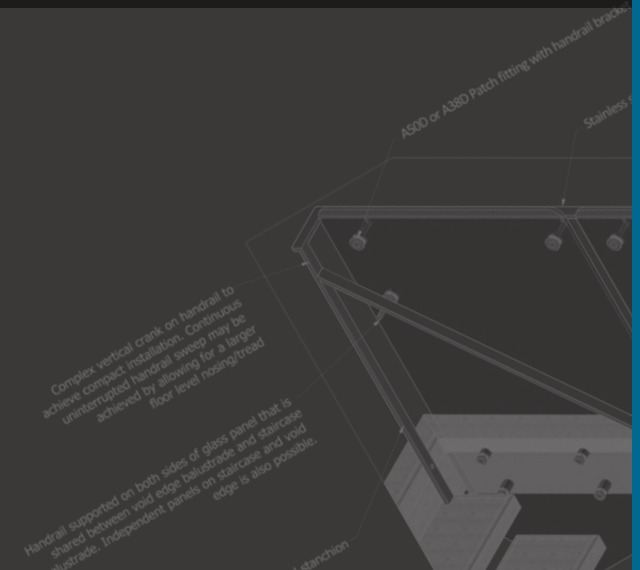
Through-glass patch fittings supporting cantilevered glass panels

F8

design elements

arden
ARCHITECTURAL STAIRCASES

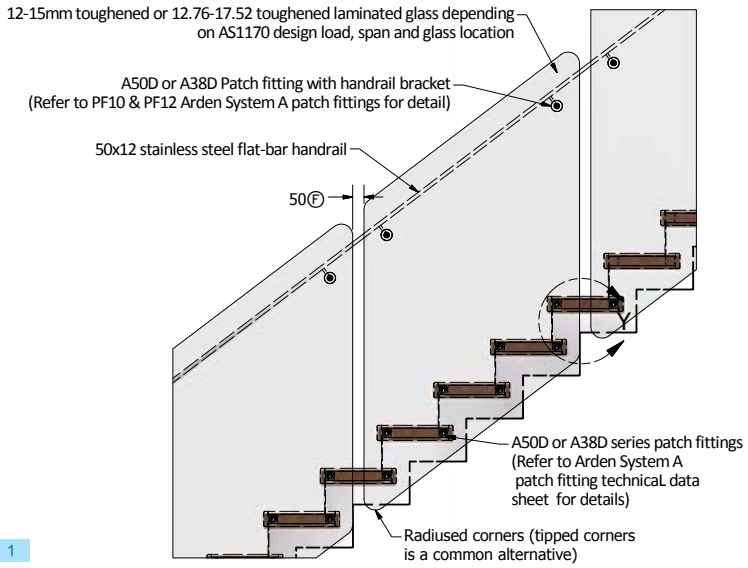


design

In many architectural contexts, the balustrade is required to maximise light, space and transparency. On a feature staircase, the priority may be to maximise the impact of the tread and stringer design. In void edge applications, the sense of openness, or the highlighting of other architectural features may be required. When less is more, a fully cantilevered solution such as F8 is often the best choice.

Modern glass manufacturing methods permit curves and a wide variety of shapes, as well as relatively long spans. As the photographs and renderings show, dramatic architectural statements can be made in either format. Because the F8 style avoids the use of stanchions entirely, the eye is drawn to the patch fittings that effect the structural fixing and support the handrail.

The selection of Arden system A38D/A50D stainless steel patch fittings significantly enhances the appearance of the F8 design with clean geometrical details.



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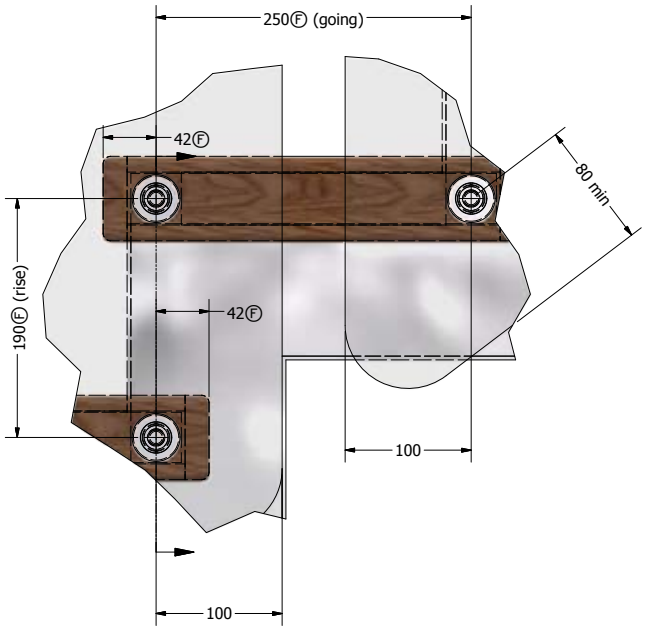

