Concorde Glass Ltd.,

Linx House,

104 Waterloo Rd,

Mablethorpe,

LN12 1LE,

UK.

# Glassloc Juliette Balcony

# Front Fix Fixing Data

| Analysis By | Checked By |
|---|---|
| A.N & R.F. &CC | C.K |

| | | | |
|---|---|---|---|
| 0 | 15/04/2024 | T.S. | Issued |
| **Revision** | **Date** | **Issued By** | **Comment** |

## Contents

## Introduction/Actions/Assumptions/Result Summary:

### Introduction:

TSA was instructed by Concorde Glass Ltd to provide the below Calculations:.

1- Provide fixing details for front-fix connections from GLASSLOC JULIETTE to concrete, steel, aluminium, and timber for spans up to 2000mm.

2- Provide a glass analysis for the GLASSLOC JULIETTE for spans up to 2000mm.

### Actions:

Balustrade load = 0.74kN (Table NA.6 IS1991-1-1:2002)

Point load = 0.5kN (Table NA.5 IS1991-1-1:2002)

Typical High Wind load = 2.5kN/m²

### Assumption:

Concrete Grade = C30/37

Bolts are grade 8.8 Mild Steel.

Timber Grade = C16 (minimum)

### Result Summary:

**A. Front Fix Glassloc Juliette:**

A1. For Span of 2000mm:

1- **Connection to Concrete**: Use 1No. Ultracut FBS II 8×70 20/5 Zinc Plated Steel Fischer Concrete screws@200mm C/C with Minimum Embedment depth is 40mm and Minimum edge distance is 50mm.

2- **Connection to Steel:** Use M8 Grade 8.8 bolts @200mm C/C.

3- **Connection to Wood:** Use M8×40mm Timco Coach Wood Screws @200mm C/C.

4- **Connection to Aluminium:** Use M5.5 ABR Index Screws or similar @200mm C/C.

5- **Glassloc Juliette Glass Panel 3:** 1100mm (H) × 2000mm (W) × 21.52mm Toughened Laminated Glass Panels with EVA Interlayers.

## Glass Strength

### Balustrade Loading:

< 5mins duration => $k_{mod} = 0.77$

$f_{gd} = (k_{mod})(k_{sp})(f_{gk})/\ \gamma_{ma} + k_v(f_{bk}-f_{gk})/\gamma_{mv}$

$f_{gd} = (0.77)(1.0)(45)/1.6 + 1.0(120-45)/1.2$

$\underline{f_{gd} = 84.2\text{N/mm}^2}$

### Wind Loading:

10min duration, Multiple Gust Storm => $k_{mod} = 0.74$

$f_{gd} = (k_{mod})(k_{sp})(f_{gk})/\ \gamma_{ma} + k_v(f_{bk}-f_{gk})/\gamma_{mv}$

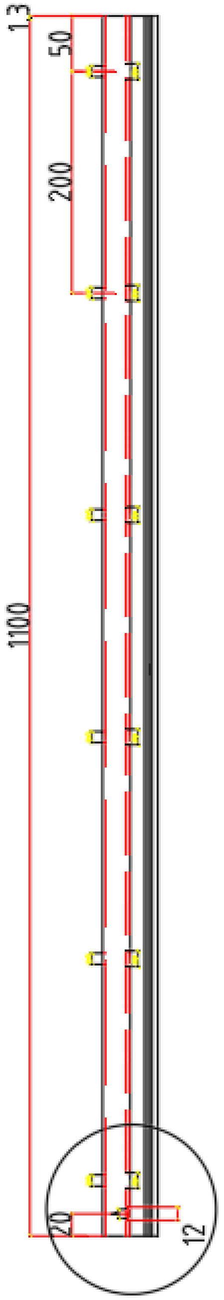
$f_{gd} = (0.74)(1.0)(45)/1.6 + 1.0(120-45)/1.2$

$\underline{f_{gd} = 83.3\text{N/mm}^2}$

| Project: Concorde Glass Ltd | Contract: 1983-1 |
|---|---|
| Subject: Glassloc Juliette Balcony Front Fix | Sheet No. 5 |
| Date: 15/04/2024 | By: A.N & R.F. & CC |

## Glassloc Juliette – Front Fix Connections:

### Sketch of System:



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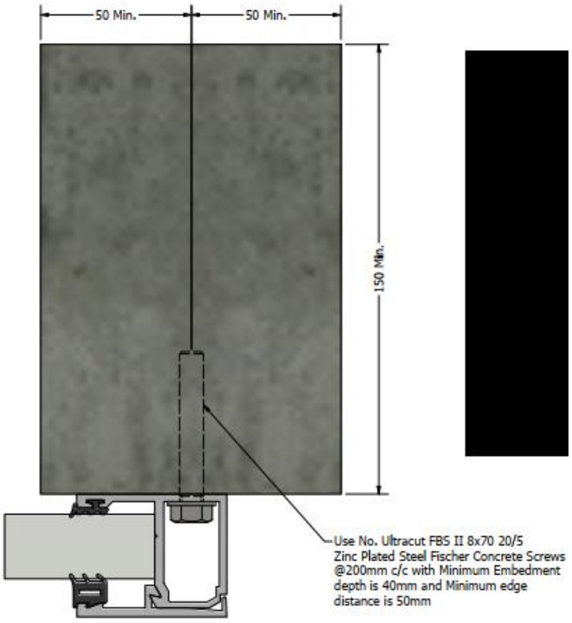
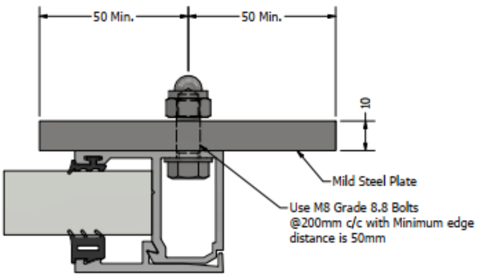
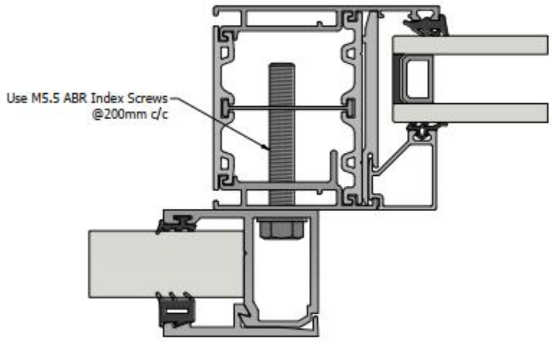
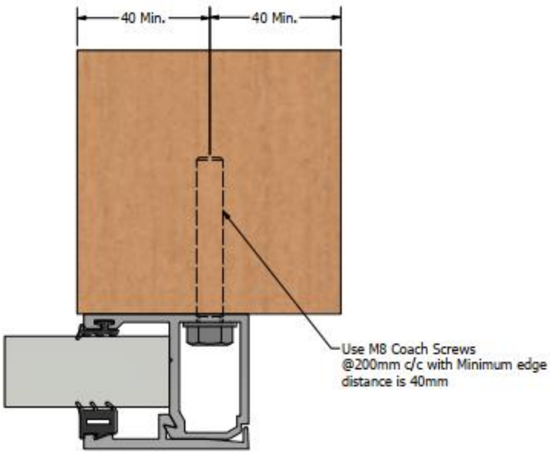
|---|---|
| **Subject:** Glassloc Juliette Balcony Front Fix | **Sheet No.** 6 |
| **Date:** 15/04/2024 | **By:** A.N & R.F. & CC |




Note: The above sketches are for Illustration purposes only.

