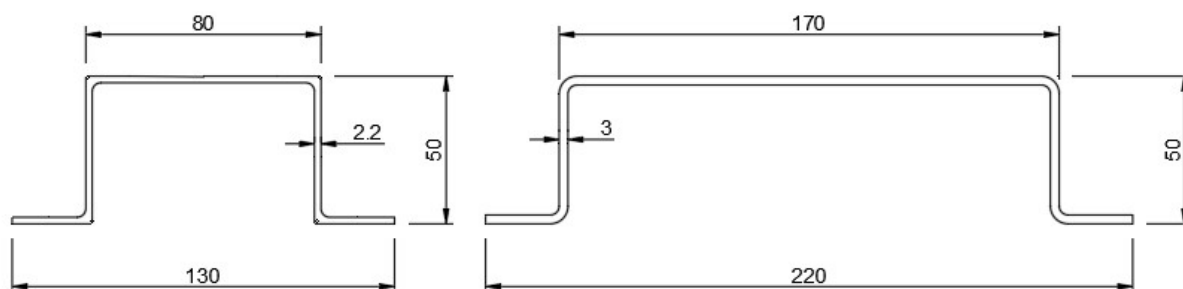
Material: 6063T6 aluminium

Application: for use in a ventilated rainscreen facade, the façade is fixed to the rail, which is supported by the bracket. For AX1, the rails are installed vertically. L rail is used as the primary rail to support the façade. If a wide fixing face is required for multiple-fixings, or around the panel joint, generally T rails should be used.



Top Hat Options

Dimension: two top hats with 50 mm depth in the range with dimensions and configuration below:



Material: 6063T6 for AXL-TH50X130X2.2,

1050A H14 for AXL-TH50X220X3.0

Application: In the application, the top hats are fixed to the substrate. In most cases, the brackets will be fixed to the top hats. But the façade can also be installed on the top hats directly if required for the project.

Bracket Adjustment

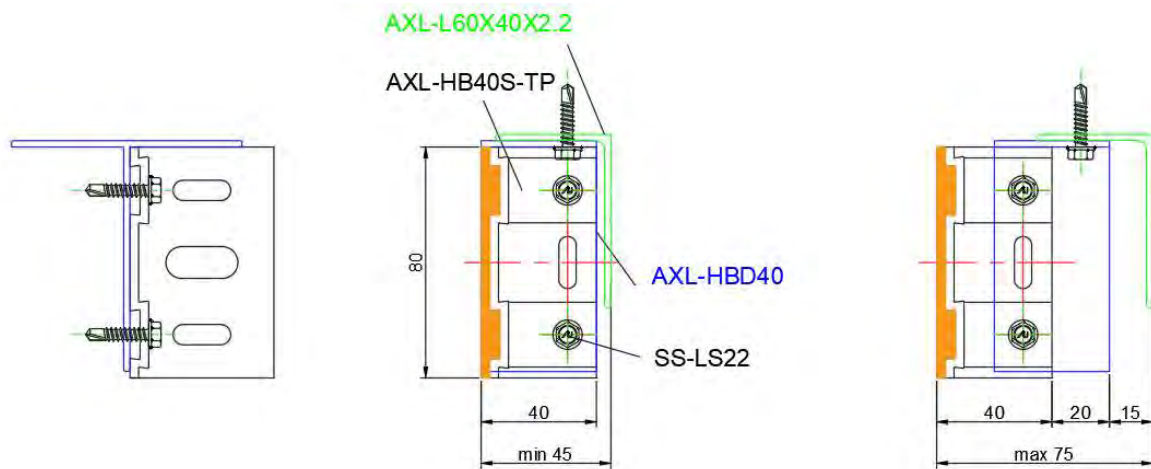
Leg of Vertical Bracket (mm)	40 ^[1]	60 ^[2]	60	90	120	150	180	210	240	270	300	330	360
L _{min} (mm)	45	65	85	125	155	185	215	245	275	305	335	365	395
L _{max} (mm)	75	115	130	155	185	215	245	275	305	335	365	395	425
Note: [1] The adjustment is only applicable for AXL-T40X100X2.2 & AXL-L60X40X2.2 rails with AXL-HBD40 adaptor													
[2] The adjustment is only applicable for 60 mm leg rail with AXL-HBD40 adaptor													
[3] For all other adjustments, AXL-HBD80 adaptor & 60 mm leg rails are as default													

AX2 can provide the support for the façade system to accommodate cladding zones from 45mm to 425mm using standard components.

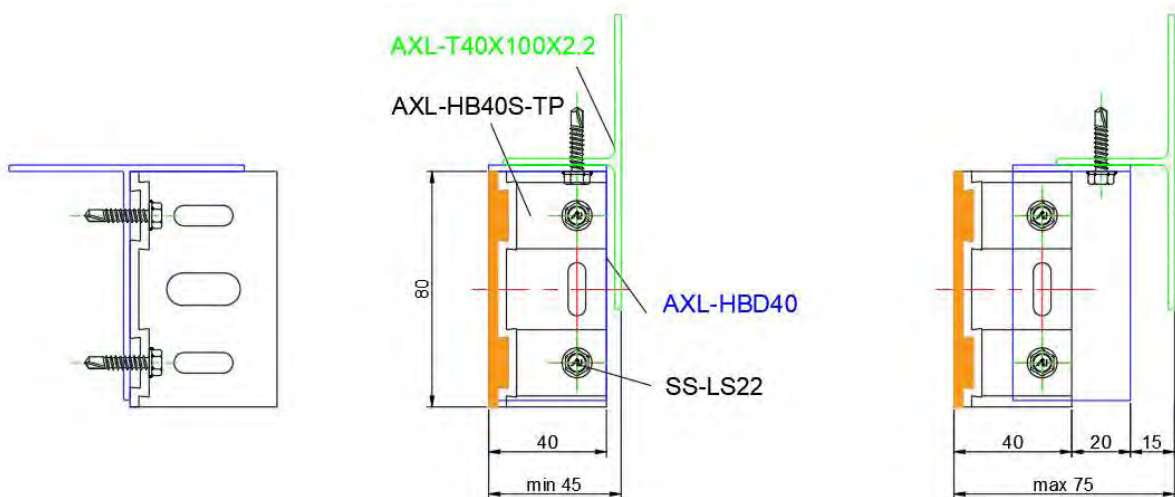
AXL-HB040S-TP Bracket Adjustment Configuration