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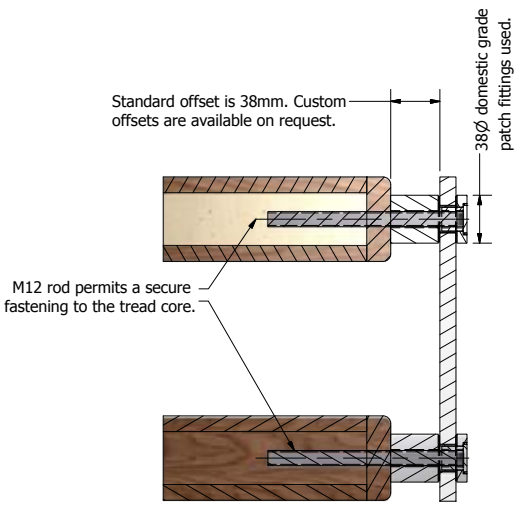


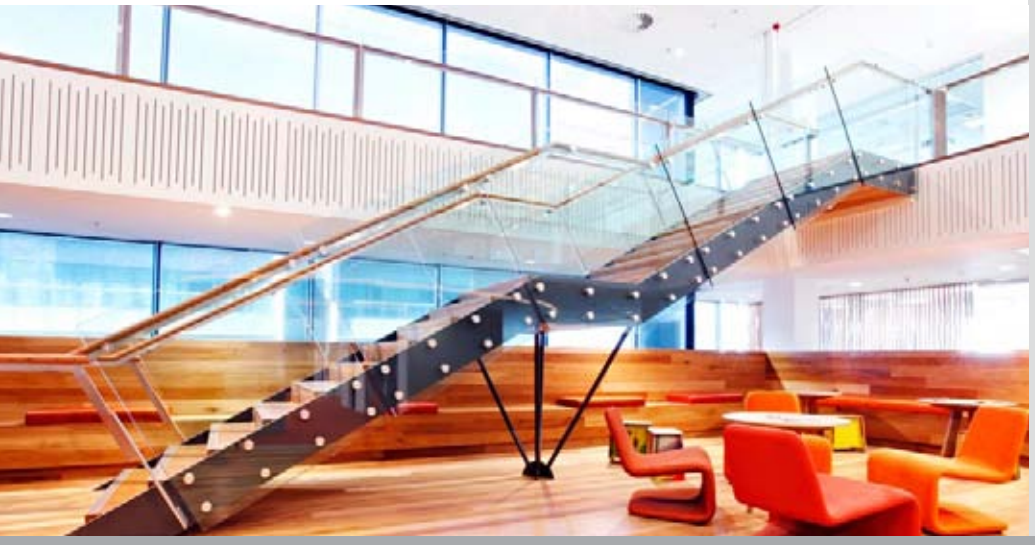
2B

Figure 1. Side elevation of a typical raking balustrade layout on a straight flight section. This particular application of F8 has the balustrade mounted on the Z2 zigzag stringer design.

Figure 2. Composite stainless steel mono-stringer with integrated tread supports. The optional selection of radiused panel corners and flat bar profile handrail is also shown.

2A. Tread supported raking panel side elevation detail. Because patch fittings are located on consistent locations on each tread, the vertical and horizontal spacing of the patch fittings is determined by the rise and going of the flight.

2B. Vertical section. This offset between the line of glass and the ends of the staircase treads / stringer exterior surface is determined by the configuration of the A38D/A50D patch fitting system. Please refer to the corresponding Arden brochure for details on possible configurations of Arden proprietary patch fittings.