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| | |
|---|---|
| **Project:** Concorde Glass Ltd | **Contract:** 1983-1 |
| **Subject:** Glassloc Juliette Balcony Front Fix | **Sheet No.** 7 |
| **Date:** 15/04/2024 | **By:** A.N & R.F. & CC |

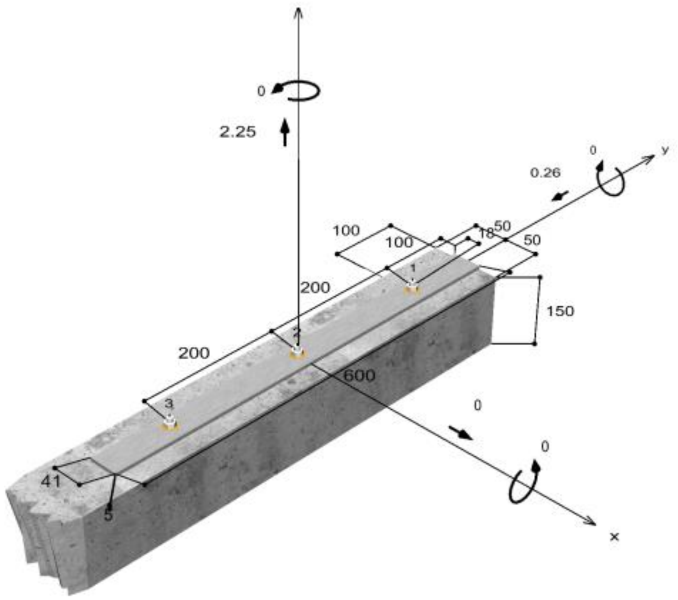
### Connection to Concrete Design - Front Fixed – Span of 2000mm:

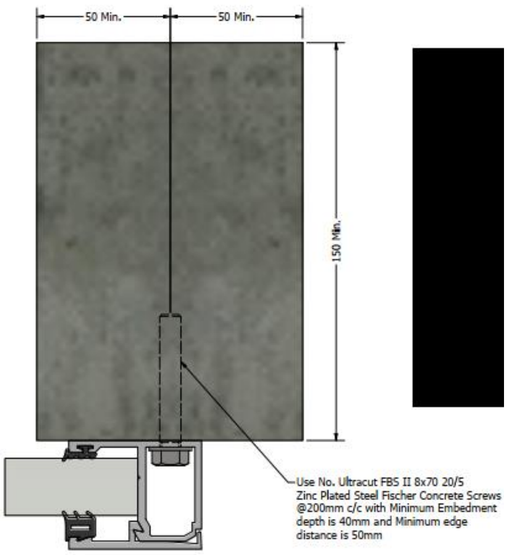
$\text{Tension Load due to Balustrade load} = 0.74\text{kN/m} \times 1.5 \ \times 1\text{m} = 1.11\text{kN (ULS)}$

$\text{Tension Load due to Wind load} = 2.5\text{kN/m}^2 \times 1.5 \ \times 1\text{m} \times 0.6\text{m} = 2.25\text{kN (ULS)}$ – Worst Case.

$\text{Shear Load due to self weight of glass assuming heaviest glass thickness} = 0.26\text{kN (ULS)}$

**Therefore, use 1No. Ultracut FBS II 8×70 20/5 Zinc Plated Steel Fischer Concrete screws@200mm C/C with Minimum Embedment depth is 40mm and Minimum edge distance is 50mm as per the screenshot below.**



Connection To Mild Steel Baseplate - Side Fixed – Span of 2000mm:

**M8 Grade 8.8 Bolt:**

$f_{ub} = 800\ MPa$ *(Grade 8.8 Mild Steel, Table 3.1 EN 1993-1-8:2005)*

$\alpha = 0.6$ *(Table 3.4 EN 1993-1-8:2005)*

$A = 36.6mm^2$ *(For M8 Bolts)*

$\lambda_{m2} = 1.25$ *(Table 5.1 EN 1993-1-4:2006)*

**Tensile Resistance Check:** ***(Table 3.4 EN 1993-1-8:2005)***

$F_{t,Ed}$: *is the design tensile force per bolt for the ultimate limit state.*

$F_{t,Rd}$: *is the design tension resistance per bolt.*

$F_{t,Ed} = 0.84kN$

$$F_{t,Rd} = \frac{K_2 F_{ub} A}{\lambda m2} = \frac{0.9\ x\ 800\ x\ 36.6}{1.25}\ x\ 10^{-3} = 21.08kN \rightarrow F_{t,Rd} = 21.08kN > 0.84kN$$ **Okay**

**Shear Resistance Check:** ***(Table 3.4 EN 1993-1-8:2005)***

$F_{v,Ed}$: *is the design shear force per bolt for the ultimate limit state.*

$F_{v,Rd}$: *is the design shear resistance per bolt.*

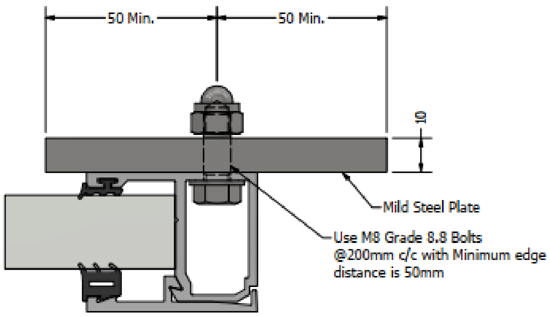
$F_{V,Ed} = 0.09kN$

$$F_{V,Rd} = \frac{\alpha F_{ub} A}{\lambda m2} = \frac{0.6\ x\ 800\ x\ 36.6}{1.25}\ x\ 10^{-3} = 14.05kN \rightarrow F_{V,Rd} = 14.05kN > 0.09kN$$ **Okay**

**Combined Shear & Tensile Resistance Check:** ***(Table 3.4 EN 1993-1-8:2005)***

$$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4F_{t,Rd}} \leq 1 \rightarrow \frac{0.09}{14.05} + \frac{0.84}{1.4\ x\ 21.08} = 0.035 \leq 1$$ **Okay**

**Therefore, Use M8 Grade 8.8 Bolts @200mm C/C.**



Connection To Timber - Front Fixed – Span of 2000mm:

**Tensile Resistance Check:**

$\text{Tensile Force per screw} = \frac{0.84\text{kN}}{1.5} = 0.56\text{kN}$

$\text{Tension Capacity of } 8 \times 40\text{mm Coach Screws} = 16.21\text{kN}$ as per specification sheet in appendix A.