Assembly of AXL-HB050S-TP+AXL-HBD40



Adjustment for AXL-HB040S-TP + AXL-HBD40 + AXL-L60X40X2.2



Adjustment for AXL-HB040S-TP + AXL-HBD40 + AXL-T40X100X2.2

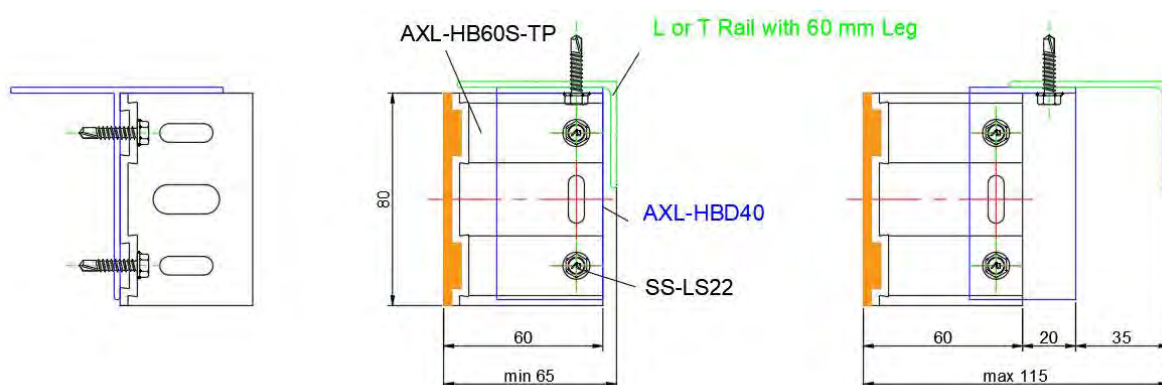
AXL-HB060S-TP Bracket Adjustment Configuration



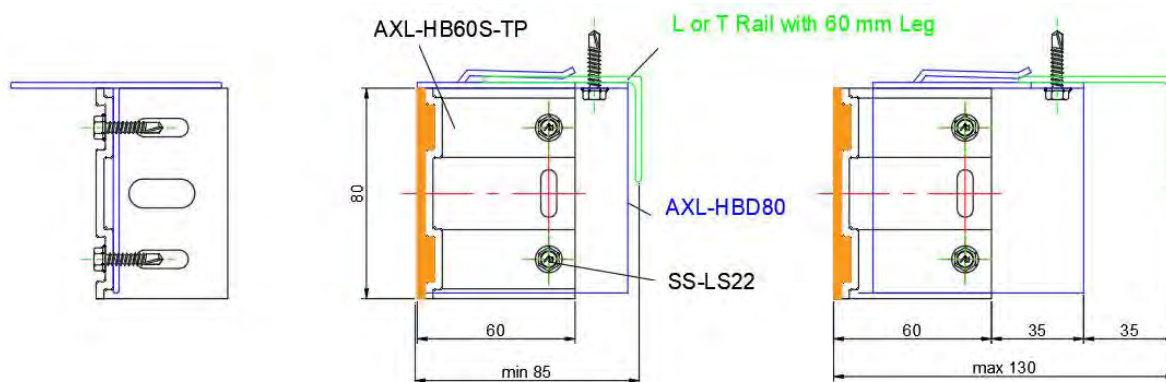
Assembly of AXL-HB060S-TP + AXL-HBD40



Assembly of AXL-HB060S-TP + AXL-HBD80



Adjustment for AXL-HB060S-TP + AXL-HBD40 + L or T Rail with 60mm Leg



Adjustment for AXL-HB060S-TP + AXL-HBD80 + L or T Rail with 60mm Leg

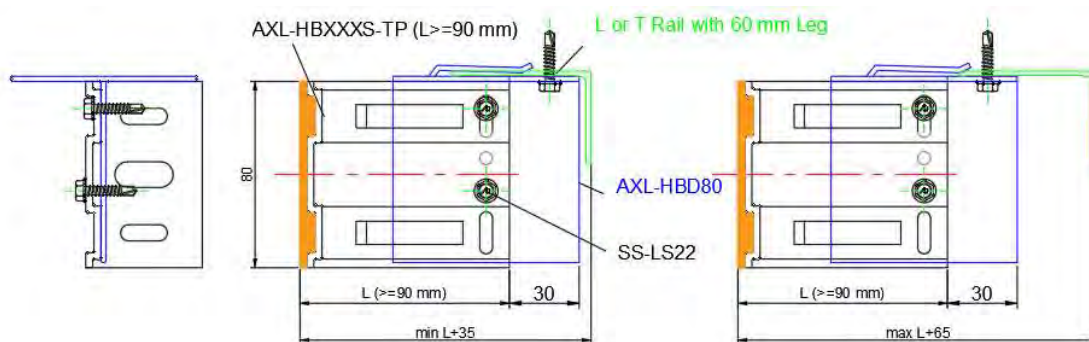
AXL Standard HB Bracket Adjustment Configuration