Ⓕ indicated on dimensions denotes a nominal dimension that typically varies according to specific application, engineering requirements or client preferences.

technical

The F8 cantilevered glass balustrade design relies on the strength of structural glass and proprietary heavy-duty stainless steel patch-fittings to transfer loads from handrails to structural floors or staircase components. Cantilevered glass based on the use of patch fittings typically forms the cantilever by a series of upper and lower patch fittings, fixed to the stringer face or floor edge. The cantilever effect is one of a simple lever calculation where the load applied to the glass is resisted by the bottom and top patch fittings that act in compression whilst its partner is acting in tension.

The engineering needs to consider the following:

a) the load applied to the glass (varies according to the situation - see AS1170.1)

b) the height of the glass (effectively setting the length of the “lever”)

c) the horizontal spacing of the fittings (determines how each series shares the load)

d) the vertical spacing of the fittings (determines the amount of compression and tension that is applied to the patch fittings)

e) the specifications of the glass, which determines the size and thickness required to handle the loads applied and resisted by the patch fittings.

Consideration of all of these factors sets the glass specification and the number and type of patch fittings, including pull-out strengths required of the fittings to the structure.

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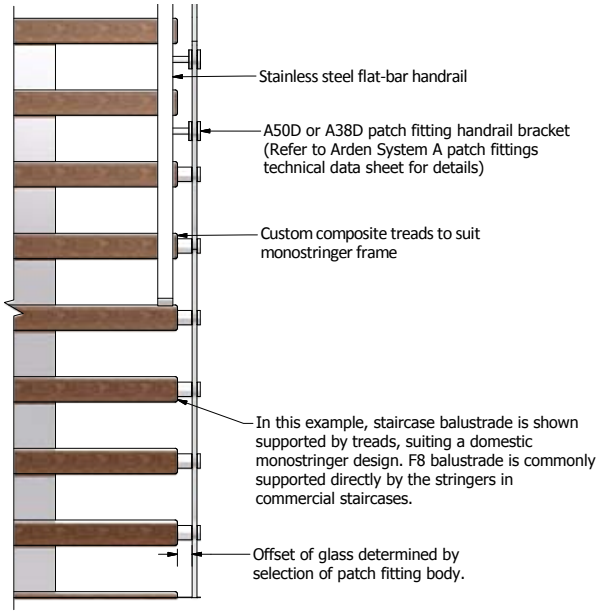

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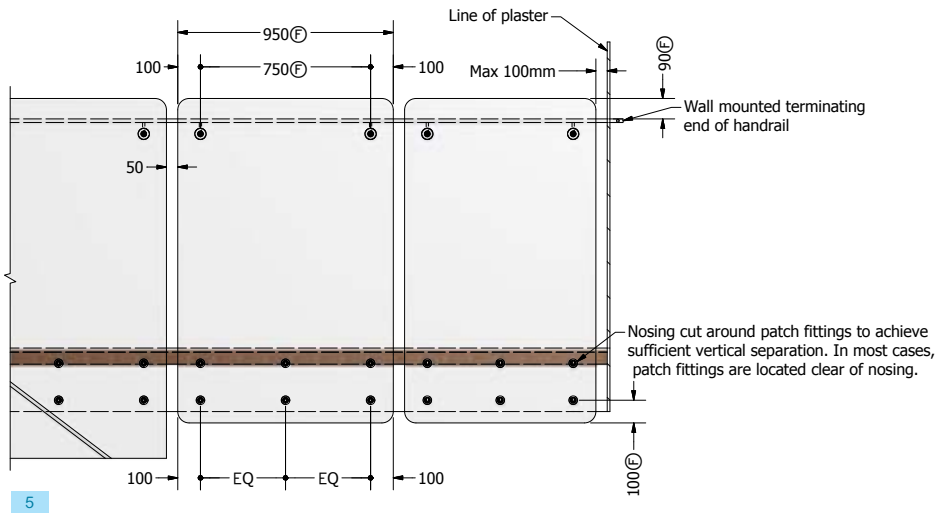