$\text{Therefore}, 16.21\text{kN} > 0.56\text{kN}$ **Okay**

**Shear Resistance Check:**

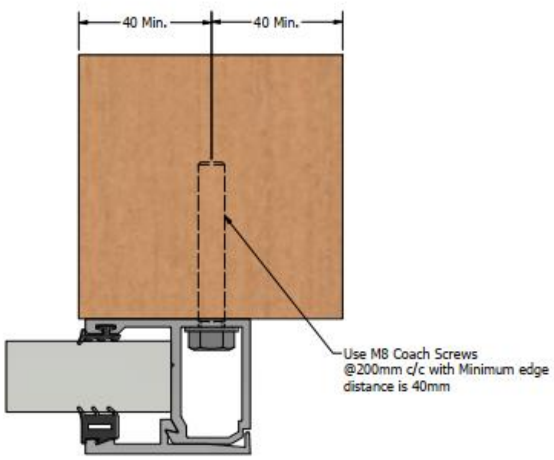
$\text{Shear Force per screw} = \frac{0.09\text{kN}}{1.5} = 0.06\text{kN}$

$\text{Shear Capacity of M8 Coach Screws} = 1.17\text{kN}$ as per BS 5268-2:2002

$\text{Therefore}, 1.17\text{kN} > 0.06\text{kN}$ **Okay**

**Minimum edge distance required is 5d = 5 x 8 = 40mm.**

**Therefore, use M8 Coach Screws or similar @200mm C/C.**



## Connection To Aluminium window frame - Front Fixed – Span of 2000mm:

**Tensile Resistance Check:**

$$\text{Tensile Force per screw} = 0.84\text{kN}$$

$$\text{Tension Capacity of M5.5 Index Screws} = \frac{9.63\text{kN}}{2} = 4.8\text{kN per Datasheet in Appendix B}$$

$\text{Therefore}, 4.81\text{kN} > 0.84\text{kN}$ **Okay**

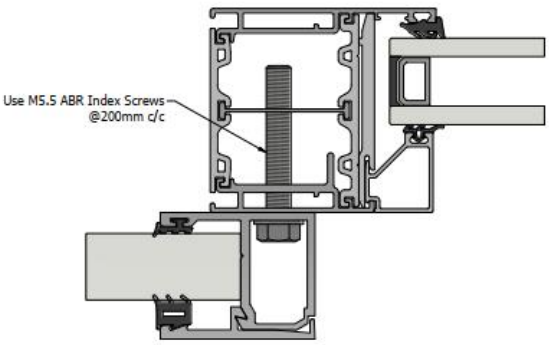
**Shear Resistance Check:**

$$\text{Shear Force per screw} = 0.09\text{kN}$$

$$\text{Shear Capacity of M5.5 Index Screws} = \frac{4.82\text{kN}}{2} = 2.41\text{kN as per Datasheet in Appendix B.}$$

$\text{Therefore}, 2.41\text{kN} > 0.09\text{kN}$ **Okay**

**Therefore, use M5.5 ABR Index Screws or similar @200mm C/C.**



## Glass Analysis for Span of 2000mm – Glassloc Juliette:

**System Sketch:**

| Project: Concorde Glass Ltd | Contract: 1983-1 |
|---|---|
| Subject: Glassloc Juliette Balcony Front Fix | Sheet No. 12 |
| Date: 15/04/2024 | By: A.N & R.F. & CC |

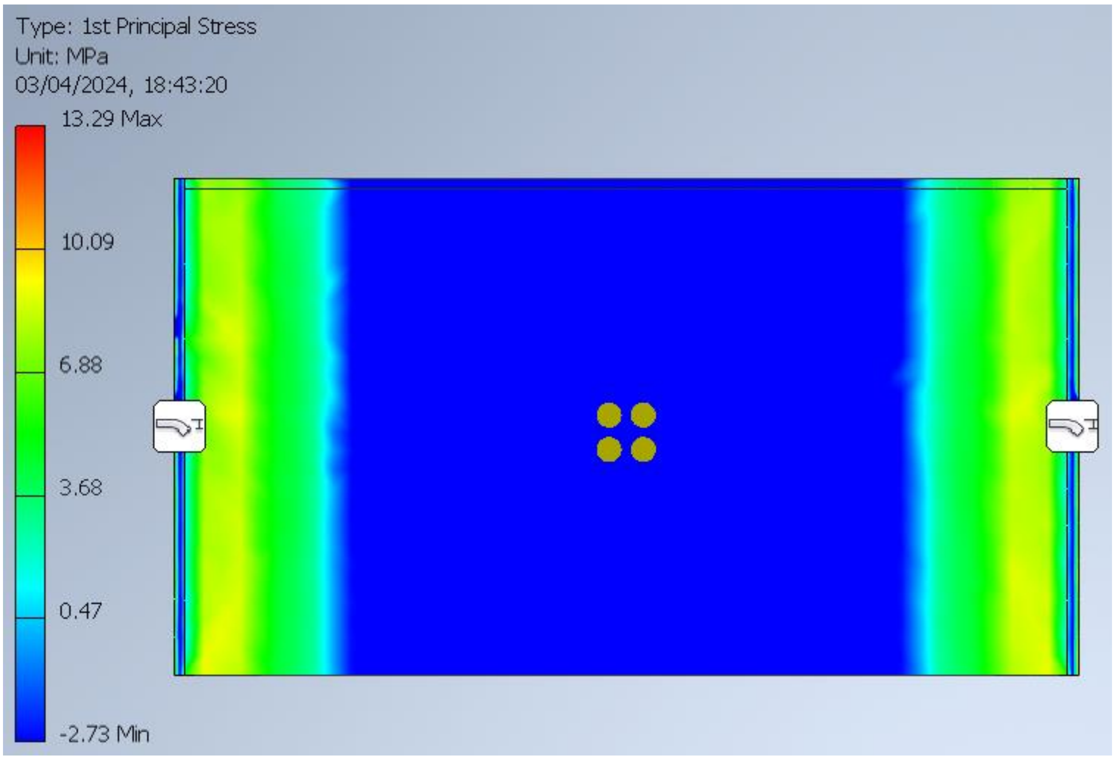
**Glass Analysis - Bending Stress of Glass Panel due to 2.5kN/m2 Wind Loading:**

- Analysis Software was used to determine maximum bending stress of the glass due to 2.5N/m2 Wind Loading.
- 10/10/1.52mm T/L/T Glass analysed, horizontally toughened Laminated.
- Interlayer Properties used for analysis, E= 18MPa, G = 6.82MPa EVA
- Bending Stress analysed based on glass panel of 2000 (l) x 1100 (h) mm.