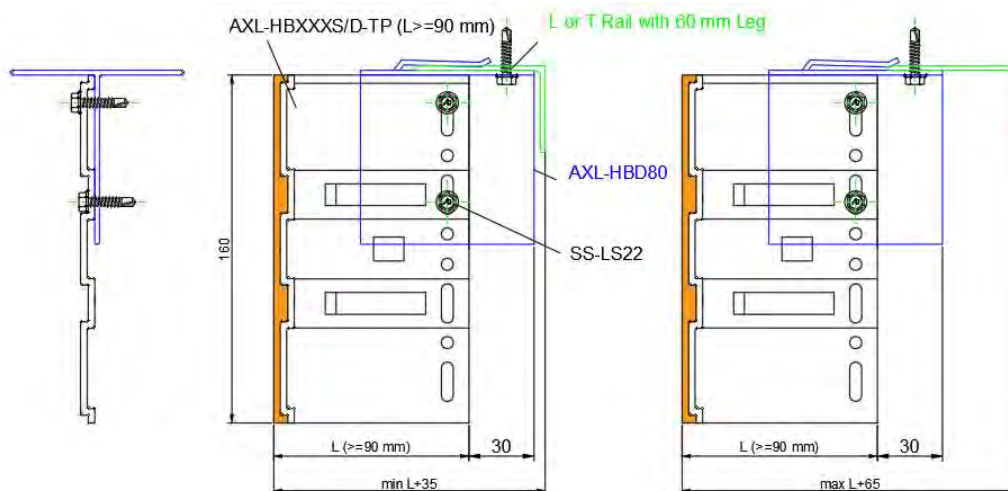
Assembly of AXL-HBXXXS-TP + AXL-HBD80



Assembly of AXL-HBXXD-TP + AXL-HBD80



Adjustment for AXL-HBXXXS-TP + AXL-HBD80 + L or T Rail with 60mm Leg



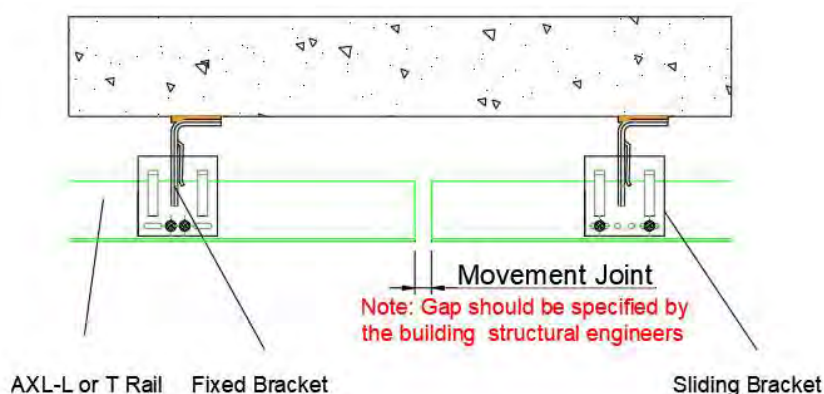
Adjustment for AXL-HBXXD-TP + AXL-HBD80 + L or T Rail with 60mm Leg

Note: The standard bracket is referred to the bracket with the length over 90 mm.

Rail joint

Movement Joints

A movement joint should be introduced between the ends of two rails. The joint gap should be specified based on the application. There are two types of movement joints: thermal movement joint and structural movement joint.

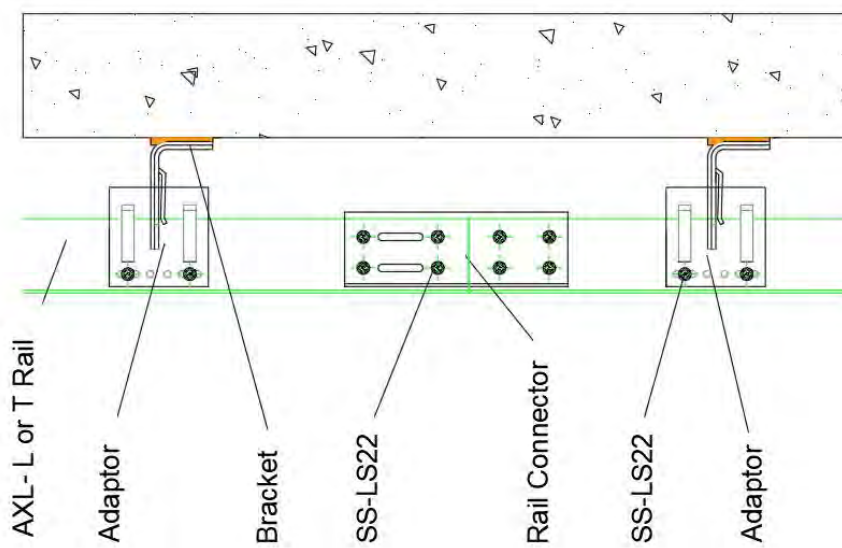
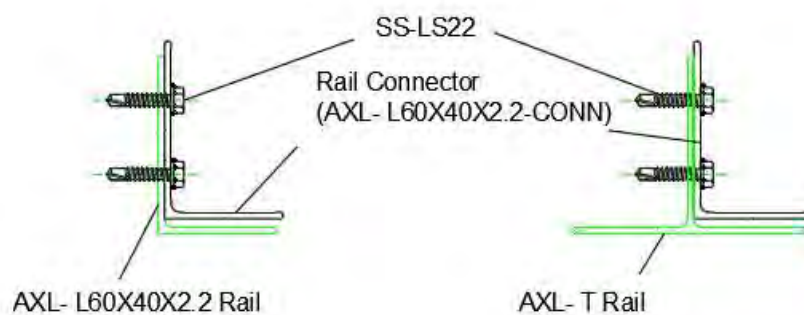
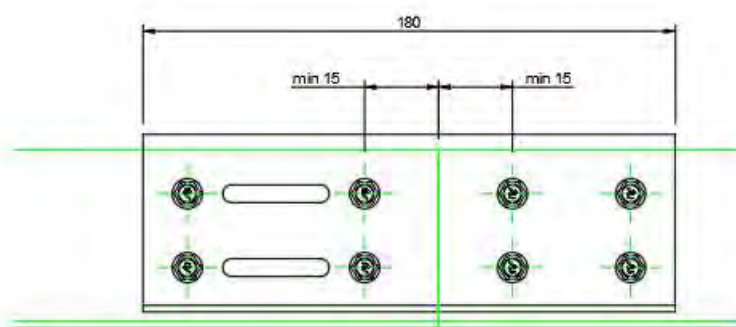


