

RATIONEL DESIGN DRAWINGS & STRUCTURAL CALCULATIONS

WINDOWS WITH VISION

rationel[®]

RATIONEL DESIGN RESPONSIBILITY

As part of the Rationel portfolio we offer a Design Drawings and Structural Calculations service.

This is a bespoke service that uses our wealth of experience in product design and installation to ensure an efficient problem free installation and the best use of the Rationel product.

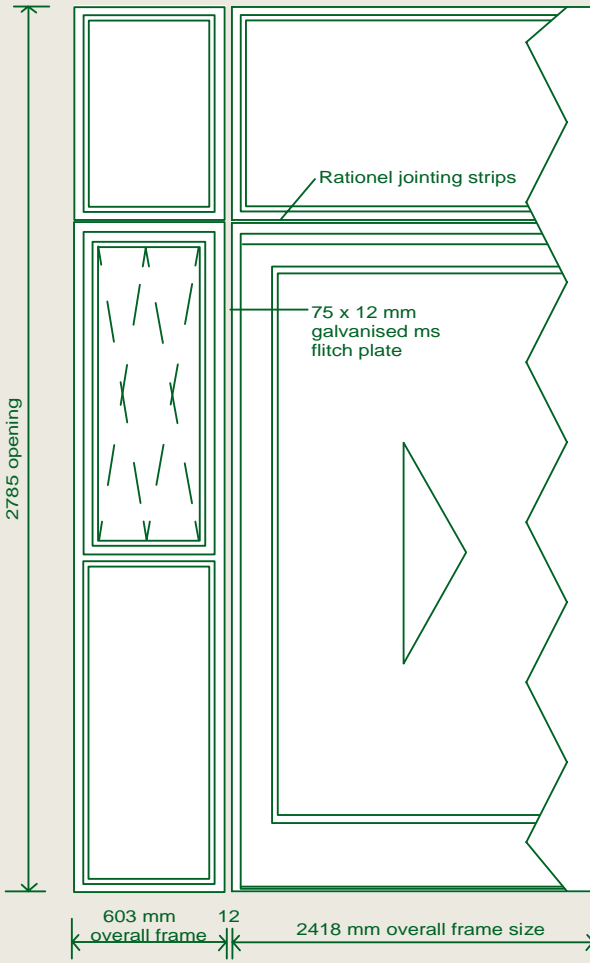
Once you have approved the design drawings and calculations, the onus of responsibility is placed on Rationel. This can help you design the risk out of the construction phases of your project.

Rationel will advise and make recommendations on interface details between the Rationel product and the main structure. We will draft all necessary designs and calculations and take full responsibility for window sizing, wind load calculations and take liability for the structural integrity of windows and doors.

WIND LOAD ASSESSMENT MULLION VERIFICATION

Wind load assessment is carried out in accordance with BS 6399-2:1997 Part 2: Code of Practice for wind loads.

The wind speeds and parameters of the site are obtained using the computer program BReVe2: Version 2.0.4.2. (or later). Results of the effective wind speed V_e (m/s) are based on the Directional Method.



Rationel will take full responsibility for window performance when the products are installed in accordance with our design recommendations.

Section: Double 115 × 54 + Flitch 75 × 10

Timber Properties

Modulus of Elasticity	7200 N/mm ²
Allowable Bending Stress	11.5 N/mm ²

Frame Section Properties

Second Moment of area I_{xx} (508.65 T 2)	1017.3 cm ⁴
Section Modulus Z_{xx}	176.92 cm ³

Flitch plate properties

Second Moment of area I_{xx}	1025.39 cm ⁴
Section Modulus Z_{xx}	9.38 cm ³

Composite section properties I_{xx}

2042.69 cm⁴

Mullion verification for Wind load

Design Wind Load	= 1.50 kN/m ²
Span	= 2.785 m

$$\text{Load on Transom } W = 1.5 \times \frac{(0.603 + 2.418)}{2} \times 2.785 = 6.31 \text{ kN}$$

$$\begin{aligned} \text{Deflection (Double 115} \times 54) &= \frac{5}{384} \times WL^3/EI \\ &= \frac{5}{384} \times (6.31 \times 10^3 \times 2785^3) \div (7200 \times 1017.3 \times 10^4) \\ &= 24.2 \text{ mm} > L/175 = 2785/175 \\ &= 15.91 \text{ mm} \\ \text{Deflection not ok} \end{aligned}$$