**Result:**

Max. Bending Stress = 13.29N/mm$^2$ X 1.5 = 19.94N/mm$^2$ < 83.3N/mm$^2$

**OK in Bending**



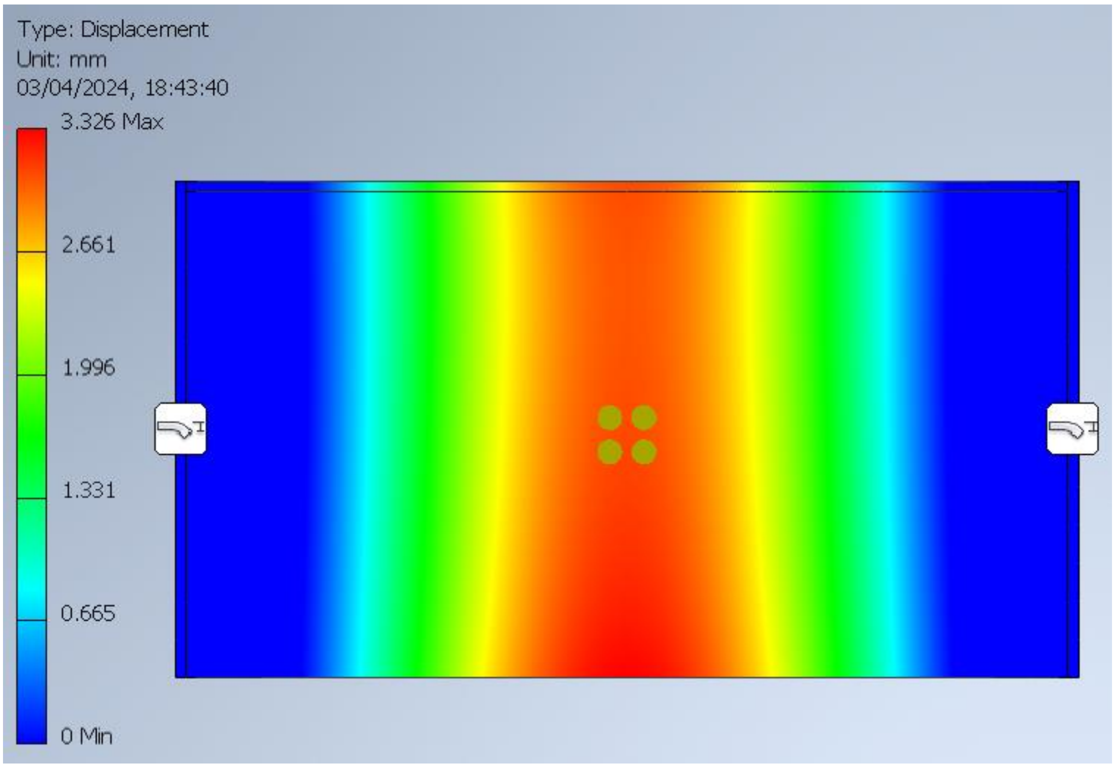
**Glass Analysis - Deflection of Glass Panel due to 2.5kN/m2 Wind Loading:**

- Analysis Software was used to determine maximum deflection of the glass due to 2.5N/m2 Wind Loading
- 10/10/1.52mm T/L/T Glass analysed, horizontally toughened Laminated
- Interlayer Properties used for analysis, E= 18MPa, G = 6.82MPa EVA
- Deflection analysed based on glass panel of 2000 (l) x 1100 (h) mm

**Result:**

Max. Deflection = 3.326mm < 25mm {BS6180:2011 cl. 6.4.1}

**OK in Deflection (Glass Only)**



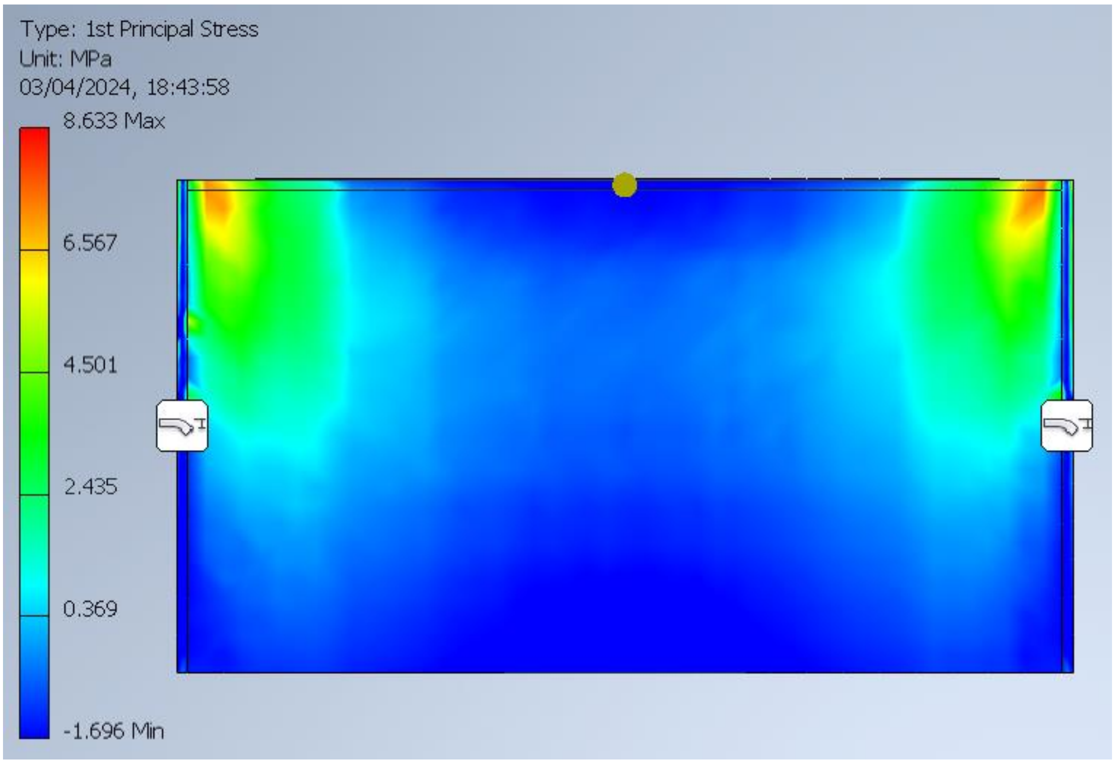
## Glass Analysis - Bending Stress of Glass Panel due to 0.74kN/m Balustrade Loading:

- Analysis Software was used to determine maximum bending stress of the glass due to 0.74kN/m Balustrade Loading
- Actual Balustrade Load applied to the glass is 1.48kN (0.74kN/m x 2.0m)
- 10/10/1.52mm T/L/T Glass analysed, horizontally toughened Laminated
- Interlayer Properties used for analysis, E= 18MPa, G = 6.82MPa EVA
- Bending Stress analysed based on glass panel of 2000 (l) x 1100 (h) mm

**Result:**

Max. Bending Stress = 8.633N/mm$^2$ X 1.5 = 12.95N/mm$^2$ < 84.2N/mm$^2$

**OK in Bending**



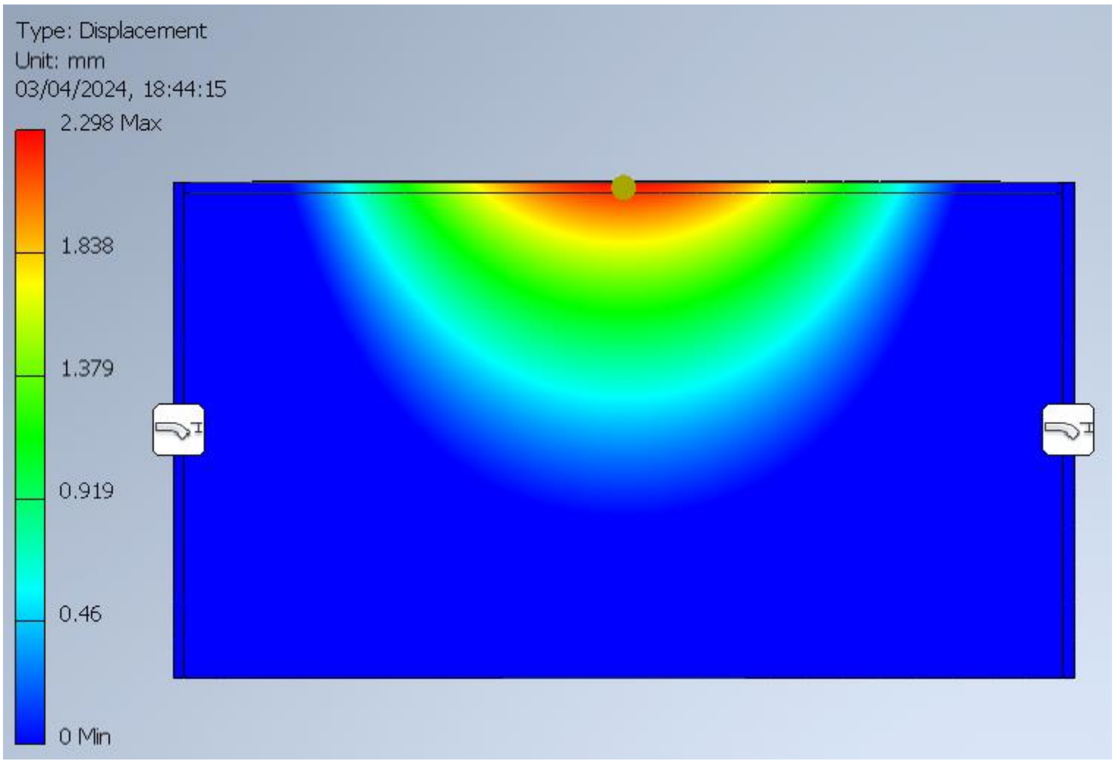
## Glass Analysis - Deflection of Glass Panel due to 0.74kN/m Balustrade Loading:

- Analysis Software was used to determine maximum deflection of the glass due to 0.74kN/m Balustrade Loading
- Actual Balustrade Load applied to the glass is 1.48kN (0.74kN/m x 2.0m)
- 10/10/1.52mm T/L/T Glass analysed, horizontally toughened Laminated
- Interlayer Properties used for analysis, E= 18MPa, G = 6.82MPa EVA
- Deflection analysed based on glass panel of 2000 (l) x 1100 (h) mm

**Result:**

Max. Deflection = 2.298mm < 25mm {BS6180:2011 cl. 6.4.1}

**OK in Deflection (Glass Only)**



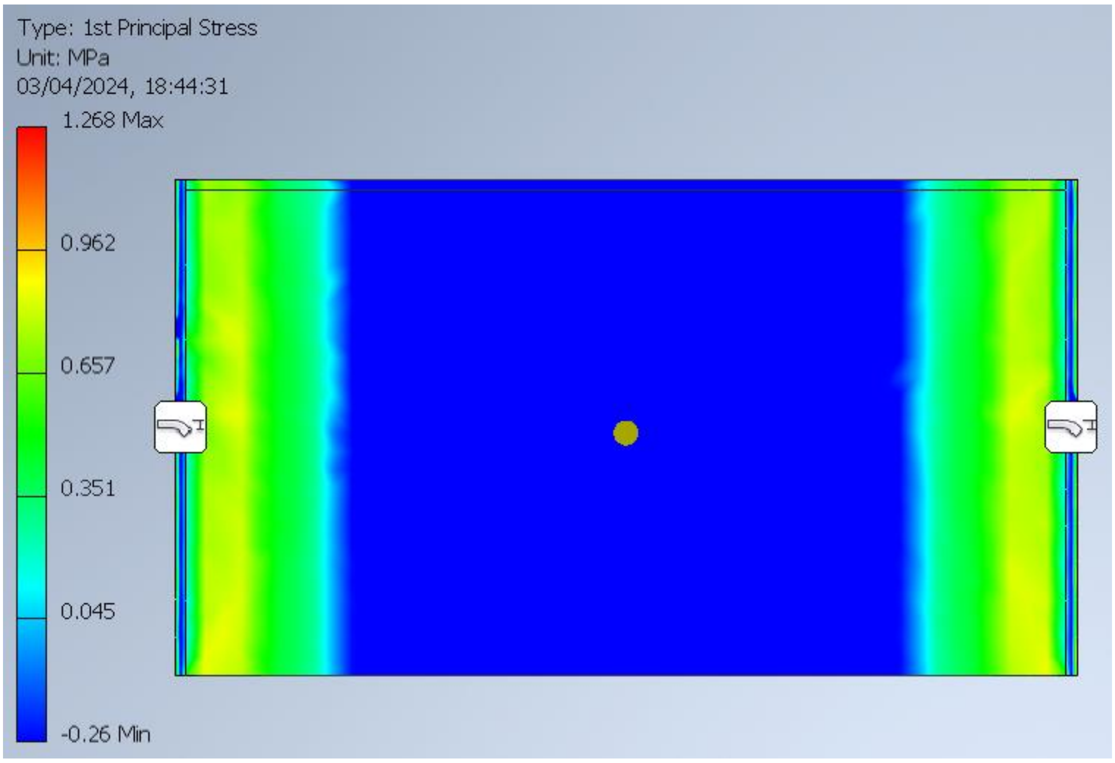
**Glass Analysis - Bending Stress of Glass Panel due to 0.5kN Point Load:**

- Analysis Software was used to determine maximum bending stress of the glass due to 0.5kN Point Load
- 10/10/1.52mm T/L/T Glass analysed, horizontally toughened Laminated
- Interlayer Properties used for analysis, E= 18MPa, G = 6.82MPa EVA
- Bending Stress analysed based on glass panel of 2000 (l) x 1100 (h) mm

**Result:**

Max. Bending Stress = 1.268N/mm$^2$ X 1.5 = 1.91N/mm$^2$ < 84.2N/mm$^2$

**OK in Bending**



| | | |
|---|---|---|
| TSA TED SINGLETON & ASSOCIATES CONSULTING ENGINEERS | **Project:** Concorde Glass Ltd | **Contract:** 1983-1 |
| | **Subject:** Glassloc Juliette Balcony Front Fix | **Sheet No.** 17 |
| | **Date:** 15/04/2024 | **By:** A.N & R.F. & CC |

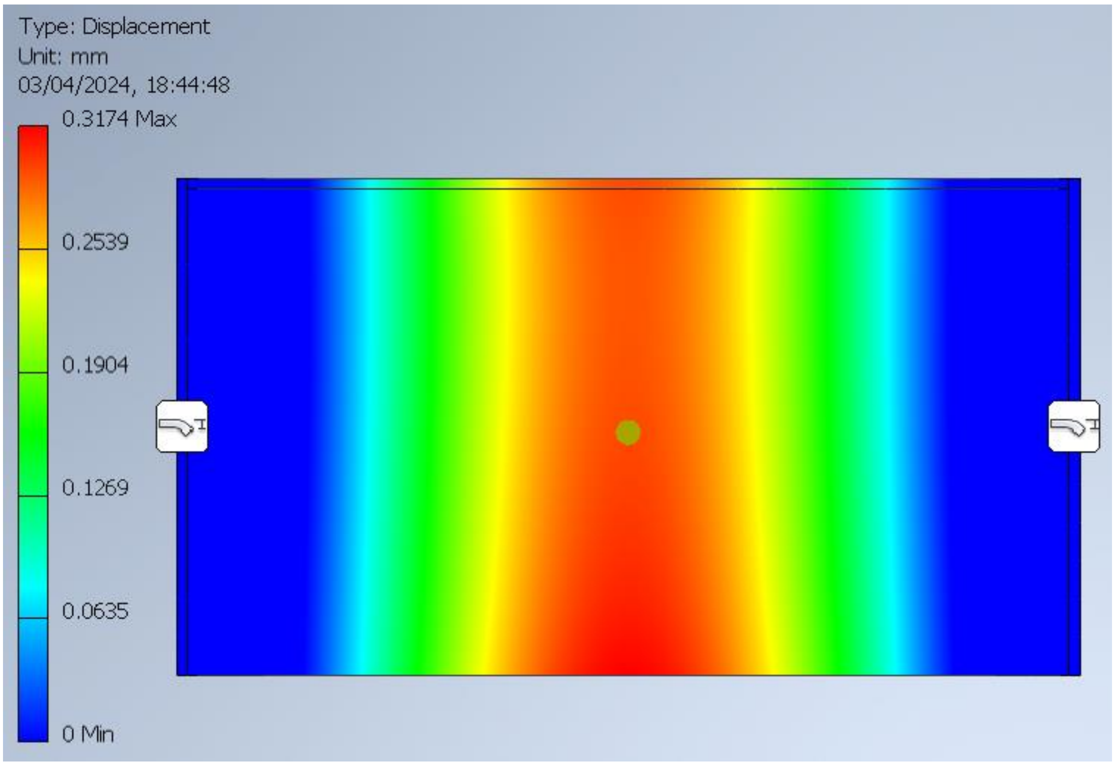
## Glass Analysis - Deflection of Glass Panel due to 0.5kN Point Load:

- Analysis Software was used to determine maximum deflection of the glass due to 0.5kN Point Load
- 10/10/1.52mm T/L/T Glass analysed, horizontally toughened Laminated
- Interlayer Properties used for analysis, E= 18MPa, G = 6.82MPa EVA
- Deflection analysed based on glass panel of 2000 (l) x 1100 (h) mm

**Result:**

Max. Deflection = 0.3174mm < 25mm {BS6180:2011 cl. 6.4.1}

**OK in Deflection (Glass Only)**



## Appendix A – Timco Timber Screws Specfication Sheet

TSA is Both the Designer and the Specifier of the Fixings.

## TIMco Coach Screws DIN571

CE

# DECLARATION OF PERFORMANCE

DOP7 v2

We here by declare the following designated products

**TIMco Coach Screws DIN571**
**Diameter 6.0mm, 8.0mm, 10.0mm, 12.0mm**

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Have been tested by the following independant testing organisation:

- Notified Body 1015
  Strojirensky Zkusebni Ustav, s.p., Czech Republic

And that they have performed initial type testing under system 3, Annex V of the regulation (EU) no. 305/2011 (Construction Products Regulation), with the reference to the harmonised European standard (hEN) BS EN 14592:2008+A1:2012 (Timber structures - Dowel type fasteners - Requirements) for nails intended for the use in "load bearing timber structures" and produced the calculation/test reports and certificates as listed below;

**Certificate Number:** E-30-20414-13, E-30-20405-13, E-30-20406-13, E-30-20407-13.

**Test Report Number:** No. 30-9915/1 to No. 30-9915/4.

**Factory Process Control (FPC)** has been established by the factory and independently audited by TUV Rheinland UK in accordance with ISO9001:2008..

This declaration of conformity is valid until there is a significant change in the product and declared characteristics. ie. raw material or change in production process.

---

Signed by: [signature]

Name: *Simon Midwood*

Position: *Managing Director*

Date & Location: *29. 07. 2013*
*TIMco House, CW5 6BJ*

**This declaration is the responsibility of the importer**
T.I Midwood & Co. Ltd. Green Lane, Wardle, Nantwich, Cheshire, CW5 6BJ

TIMco

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| **Project:** Concorde Glass Ltd | **Contract:** 1983-1 |
|---|---|
| **Subject:** Glassloc Juliette Balcony Front Fix | **Sheet No.** 20 |
| **Date:** 15/04/2024 | **By:** A.N & R.F. & CC |

# Declaration Of Performance

## TIMco Coach Screw DIN571 - Zinc

| Size | Nominal diameter d (mm) | Inner thread diameter d1 | Total Length L (mm) | Thread Length lg (mm) | Head diameter dh (mm) | Test Report No. | Certificate No. | Characteristic yield moment $M_{y,k}$ (Nmm) | | Characteristic withdrawal parameter $f_{ax,k}$ (N/mm$^2$) | | Characteristic head pull-through parameter $f_{head,k}$ (N/mm$^2$) | Characteristic tensile capacity $f_{tens,k}$ (kN) | Characteristic torsional ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Thread Section | Smooth Section | Loading across the fibre | Loading along the fiber | | | |
| 6 x 25 | 6.0 | 4.2 | 25 | 15 | 10.0 | No. 30-9915/1 | E-30-20414-13 | 11 166 | 18 366 | 16,64 | 10,45 | 24,27 | 9.9 | 1,87* |
| 6 x 30 | | | 30 | 18 | | | | | | | | | | |
| 6 x 40 | | | 40 | 24 | | | | | | | | | | |
| 6 x 50 | | | 50 | 30 | | | | | | | | | | |
| 6 x 60 | | | 60 | 36 | | | | | | | | | | |
| 6 x 65 | | | 65 | 39 | | | | | | | | | | |
| 6 x 70 | | | 70 | 42 | | | | | | | | | | |
| 6 x 75 | | | 75 | 45 | | | | | | | | | | |
| 6 x 80 | | | 80 | 48 | | | | | | | | | | |
| 6 x 100 | | | 100 | 60 | | | | | | | | | | |
| 8 x 30 | 8.0 | 5.6 | 30 | 18 | 13.0 | No. 30-9915/2 | E-30-20405-13 | 22 852 | 41 589 | 13,91 | 8,52 | 22,20 | 16,21 | 1,50* |
| 8 x 40 | | | 40 | 24 | | | | | | | | | | |
| 8 x 50 | | | 50 | 30 | | | | | | | | | | |
| 8 x 60 | | | 60 | 36 | | | | | | | | | | |
| 8 x 65 | | | 65 | 39 | | | | | | | | | | |
| 8 x 70 | | | 70 | 42 | | | | | | | | | | |
| 8 x 75 | | | 75 | 45 | | | | | | | | | | |
| 8 x 80 | | | 80 | 48 | | | | | | | | | | |
| 8 x 90 | | | 90 | 54 | | | | | | | | | | |
| 8 x 100 | | | 100 | 60 | | | | | | | | | | |
| 8 x 150 | | | 150 | 90 | | | | | | | | | | |
| 10 x 40 | 10.0 | 7.0 | 40 | 24 | 17.0 | No. 30-9915/3 | E-30-20406-13 | 42 887 | 89 040 | 12,47 | 10,04 | 22,13 | 26,45 | 2,18* |
| 10 x 50 | | | 50 | 30 | | | | | | | | | | |
| 10 x 60 | | | 60 | 36 | | | | | | | | | | |
| 10 x 70 | | | 70 | 42 | | | | | | | | | | |
| 10 x 75 | | | 75 | 45 | | | | | | | | | | |
| 10 x 80 | | | 80 | 48 | | | | | | | | | | |
| 10 x 100 | | | 100 | 60 | | | | | | | | | | |
| 10 x 120 | | | 120 | 72 | | | | | | | | | | |
| 10 x 130 | | | 130 | 78 | | | | | | | | | | |
| 10 x 150 | | | 150 | 90 | | | | | | | | | | |
| 10 x 200 | | | 200 | 120 | | | | | | | | | | |
| 12 x 50 | 12.0 | 9.0 | 50 | 30 | 19.0 | No. 30-9915/4 | E-30-20407-13 | 82 789 | 147 141 | 12,24 | 9,81 | 21,12 | 40,37 | 2,11* |
| 12 x 75 | | | 75 | 45 | | | | | | | | | | |
| 12 x 80 | | | 80 | 48 | | | | | | | | | | |
| 12 x 100 | | | 100 | 60 | | | | | | | | | | |
| 12 x 150 | | | 150 | 90 | | | | | | | | | | |

## Appendix B – Index Screws Specfication Sheet

TSA is Both the Designer and the Specifier of the Fixings.