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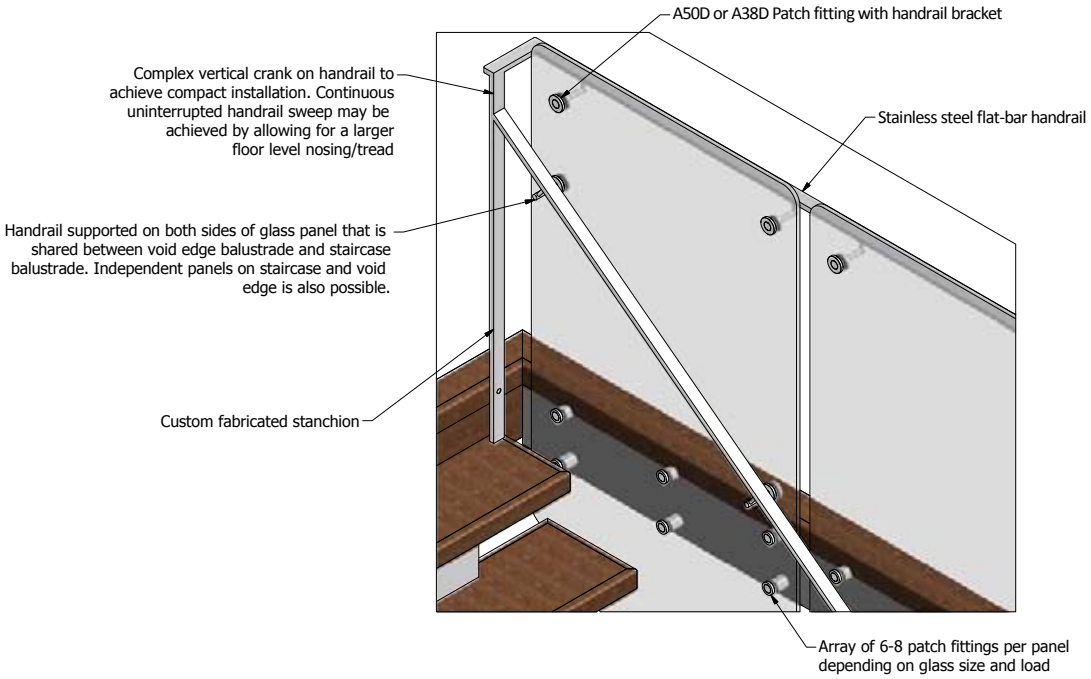

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Figure 3. Front elevation of F8 raking balustrade layout. Relative position of glass and handrail is determined by patch fittings.

Figure 4. Isometric view of F8 balustrade on a zig-zag monostringer. Structural integrity is maintained from stringer to tread, and finally to glass panels cantilevering vertically to support a handrail. The F8 enhances the natural tendency of monostringers to increase the sensation of space of light. Note that tread-supported panel designs are only applicable to domestic installations. For commercial projects the F8 system should be fixed to stringers.

Figure 5. Void edge balustrade front elevation: typical domestic application. In normal circumstances, consistent sizing and spacing of panels and patch fitting locations are maintained. Depending on glass panel size, the F8 style incorporates 4, 6, or 8 lower patch fittings per panel. Two patch fittings per panel are usually sufficient for handrail support. As in all Arden balustrade styles, spans, heights and material grades are maintained in accordance with Australian standards and building codes.

Figure 6. Interaction of void edge balustrade panel and staircase handrail. The F8 style handles complex points of interaction well, permitting fixings to occur on both sides of the glass panel. In the example shown, a custom fabricated stanchion ensures the integrity of the interlinking handrail in the unlikely event of glass breakage.

Figure 7. Void edge balustrade side elevation (thick concrete slab fixing).

Figure 8. Void edge balustrade side elevation: handrail patch fitting detail. Propriety Arden system patch fittings provide a clean and architectural aspect. The unique pin system of the A50D/A38D patch fittings ensures that glass can be easily replaced in the unlikely event of glass breakage.

Figure 9. Detail of thick concrete slab fixing. The 50mm diameter patch fittings illustrated provide for high design loads.