The frames need to be flitched, use Flitch plate 75 × 10 mm

$$\begin{aligned} \text{Deflection} &= \frac{5}{384} \times WL^3/EI \\ &= \frac{5}{384} \times (6.31 \times 10^3 \times 2785^3) \div (7200 \times 2042.69 \times 10^4) \\ &= 12.1 \text{ mm} < L/175 \\ \text{Deflection ok} \end{aligned}$$

$$\begin{aligned} \text{Moment } M &= \frac{WL}{8} \quad \text{Shear} = 6.3/2 = 3.155 \text{ kN} \\ &= (6.31 \times 2.785/8) \\ &= 2.2 \text{ kN.m} \end{aligned}$$

$$\begin{aligned} \text{Moment to Timber} &= 2.2 \times 1017.3/2042.69 \\ &= 1.1 \text{ kN.m} \end{aligned}$$

$$\begin{aligned} \text{Stress in Timber} &= \frac{M}{Z} = 1.1 \times 1000/176.92 \\ &= 6.2 \text{ N/mm}^2 < 11.5 \text{ N/mm}^2 \\ \text{Stress in Timber ok} \end{aligned}$$

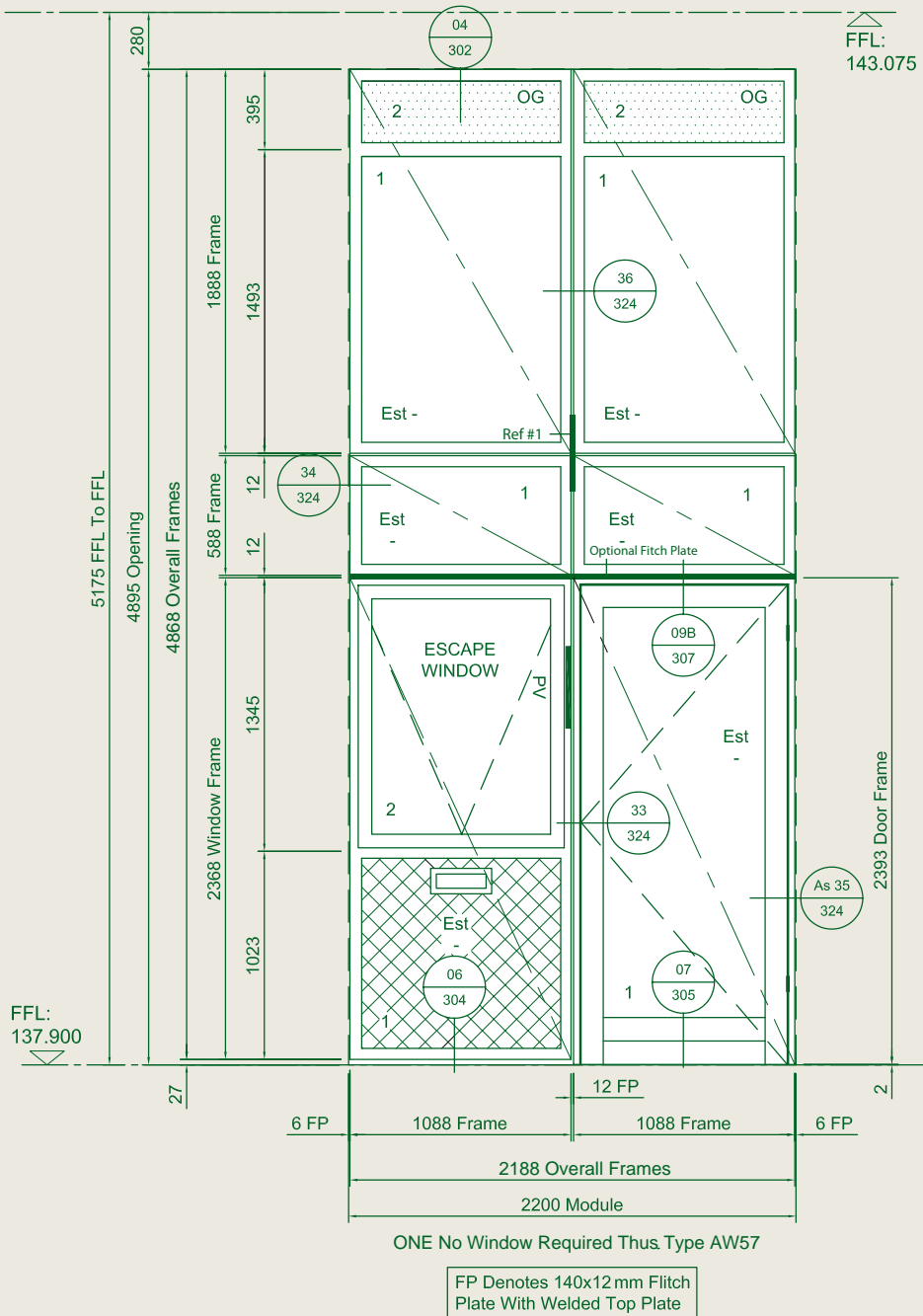
$$\begin{aligned} \text{Moment to Steel} &= 2.2 \times 1025.4/2042.69 \\ &= 1.1 \text{ kN.m} \end{aligned}$$