The thermal movement of aluminium facades $\pm 1\text{mm/m}$ is taken into account which reflects the external temperature changes from -20 to 65°C on the face of façade. Generally, the temperatures of façade and rail are almost the same because they are in close contact and both of them are in the cold zone. The max rail length is 6 m with the max thermal movement ± 6 mm, so the slot on the sliding bracket can accommodate the max thermal movement. Between the ends of two rails, it is recommended that a 10 mm gap is incorporated to accommodate the rail thermal movement.

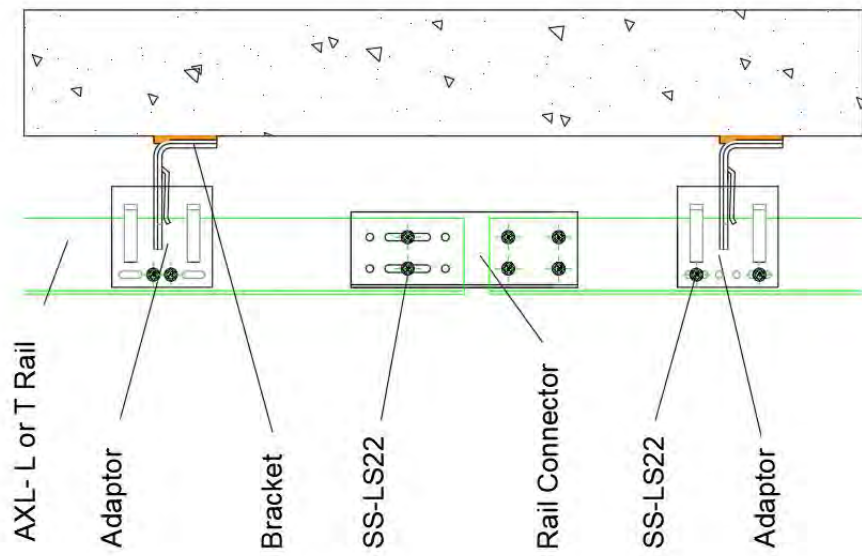
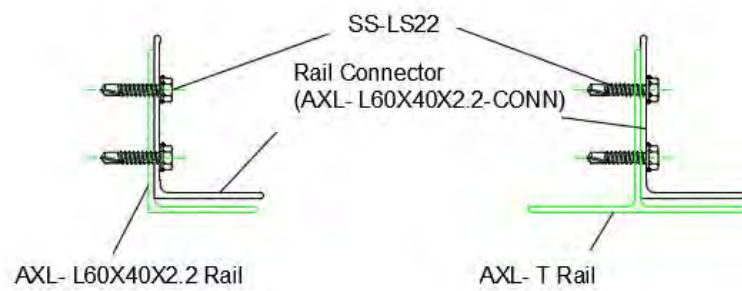
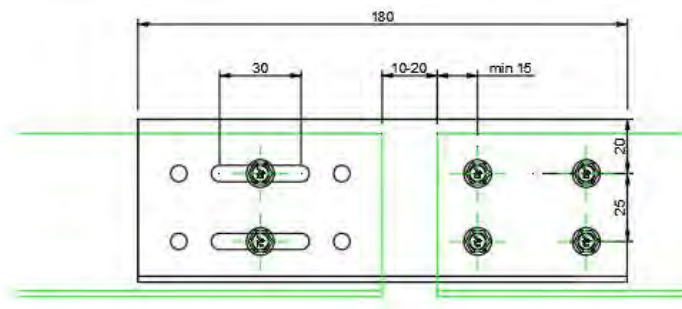
If the two rails are installed on different substructures, the structural movement should be taken into account. The structural movement joint gap should be specified by the building structural engineers.

Rail Joint Options

Two rails may need to be joined together in order to reduce cantilever length, maintain uniform bracket centres on the building, or utilise the rail to create more cost-effective solutions for the supporting system. There are two configurations – fixed joint configuration and sliding joint configuration. The fixed joint configuration can be taken as the rail extension joint. After two rails are joined together by using the fixed joint, the rail will be design as one single rail. The sliding movement joint configuration can be used as the thermal movement joint of a rail or the structural movement joints with a max movement of ± 15 mm. For the sliding joint configuration, two rails are designed as separate rails, so each rail needs to be supported by at least two brackets.