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CONSULTING ENGINEERS

TECHNICAL DATA SHEET

INDEX FIXING SYSTEMS

## SELF-DRILLING SCREW FIXINGS

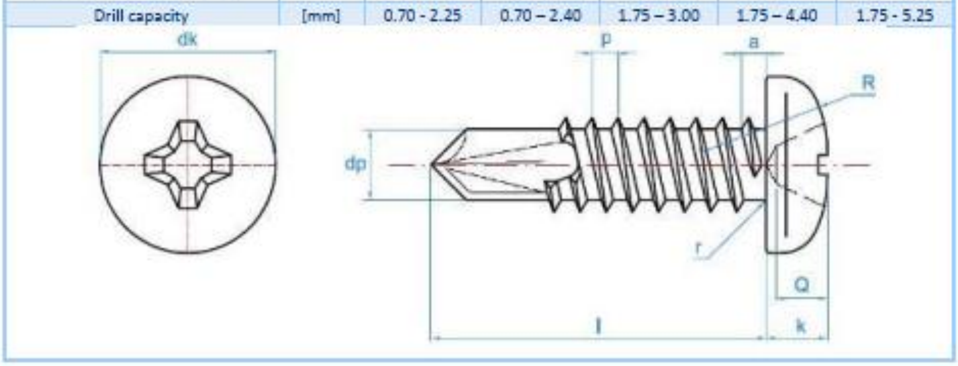
| Denomination: SELF-DRILLING SCREW FIXINGS | Codes: ABE, ABEI, ARE, ABR, ABRBLE, NBR, ABRC, ABRCA2, ABRA2, ABA, FS, ABP, NBP, ABPC, ABPCA2, TAEZ, TAEN, BCPZ, BZPZBL, BCPN, BCPB, BCPA2, BIE, AUTO, BAUTO, RS. | | |
|---|---|---|---|
| Reference: FT BRO-en | Date: 30/05/19 | Revision: 13 | Page: 12 of 23 |

## 5. ABR, NBR, ABR_BLE, ABRA2

Self-drilling screw - Dome head - Ph socket


### 4.1. Details

| Code | | ST 3.5 | ST 3.9 | ST 4.2 | ST 4.8 | ST 5.5 |
|---|---|---|---|---|---|---|
| $d_k$: head diameter | [mm] | 6.9 | 7.5 | 8.2 | 9.5 | 10.8 |
| k: head thickness | [mm] | 2.60 | 2.80 | 3.05 | 3.55 | 3.95 |
| Ph bit | | nº 2 | nº 2 | nº 2 | nº 2 | nº 3 |
| R: head radius | [mm] | 5.4 | 5.8 | 6.2 | 7.2 | 8.2 |
| D: exterior thread diameter | [mm] | 3.53 | 3.91 | 4.22 | 4.80 | 5.46 |
| d: interior thread diameter | [mm] | 2.64 | 2.92 | 3.10 | 3.58 | 4.17 |
| p: thread | [mm] | 1.3 | 1.3 | 1.4 | 1.6 | 1.8 |
| l: lengths | [mm] | 9.5 - 32 | 13 - 32 | 13 - 50 | 13 - 120 | 19- 73 |
| Installation bit code (Ph bit) | | PUPHC02<br>PUPHL02 | PUPHC02<br>PUPHL02 | PUPHC02<br>PUPHL02 | PUPHC02<br>PUPHL02 | PUPHC03<br>PUPHL03 |
| Drill capacity | [mm] | 0.70 - 2.25 | 0.70 – 2.40 | 1.75 – 3.00 | 1.75 – 4.40 | 1.75 - 5.25 |




- Zinc-plated (code ABR), white zinc-plated (code ABR_BLE) and black zinc-plated (code NBR) finishes.
- A2 stainless steel version (code ABRA2) for use exclusively with aluminium (does not produce corrosion by galvanic coupling). Do not use screw in stainless steel to drill steel, as point will burn out due to lack of hardness.

| Project: Concorde Glass Ltd | Contract: 1983-1 |
|---|---|
| Subject: Glassloc Juliette Balcony Front Fix | Sheet No. 23 |
| Date: 15/04/2024 | By: A.N & R.F. & CC |

TSA
TED SINGLETON & ASSOCIATES
CONSULTING ENGINEERS

TECHNICAL DATA SHEET

INDEX FIXING SYSTEMS

# SELF-DRILLING SCREW FIXINGS

Denomination: SELF-DRILLING SCREW FIXINGS

Codes: ABE, ABEI, ARE, ABR, ABRBLE, NBR, ABRC, ABRCA2, ABRA2, ABA, FS, ABP, NBP, ABPC, ABPCA2, TAEZ, TAEN, BCPZ, BZPZBL, BCPN, BCPB, BCPA2, BIE, AUTO, BAUTO, RS.

Reference: FT BRO-en | Date: 30/05/19 | Revision: 13 | Page: 6 of 23

| MAXIMUM THICKNESS TO BE FIXED | | | | | | |
|---|---|---|---|---|---|---|
| Length | ST 3,5 | ST 3,9 | ST 4,2 | ST 4,8 | ST 5,5 | ST 6,3 |
| 9,5 | 2,85 | | | | | |
| 11 | 4,2 | | | | | |
| 13 | 6,2 | 5,8 | 4,3 | 3,7 | | |
| 16 | 9,2 | 8,8 | 7,3 | 5,5 | | |
| 19 | 12,1 | 11,7 | 10,3 | 8,7 | 8,7 | 7 |
| 22 | 15,1 | 14,7 | 13,3 | 11,7 | 11,7 | 10 |
| 25 | 18,1 | 17,7 | 16,3 | 14,7 | 14,7 | 13 |
| 32 | 25,1 | 24,5 | 23 | 21,5 | 21,5 | 20 |
| 38 | | 30,5 | 29 | 27,5 | 27,5 | 26 |
| 45 | | | 36 | 34,5 | 34,5 | 33 |
| 50 | | | 41 | 39,5 | 39,5 | 38 |
| 60 | | | | 49,5 | 49,5 | 48 |
| 63 | | | | 52,5 | 52,5 | 51 |
| 73 | | | | 62,5 | 62,5 | 61 |
| 75 | | | | 64,5 | 64,5 | 63 |
| 80 | | | | 69,5 | | 68 |
| 90 | | | | 79,5 | | 78 |
| 100 | | | | 89,5 | | 88 |
| 110 | | | | | | 98 |
| 120 | | | | | | 108 |
| 130 | | | | | | 118 |
| 140 | | | | | | 128 |

SCREW RESISTANCE CHARACTERISTICS*

| SIZE | TENSION [kN] | SHEAR [kN] |
|---|---|---|
| ST 2.9 | 2.62 | 1.31 |
| ST 3.5 | 3.81 | 1.91 |
| ST 3.9 | 4.64 | 2.32 |
| ST 4.2 | 5.26 | 2.63 |
| ST 4.8 | 7.11 | 3.56 |
| ST 5.5 | 9.63 | 4.82 |
| ST 6.3 | 13.36 | 6.68 |

1 KN = 100 Kg

## Appendix C - Fischer Reports

TSA is Both the Designer and the Specifier of the Fixings.