$$\begin{aligned} \text{Stress in Steel} &= \frac{M}{Z} = 1.1 \times 1000/9.38 \\ &= 117.74 \text{ N/mm}^2 < 180 \text{ N/mm}^2 \\ \text{Stress in Steel ok} \end{aligned}$$

WINDOW AND DOOR SIZING CLEAR AND CONCISE SCHEDULING

The dimensions required for an agreed fitting tolerance will be determined by Rational after an analysis of structural information provided by project management.

Elevation drawings that indicate window and door types, and their specifications, ensure an efficient, problem free installation process.



Floor Level

Total Quantity
2

Sash
2 ALDUS Fixed Frame
1 ALDUS Fixed Frame

Panel – Outer
Enamelled glass 6 mm
Sash 2 – Gap
Ventilated airspace
Sash 2 – Inner
8 mm Intertie
Sash 2 – Internal
16 mm MDF (loose)

Glass Outer
4 mm Clear
Sash 1 – Gap
22 mm Argon filled
Sash 1 – Inner
6.38 mm Energy laminated

Fittings
Special ALDUS glazing bead

Note
No groove for window board

Total Quantity
2

Sash
1 ALDUS Fixed Frame
2 ALDUS Topguided escape window

Glass – Outer
4 mm Clear toughened
Sash 2 – Gap
22 mm Argon filled
Sash 2 – Inner
6.38 mm Energy laminated

Glass – Outer
Aluminium 3 mm
Sash 1 – Gap
Ventilated airspace
Sash 1 – Inner
8 mm Intertie
Sash 1 – Internal
16 mm MDF (loose)

Fittings
– ALDUS bead security sealing
– Hoppe lockable handle satin anodised right
– Push Vent in window right jamb
– ALDUS Glazing bead security sealing (2)
– Special ALDUS glazing bead (1)

Total Quantity
2

Sash
1 ALDUS Fixed Frame

Glass – Outer
4 mm Clear
Glass – Gap
22 mm Argon filled
Glass – Inner
6.38 mm Energy laminated

Fittings
ALDUS glazing bead
Fixed Frame

Note
No groove for window board

Total Quantity
1

Sash
1 ALDUS Entrance door
Left inward
With security PAS 23 & 24, SBD

Glass – Outer
4 mm Clear toughened
Sash 1 – Gap
22 mm Argon filled
Sash 1 – Inner
6.38 mm Energy laminated