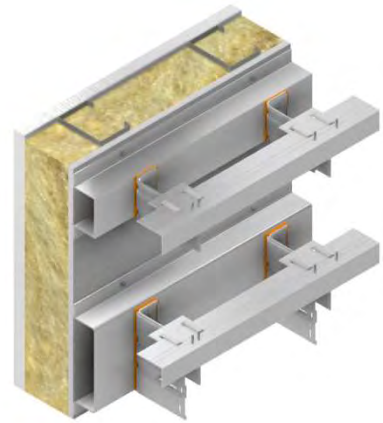
AX2 Rail Fixed Joint Configuration



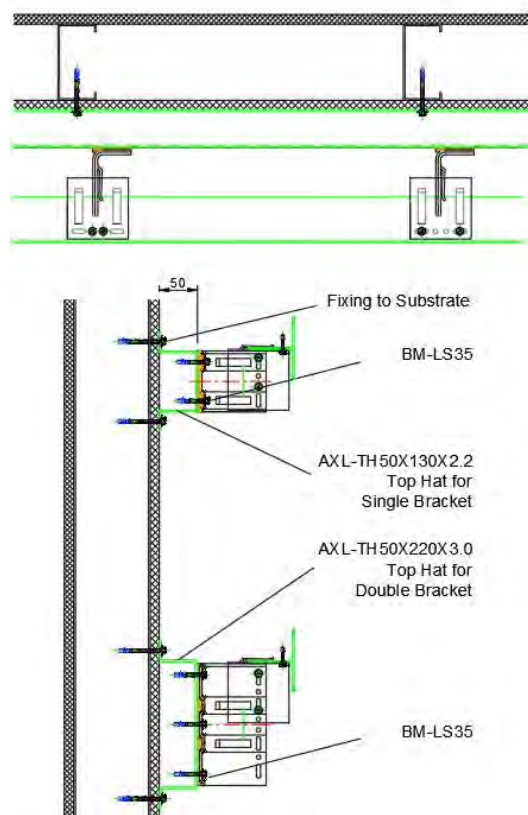
AX2 Rail Sliding Joint Configuration

Top Hat Arrangement

AX2 brackets are fixed to the substrate. The rail centre & bracket centre should be specified based on typical façade sizes, rail & bracket performance, and fixing performance between the rail/bracket and bracket/substrate. If a uniform substrate is specified, such as concrete, the brackets can be fixed to the substrate based on the façade's requirement. If a non-uniform substrate is specified, such as SFS, hot-rolled steel frame, or timber frame, the brackets must be fixed to the studs or hot-rolled steel sections. In this case, if the façade size and stud spacing are not equal to each other, a top hat may be required to accommodate the difference of the bracket position required by the façade and stud position required by the substrate.



Standard top hats within the AxiAL range are produced at 50 mm depth. AXL-TH50X130X2.2 is specified to support single brackets, and AXL-TH50X220X3.0 is specified for double brackets. At each fixing position, two top hat flanges need to be fixed to the substrate. The recommended maximum top hat fixing spacing is 600 mm.



The depth of standard top hats is 50 mm. If top hats with a depth outside of the standard 50mm are required, please contact the technical support team at Ash & Lacy for guidance.

Structural Design Consideration

Wind Load

AX2 system provides structural support for the façade. In consideration of this, the wind loads and dead loads (façade weight) are applied onto the rails uniformly, and then passed through the brackets to the substrate.

Wind load applied on the façade should be calculated by the structural engineer of the client, referring to BS EN 1991-1-4. If the client can't provide the wind load calculation, Ash & Lacy's engineer will do the wind load calculation for the indicative design.

Referred to CWCT Guidance for Build-up Wall 2017, Wind loads are calculated by reference to:

BS EN 1991-1-4: Eurocode 1. Actions on structures. General actions. Wind actions;

NA to BS EN 1991-1-4: UK National Annex to Eurocode 1. Actions on structures. General actions. Wind actions;

PD 6688-1-4: Background information to the National Annex to BS EN 1991-1-4 and additional guidance;

CWCT Standard for systemised building envelopes.

Wind load depends on geographical location, ground orography and surrounding buildings. BS EN 1991-1-4 gives rules for the calculation of the basic wind velocity (v_b) and this has to be evaluated for each project considering its location. The basic wind velocity is converted to a basic velocity pressure q_b . This is modified to take into account exposure and height above ground giving the peak velocity pressure q_p . The actual pressure on the external surface of an element of the building envelope will depend on the shape of the building; considering this, an external pressure coefficient C_{pe} can be determined. The pressure on the internal surface will depend on the relative permeability of each façade of the building and any dominant openings in the building envelope; from these an internal pressure coefficient, C_{pi} can be determined. Knowing the peak velocity pressure and the pressure coefficients it is possible to calculate the pressure on the external and internal surfaces of a sealed building envelope.

Guidance on cavity pressures available in CWCT Standard for systemised building envelopes which has been common practice in the UK. The pressures on the rainscreen and air barrier are shown in Table 6.3.2 as

	Drained-and-ventilated	Pressure-equalised*
Rainscreen	$q_p \times C_{pe}$	$0.67 \times q_p \times C_{pe}$
Air barrier	$q_p \times (C_{pe} - C_{pi})$	$q_p \times (C_{pe} - C_{pi})$
Windows and doors	$q_p \times (C_{pe} - C_{pi})$	

The external wind load coefficient is referred to Table 7.1 of BS EN 1991-1-4.