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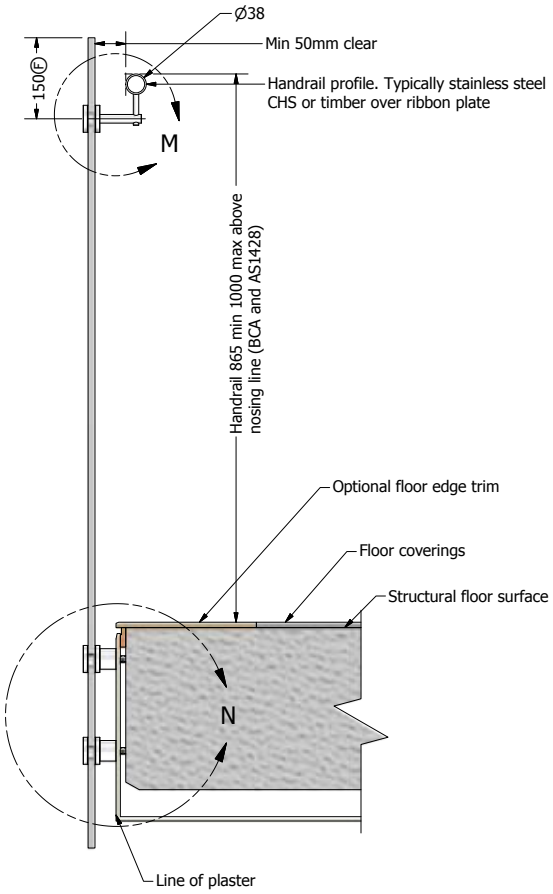

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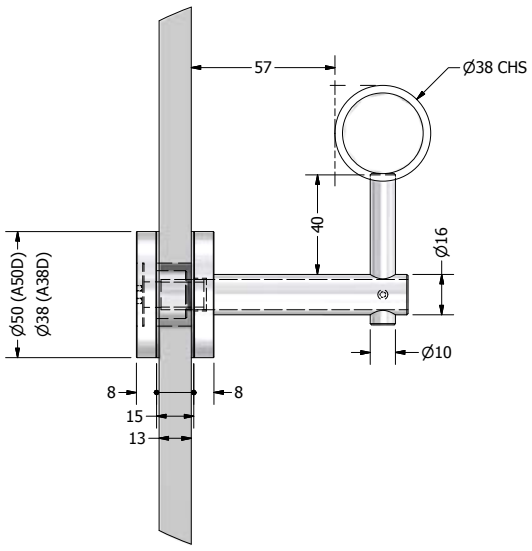
57
Ø38 CHS
40
Ø16
Ø50 (A50D)
Ø38 (A38D)
Ø10
8
8
15
13

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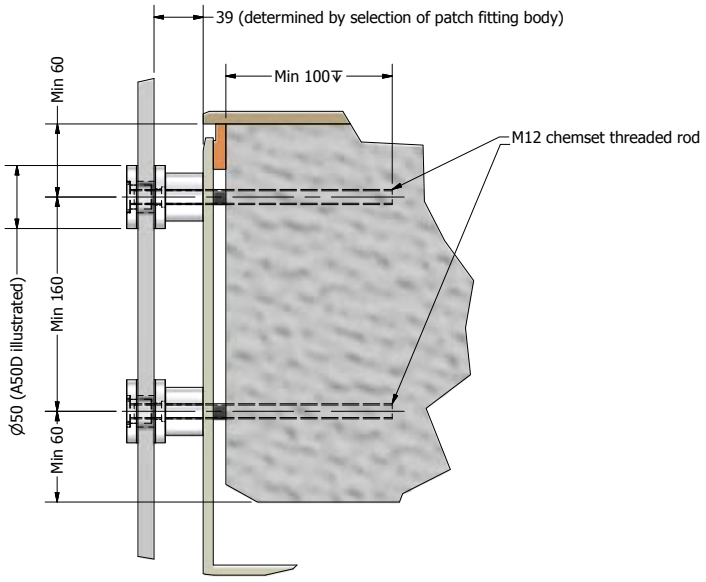
39 (determined by selection of patch fitting body)
Min 100
M12 chemset threaded rod
Min 60
Min 160
Min 60
Ø50 (A50D illustrated)