Fittings
ALDUS bead security sealing with aluminium threshold

Stainless steel handles & back plates
6 lever cylinder

Note
No groove for window board
Transom 68 x 115 mm

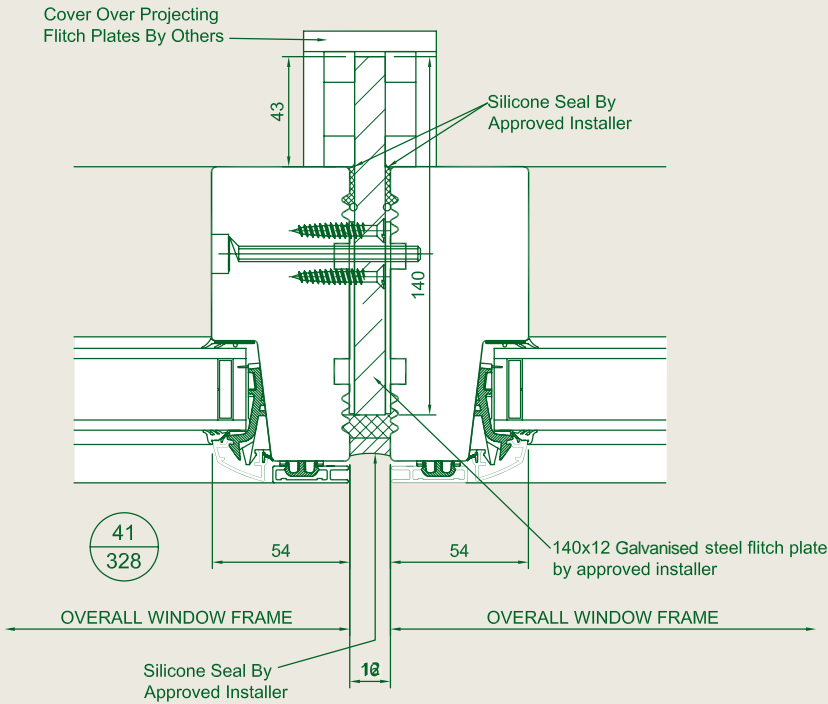
Ref #1
Denotes optional fitch plate

FLITCH PLATE DESIGN BESPOKE DETAILING

Normally constructed from galvanised steel, flitch plates are installed either horizontally or vertically between window or door frames. They can be tied back onto the main structure to ensure rigidity, stability and resistance to wind and deadweight loadings.

It is standard practice that flitch plates are concealed within the final finishes.

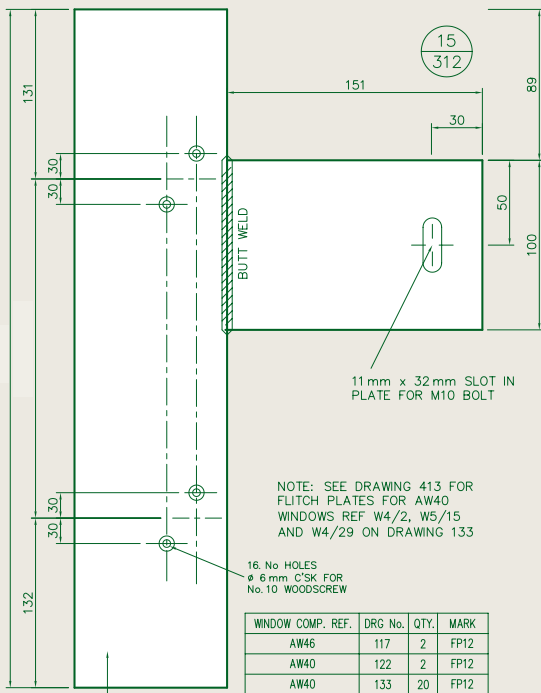
Use of the Rational design service ensures the structural stability of combination units and the correct functionality of windows and doors.