Zone	A		B		C		D		E	
h/d	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$	$C_{pe,10}$	$C_{pe,1}$
5	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,7	
1	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,5	
$\leq 0,25$	-1,2	-1,4	-0,8	-1,1	-0,5		+0,7	+1,0	-0,3	

In rainscreen structural design, after consideration of the actual panel size, 2 wind load zones will be taken into account as:

$C_{pe} = -1.2$ in Zone A

$C_{pe} = -0.8$ in Zone B

If the wind load is provided by the client, Ash & Lacy will design the rainscreen system based on the client wind load.

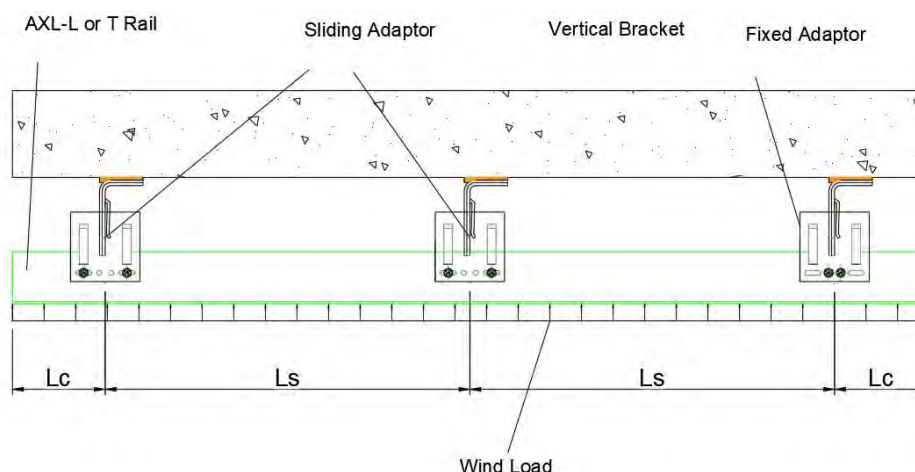
Load Factor

Load factors used in the UK are defined in the National Annex to BS EN 1990: Eurocode – Basis of structural design. For the rainscreen system, only wind load and dead load apply on the system so, the load factor can be summarised as:

Load type	Ultimate Limit State	Serviceability Limit State
Wind	1.50	1.0
Dead	1.35	1.0

Thermal Expansion of Rail

The rail is connected to the adaptor. On each rail, one adaptor needs to be installed as the fixed adaptor which can be installed at the end or middle of the rail. All other adaptors are installed as sliding adaptors, which can accommodate the maximum ± 6 mm thermal movement between sliding adaptors and the rail.



Adaptor Arrangement on the Rail

Structural Design Consideration

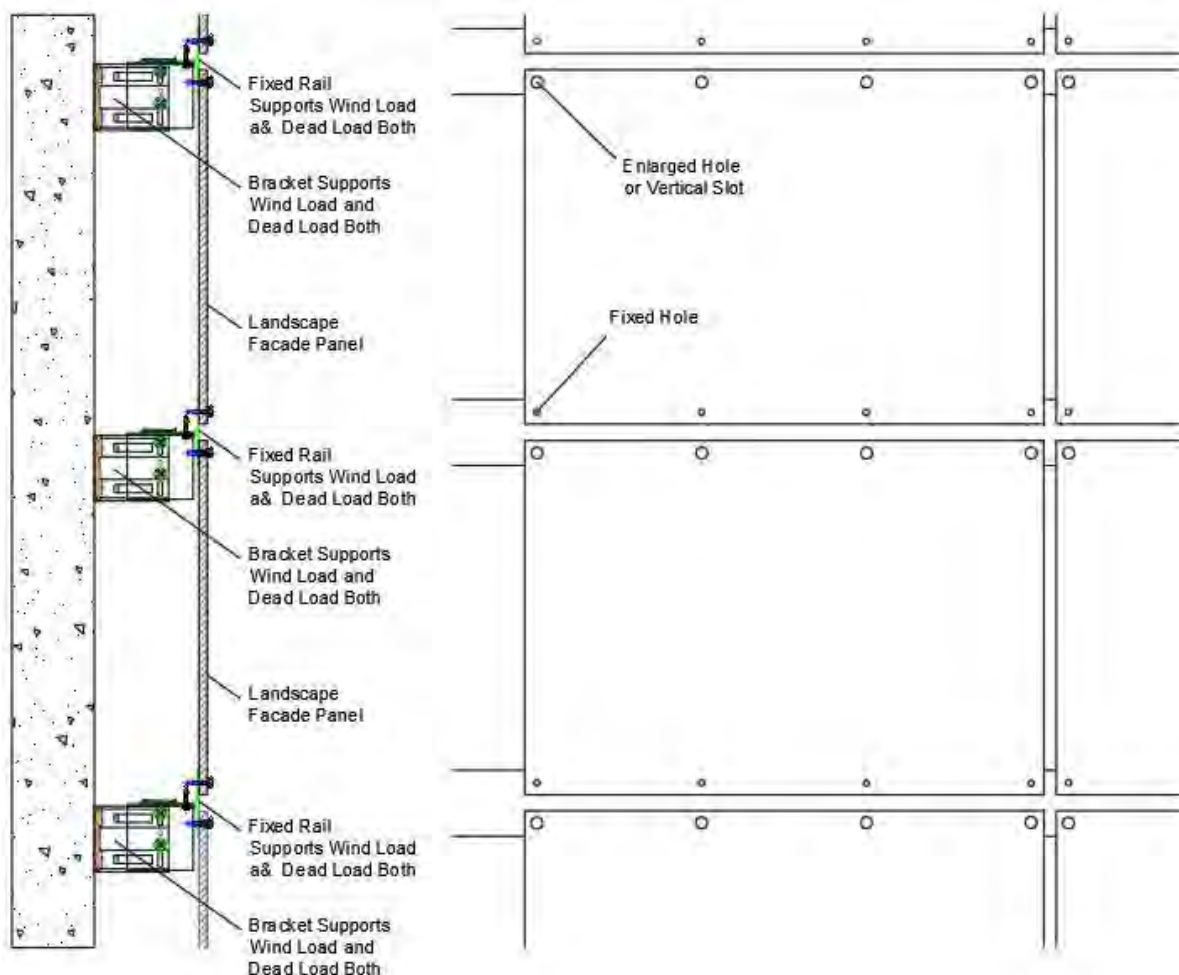
AX2 system can provide the support for the landscape panels and portrait panels. Based on the interface between the rail and façade panels, from a structural design standpoint, the concepts of two different rails are introduced as:

Fixed rail: the rail supports both the wind load and dead load.

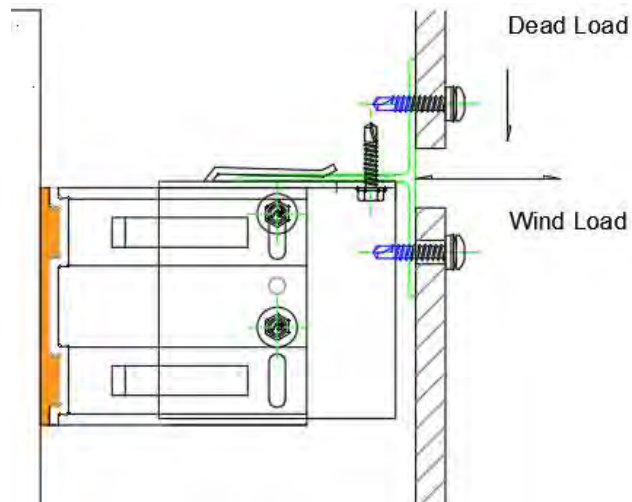
Sliding rail: the rail supports the wind load only.

When the AX2 supports the landscape panels, the panels are generally installed between two horizontal rails, so the rail is taken as the fixed rail to support the wind load and dead load both.

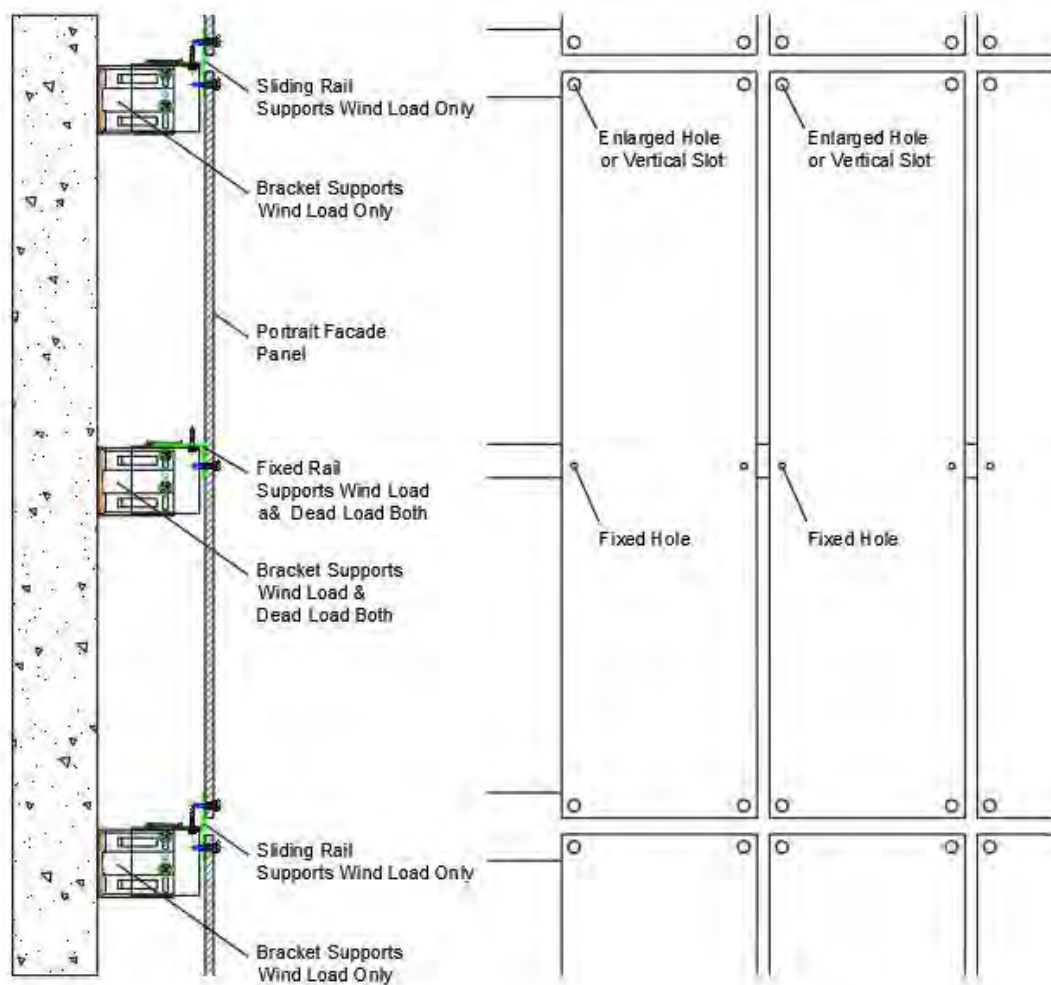
When the AX2 supports portrait panels, the panels are generally installed over multiple rails, on which the wind load is applied for all rails and brackets. The dead load is only supported by one rail, which is dependent of the configuration of holes.