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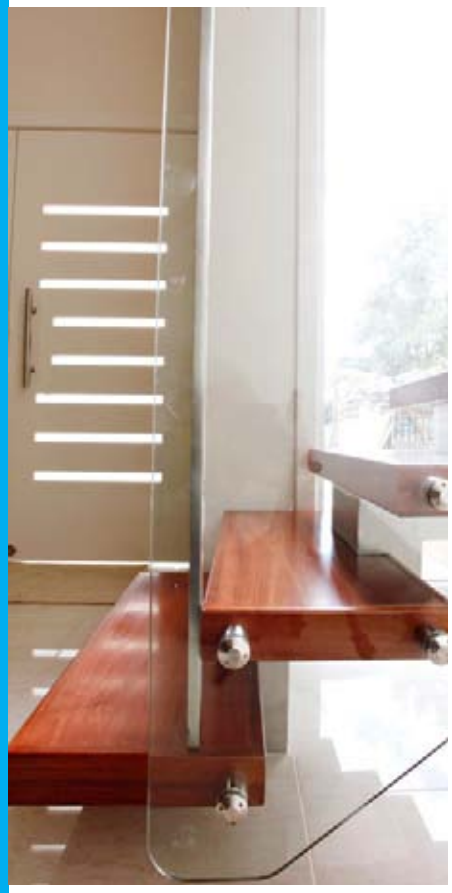
Figure 10. Void edge balustrade side elevation (thin concrete slab fixing).

Figure 11. Detail of thin concrete slab fixing. Where slab thickness does not permit the fixing of two appropriately spaced patch fittings directly into the slab face, an underslab bracket is specified. Note that sufficient space in the ceiling cavity to conceal is required.



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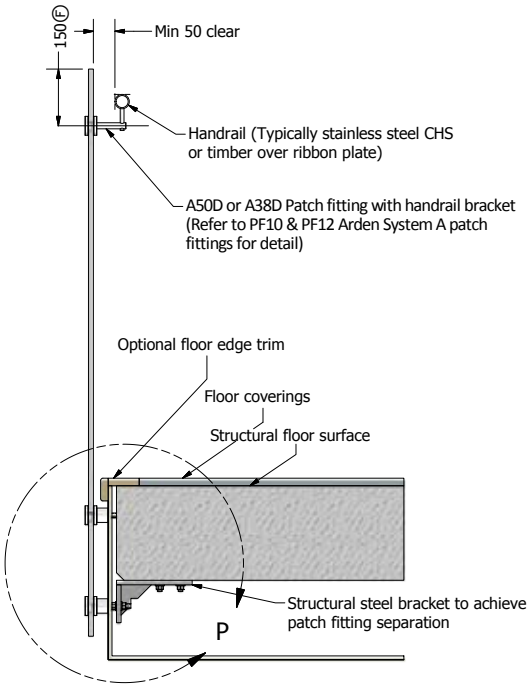