Tolerances
Tolerances for brickwork and blockwork given in British standards codes of practice and model specifications are not acceptable. The horizontal and vertical dimensions of window and door openings shall be accurate to +/- 4 mm and this tolerance shall not be cumulative.

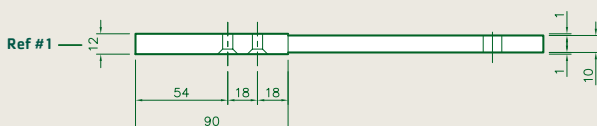
Brickwork Reveals
All External raked joints must be pointed flush to area to be occupied by timber mainframes.

Fixing Brackets
Zinc plated steel straps within 150 mm of corners and 450 mm maximum centres. Screwed to back of frame, plugged and screwed to block or directly fixed through frame.



WINDOW COMP.	REF.	DRG No.	QTY.	MARK
AW46		117	2	FP12
AW40		122	2	FP12
AW40		133	20	FP12

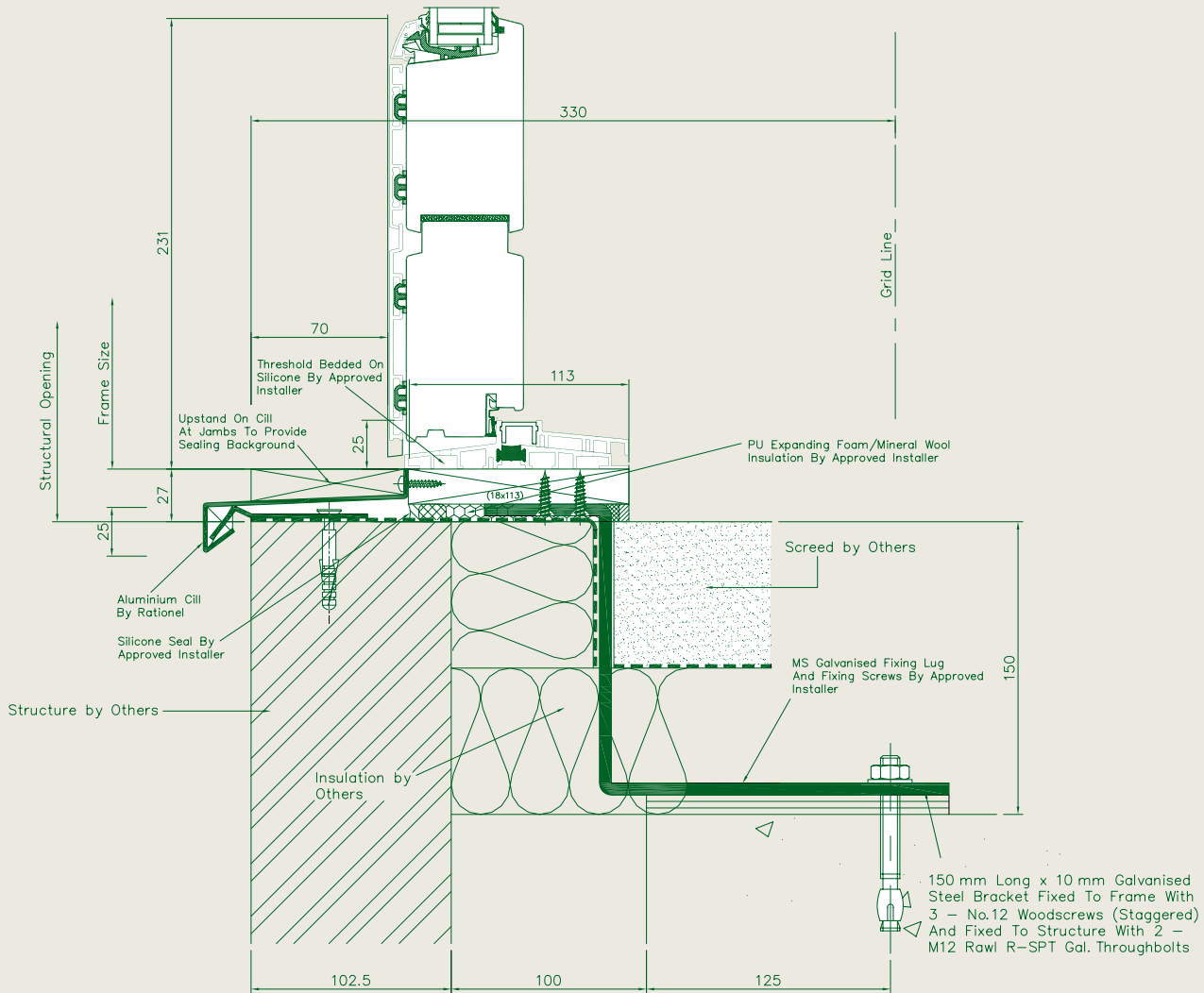
MANUFACTURED FROM 12 mm MILD STEEL PLATE
FINISH - HOT DIP GALVANISED