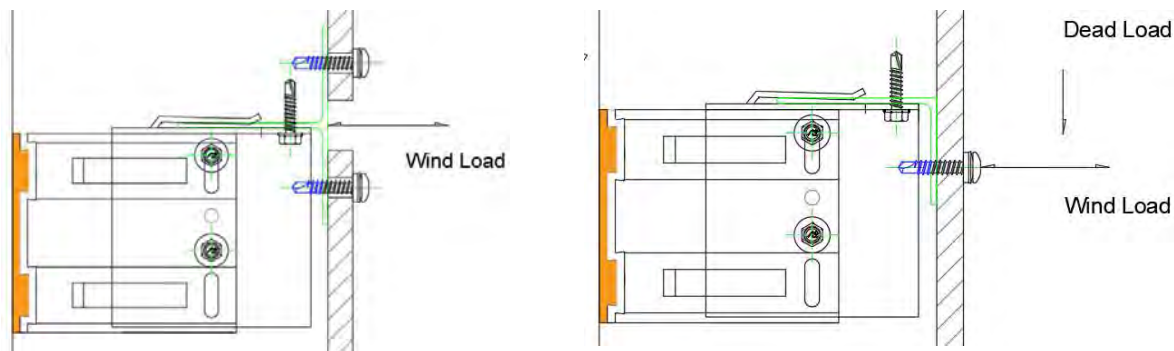
Landscape Panel Installed on AX2



Fixing configuration on the joint rail of landscape panel on AX2



Portrait Panel Installed on AX2



Fixing configuration on the joint rail of portrait panel on AX2

In the structural calculation, the rail is taken as a single span, double span or multiple span beam dependent of number of brackets installed on the rail.

On the sliding rail, the wind load is applied on rail face only to create the bending moment and shear on the rail. All brackets connected to the sliding rail support the wind load only.

On the fixed rail, the wind load is applied on the rail face and the dead load applied in the vertical direction on the rail to create the bending moment and shear on the rail on both directions. All brackets connected to the fixed rail support both the wind load and dead load.

The deflection of the rail is calculated based on the beam deflection under the working wind load. Generally, the max deflection ratio $L/200$ applied for Ash & Lacy's metal façades or $L/360$ for Mechslip and NaturAL-X brick slip systems. For façade materials supplied by others, the façade supplier should specify the deflection ratio required.

Based on the general engineering rule, the max cantilever length is $L_c \leq L_s/4$. If a longer cantilever is required, especially between the joint of two rails, rail ends should be connected together referred to the joint details.

Third Party Assessment Report & Certification

1. BBA Certificate 20/5842
2. Reaction to Fire Classification Referred to EN 13501:2018
A1 for AX1-4 Alum System Supported by WarringtonFire Report WF-413768
A1 for AXR1-4 Stainless Steel System Supported by WarringtonFire Report WF-413770
3. SCI-Assessed Certificate: Product ID - 1804
4. CWCT Test: AxiAL have been tested with various metal and brick façade system to CWCT standard such as NaturAL-X, Mechslip, LineAL-X, VairAL-TF, VariAL-CF1/2/3 etc.

Technical Documentation

1. AxiAL Brochure
2. AX2 Component Drawing: CD.AX2
3. AX2 Installation Manual
4. AX2 Typical Details
5. AX2 Product Data Sheets
PDS-BKT-034: AXL-HBD80 – AL Horizontal Bracket Adaptor HBD80
PDS-BKT-042: AXL-HBXXXS-TP – AL Single HB Bracket + Pad
PDS-BKT-043: AXL-HBXXXD-TP – AL Double HB Bracket + Pad
PDS-BKT-077: AXL-HBXXXS-TP – Short HB Single Bracket + Pad
PDS-MUL-014: AXL-L60X40X2.2 – Rail L60X40X2.2
PDS-MUL-015: AXL-T60X80X2.2 – T Rail T60X80X2.2
PDS-MUL-016: AXL-T60X100X2.2 – T Rail T60X100X2.2
PDS-MUL-020: AXL-T40X100X2.2T – T Rail T40X100X2.2
PDS-MUL-021: AXL-T60X120X2.2 – T Rail T60X120X2.2
PDS-MUL-022: AXL-T60X140X2.2 – T Rail T60X140X2.2
PDS-MUL-050: AXL-TH50X130X2.2 – Top Hat TH50X130X2.2
PDS-MUL-051: AXL-TH50X220X3.0 – Top Hat TH50X220X3.0
PDS-ANC-040: AXL-TP80L – Thermal Pad TP80L
PDS-ANC-037: AXL-TP160L – Thermal Pad TP160L
PDS-FIX-SS-LS
PDS-FIX-BM-LS
PDS-FIX-BM-LSHF
PDS-FIX-BM-HS
PDS-FIX- R-FF1-10K080-A4

Note: Third party assessment reports, certificates and technical documentations are available upon request.

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