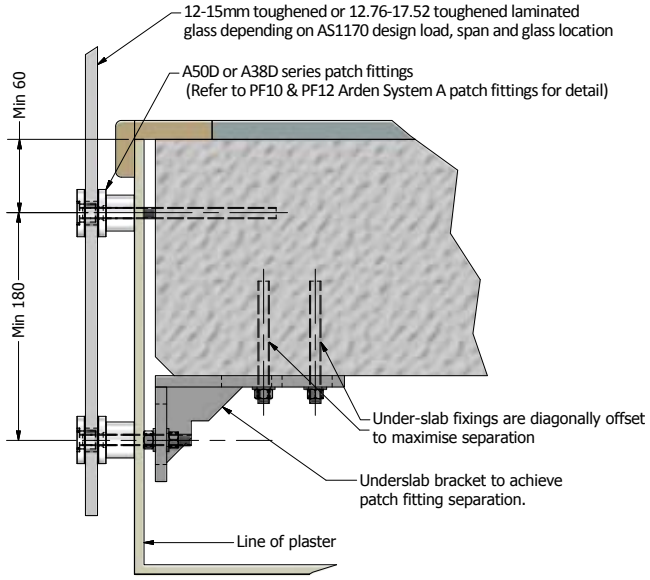

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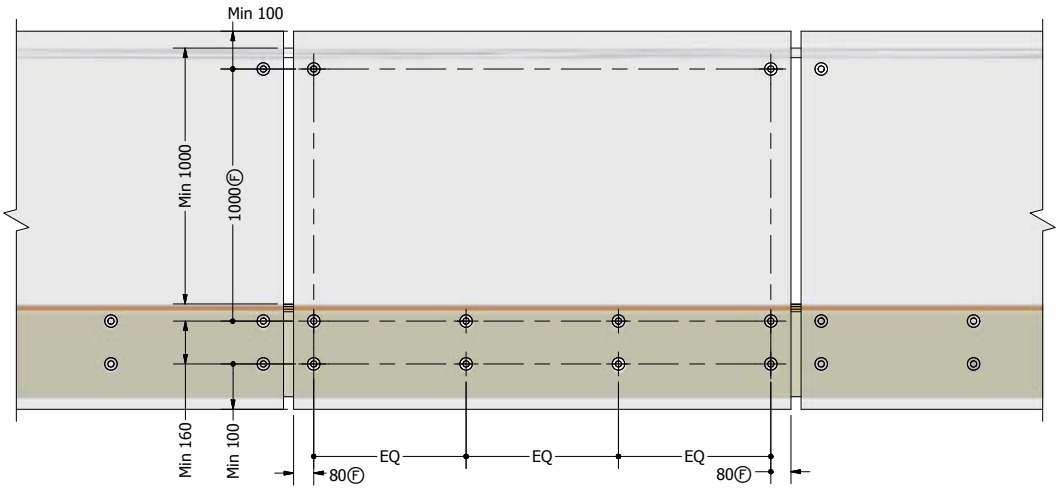

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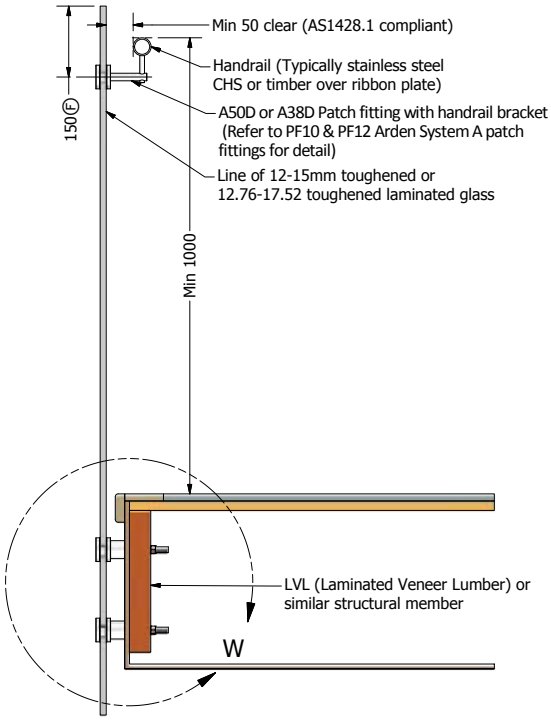

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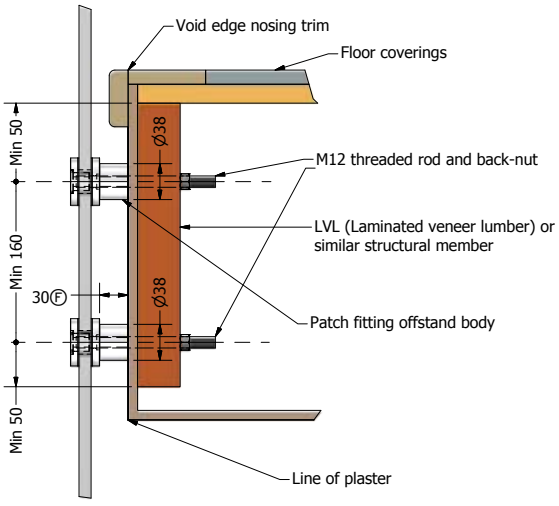

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Figure 12. Void edge balustrade front elevation: typical commercial application. In the example illustrated, relatively large panels are specified, and 8 lower patch fittings per panel are used.

Figure 13. Void edge balustrade side elevation (timber structure fixing).

Figure 14. Timber structure fixing details. Laminated veneer lumber or similar structural timber members usually have sufficient width to permit appropriate spacing of F8 patch fitting fixings.

Ⓕ indicated on dimensions denotes a nominal dimension that typically varies according to specific application, engineering requirements or client preferences.

structural glass panels

This table shows typical glass specifications depending on design load.