BRACKET DESIGN

FIXING DETAILS FOR TYPICAL BALCONY

After consultation with the project's design management, Rationel will design bespoke brackets (externally supplied) for the attachment of windows and doors to the main structure.



Wind load at sill level = $1.5 \times 0.5 \times 2.418 \times 0.5 \times 2.075$
= 1.88 kN

DL due to frame = $0.45 \times 0.5 \times 2.418 \times 2.718$
= 1.48 kN

Use continuous 'Z' bracket of MS plate, 6 mm thick

Bending of bracket M = $1.4 \times (1.88 \times 200 + 1.48 \times 80)$
= 692.16 kN.mm

Z_{req} for the bracket = $\frac{692.16}{(1.2 \times 275)}$
= 2.09 cm³

Minimum width of plate = $2.09 \times \frac{6}{(0.6 \times 0.6)}$
= 34.96 cm
= 4.94 kN

Use two M10 bolts fixed to ancon channels to steel bracket at either side of frame joint

Shear capacity of two M10 bolts
(2 x 7.5)
= 15.0 kN > 1.88 kN

Tension capacity of two M10 bolts
(2 x 5.8)
= 11.6 kN > 4.94 kN

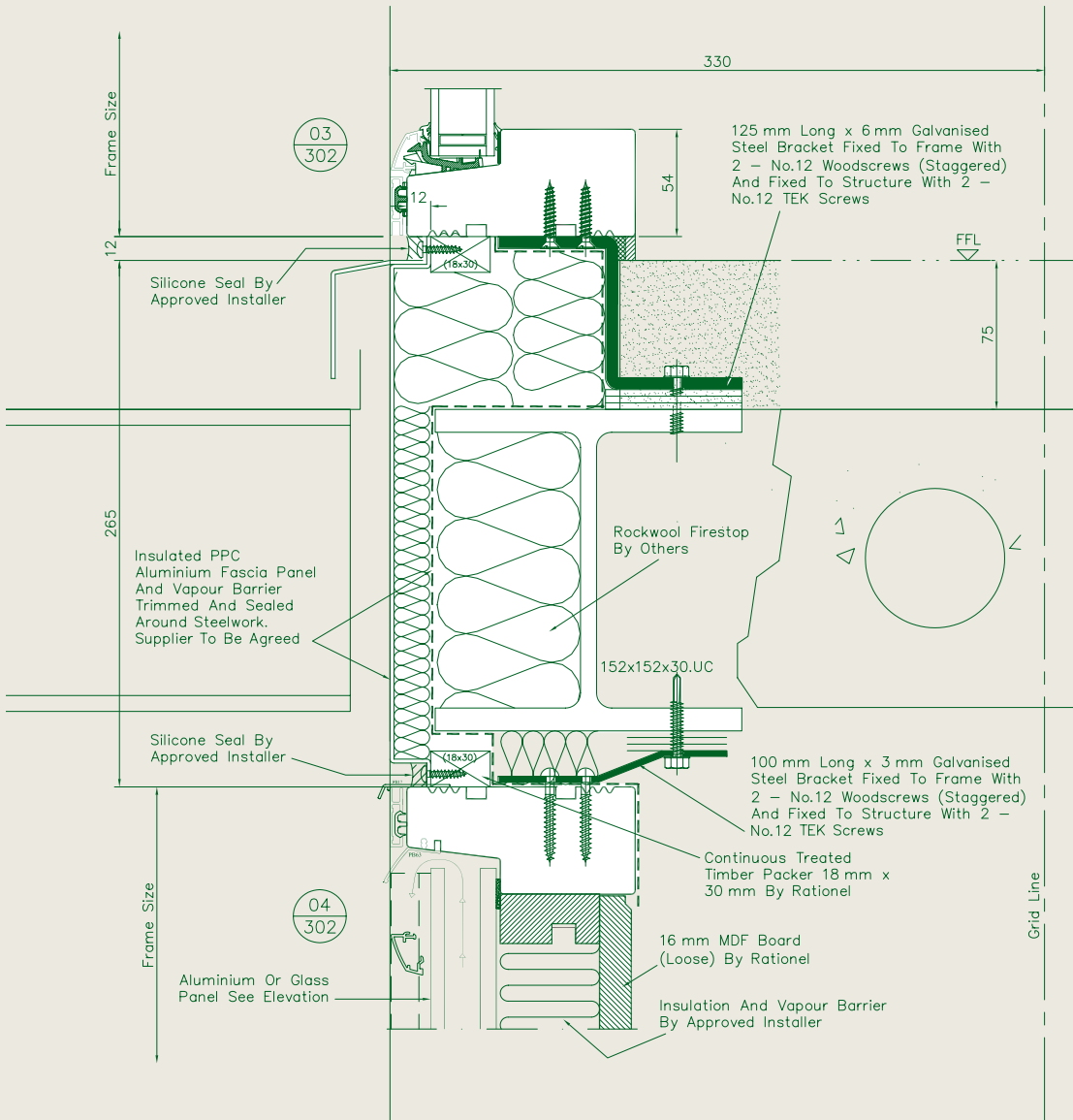
Use two M8 x 92, Hilti HAS stud anchors at either side of frame joint to concrete slab

Shear capacity (4.6 x 2)
= 9.2 kN > 1.88 kN

Tension capacity (4.8 x 2)
= 9.6 kN > 4.94 kN

BRACKET DESIGN

FIXING DETAILS – WINDOW/BRICK CLADDING



Tolerances
Tolerances for brickwork and blockwork given in British standards codes of practice and model specifications are not acceptable. The horizontal and vertical dimensions of window and door openings shall be accurate to +/- 4 mm and this tolerance shall not be cumulative.

Brickwork Reveals
All External raked joints must be pointed flush to area to be occupied by timber mainframes.

Fixing Brackets
Zinc plated steel straps within 150 mm of corners and 450 mm maximum centres. Screwed to back of frame, plugged and screwed to block or directly fixed through frame.

RATIONEL WINDOWS WITH VISION

Throughout the process of design, development and production of our windows and doors we take our responsibility seriously. Rationel has one word in mind 'Vision' as we look towards the future.

Customers across Northern Europe are benefiting from our high quality windows and doors. Rationel only use the best coniferous timber available from sustainable forests.

Our products are developed to give you light, comfortable indoor climate and superb functionality. Continuous improvements give you the peace of mind that Rationel windows and doors provide design and performance to meet demands from the market now and long into the future.

It is important that you feel confident when you choose Rationel, which is why we always aim to live up to our values. Our products are customer focused and well thought through. We are committed to your project, trustworthy and will aim to keep our promises. All together we call it – windows with vision.

If you have a project, no matter how big or small, contact us. We can help you with our expertise and the many opportunities that our product range offers. For further information you can also visit our web-site www.rationel.co.uk.

We look forward to welcoming you to Rationel Windows.

Rationel Windows (UK) Ltd
7 Avonbury Business Park
Howes Lane
Bicester
Oxon OX26 2UA

Telephone
01869 248 181

Facsimile
01869 249 693

www.rationel.co.uk