Design load	Toughened monolithic safety glass (mm)			Toughened laminated safety glass (mm)		
	12	15	19	12	16	20
Domestic/Residential	Std	On request	On request	Std	On request	On request
Offices/Commercial stairs	Min	Std	On request	Min	Std	On request
Retail/Restaurant	N/A	Std	Std	N/A	N/A	Std
C5 high loads	N/A	N/A	N/A	N/A	N/A	N/A

Notes

1. These tables are to be used as a general design guide only.
2. Individual project requirements will dictate final glass specification and thickness.
3. All spans nominated are indicative of normal internal conditions. In some exposed situations, wind loads may exceed design load and thicker glass or smaller spans may be required.

design standards for glass panels

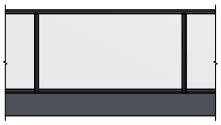
Glass balustrade panels must satisfy engineering requirements as specified in AS1288, and the Arden balustrade styles shown here are defined and specified with regard to the relevant design standards.

Of particular importance in the initial design stage, it is critical to maintain an awareness of the designation of glass panels as structural or infill, and the classification of handrail as load-supporting, non-load-supporting, or interlinking. Combined with other considerations (e.g. whether or not mechanical point-fixings are specified, span is cantilevered or supported on both sides), this determines the grade of glass (e.g. laminated annealed, toughened safety, laminated toughened) and type of handrail that satisfies the code.

As in other aspects of stair and balustrade design, Arden will advise with respect to the practicability of preliminary designs with respect to Australian standards.

glass balustrade styles

Cantilevered structural. Glass panels supporting an interlinking handrail cantilever from an appropriate floor fixing.

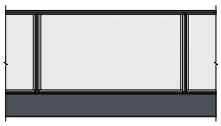


Fully framed. Glass panels are provided with four-edge support and are therefore rated as infill only.

Two-edge clasp. Glass panels are supported on two opposite edges by clasp-style mechanical fixings. The bearing of point loads influence the required grade of glass.

Semi-framed vertical channel. Glass panels are fixed via proprietary or custom channel system on each side.

Two-side patch-fitting. Glass panels are supported on two opposite sides by through-glass mechanical fixings. The bearing of point loads influence the required grade of glass. Stanchions may be located between, or at intermediate locations within, each panel span.



Semi-framed lateral channel. Glass panels are fixed via proprietary or custom channel system on the bottom rail and underside of handrail.

Hybrid. Glass panels are provided with a combination of the above methods so as to comply with safety requirements.

compliance

Arden is a BSA licensed contractor for carpentry, joinery, glass, glazing and aluminium as well as structural metal fabrication and erection. Arden supplies a Form 16 (Licensed Contractor) on all projects. In design and construct contracts, a Form 15 (Design Engineer) certification is supplied upon request. For products and services incorporating the F8 system, this table shows compliance with relevant codes and standards.

Key

- ● full compliance with the code
- ○ not applicable to this element

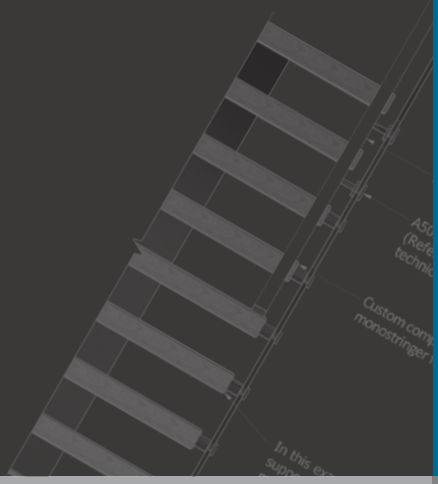
Code	Title	Applicability
BCA	The Building Code of Australia	●
AS NZS 1170.1-2002	Structural Design Actions – Permanent, imposed and other actions	●
AS 1288-2006	Glass in Buildings. Selection and installation.	●
AS NZS 1554.1-2004	Structural steel welding - Welding of steel structures	●
AS 1554.6-1994	Welding stainless steels for structural purposes	●
AS NZS 4586-2004	Slip resistance classification of new pedestrian surface materials	○
AS 1428.1-2009	Design for access and mobility	●
AS 1657-1992	Fixed platforms, walkways, stairways & ladders. Design, construction and installation	●

design note

For all commercial applications, it is important that sufficient space for the stairwell cavity be allowed to satisfy Australian Standards and BCA requirements.

The footprint is primarily driven by the floor to floor rise, as well as the staircase configuration chosen. However, stringer and balustrade style design may increase the amount of space required. Allowing too small a cavity can restrict the design options of the staircase. Also, points at where the staircase interacts with other structures are best addressed early in the design cycle.

Consultation with Arden early on will help ensure that these design issues can be addressed in a cost-effective manner.



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