| **Client** | **Design Office** | **MASONRY FIXINGS** |
|---|---|---|
| **Concorde Glass Ltd.,**<br><br>Linx House,<br>104 Waterloo Rd,<br>Mablethorpe,<br>LN12 1LE,<br>UK. | **TSA Consulting Engineers**<br>Ted Singleton<br>4 BLACKWATER HOUSE<br>MALLOW BUSINESS PARK<br>GOULDS HILL<br>MALLOW<br>CO. CORK<br>P51 KC8C<br>Phone: 0868168300<br>ted@tsaconsulteng.ie<br>tsaconsulteng.ie | <br>Unit 83, Cherry Orchard Industrial Estate<br>Dublin 10<br>Phone: +353 1 642 6700<br>Fax: +353 1 626 2197<br>technical@masonryfixings.ie<br>www.masonryfixings.ie |

## Comment

1983-1_Glassloc Juliette_Connection to Concrete Design - Front Fixed – Span of 2000mm_0

# Design Specifications

## Anchor

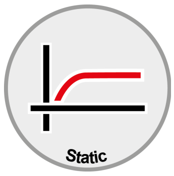
| | |
|---|---|
| Anchor system | fischer Concrete screw ULTRACUT FBS II |
| Anchor | Concrete screw with hexagon head and washer<br>FBS II 8x70 20/5 US TX,<br>zinc plated steel, with filling disc |
| Calculated anchorage depth | 40 mm |
| Design Data | Anchor design in Concrete according European Technical Assessment ETA-15/0352, Option 1,<br>Issued 05/10/2020 |

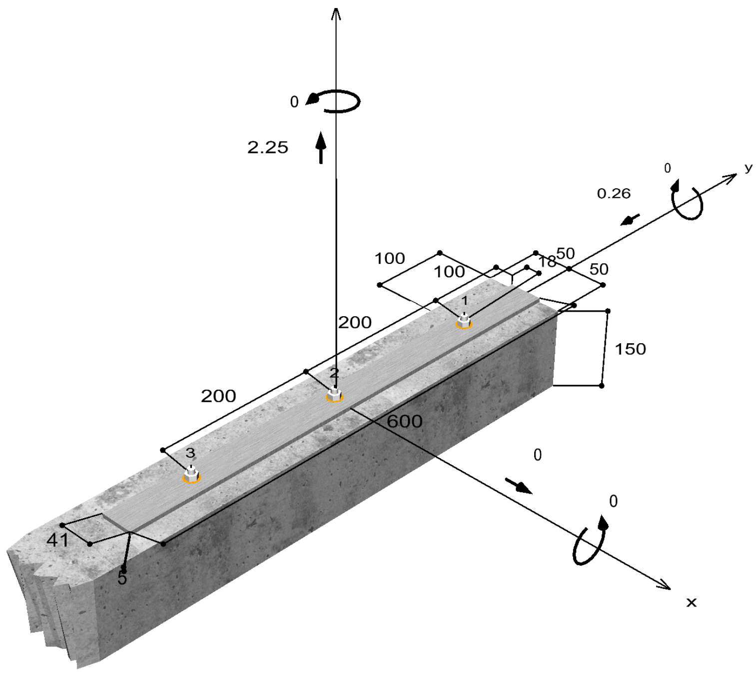
## Geometry / Loads / Scale units

**mm, kN, kNm**

**Value of design actions (including**

**partial safety factor for the load)**




**Not drawn to scale**

## Input data

| | |
|---|---|
| Design method | EN 1992-4:2018 mechanical fastener |
| Base material | C30/37, EN 206 |
| Concrete condition | Cracked, dry hole |
| Reinforcement | No or standard reinforcement. No edge reinforcement. With reinforcement against splitting |
| Drilling method | Hammer drilling |
| Installation type | Push-through installation |
| Annular gap | Annular gap filled |
| Type of loading | Permanent-Transient/Static |
| Base plate location | Base plate flush installed on base material |
| Base plate geometry | 41 mm x 600 mm x 5 mm |
| Profile type | None |

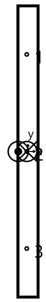
# Design actions *)

| # | $N_{Ed}$ kN | $V_{Ed,x}$ kN | $V_{Ed,y}$ kN | $M_{Ed,x}$ kNm | $M_{Ed,y}$ kNm | $M_{T,Ed}$ kNm | Type of loading |
|---|---|---|---|---|---|---|---|
| 1 | 2.25 | 0.00 | -0.26 | 0.00 | 0.00 | 0.00 | Permanent-Transient/Static |

*) The required partial safety factors for actions are included

# Resulting anchor forces

| Anchor no. | Tensile action kN | Shear Action kN | Shear Action x kN | Shear Action y kN |
|---|---|---|---|---|
| 1 | 0.86 | 0.09 | 0.00 | -0.09 |
| 2 | 0.86 | 0.09 | 0.00 | -0.09 |
| 3 | 0.86 | 0.09 | 0.00 | -0.09 |




max. concrete compressive strain : 0.02 ‰
max. concrete compressive stress : 0.5 N/mm²
Resulting tensile actions : 2.58 kN , X/Y position ( -3 / 0 )
Resulting compression actions : 0.33 kN , X/Y position ( -20 / 0 )

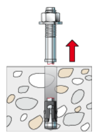
# Resistance to tension loads

| Proof | Action kN | Capacity kN | Utilisation $\beta_N$ % |
|---|---|---|---|
| Steel failure * | 0.86 | 25.00 | 3.4 |
| Pullout failure * | 0.86 | 4.88 | **17.6** |
| Concrete cone failure | 0.86 | 5.63 | 15.2 |

* Most unfavourable anchor

## Steel failure

$$N_{Ed} \leq \frac{N_{Rk,s}}{\gamma_{Ms}} \quad (\mathbf{N_{Rd,s}})$$

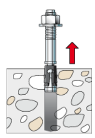


| $N_{Rk,s}$ kN | $\gamma_{Ms}$ | $N_{Rd,s}$ kN | $N_{Ed}$ kN | $\beta_{N,s}$ % |
|---|---|---|---|---|
| 35.00 | 1.40 | 25.00 | 0.86 | 3.4 |

| Anchor no. | $\beta_{N,s}$ % | Group N° | Decisive Beta |
|---|---|---|---|
| 1 | 3.4 | 1 | $\beta_{N,s;1}$ |
| 2 | 3.4 | 2 | $\beta_{N,s;2}$ |
| 3 | 3.4 | 3 | $\beta_{N,s;3}$ |

## Pullout failure

$$N_{Ed} \leq \frac{N_{Rk,p}}{\gamma_{Mp}} \quad (\mathbf{N_{Rd,p}})$$



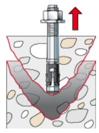
| $N_{Rk,p}$ kN | $\Psi_c$ | $\gamma_{Mp}$ | $N_{Rd,p}$ kN | $N_{Ed}$ kN | $\beta_{N,p}$ % |
|---|---|---|---|---|---|
| 7.32 | 1.220 | 1.50 | 4.88 | 0.86 | 17.6 |

The given Psi,c-factor may has been determined by interpolation.

| Anchor no. | $\beta_{N,p}$ % | Group N° | Decisive Beta |
|---|---|---|---|
| 1, 2, 3 | 17.6 | 1 | $\beta_{N,p;1}$ |

## Concrete cone failure

$$N_{Ed} \leq \frac{N_{Rk,c}}{\gamma_{Mc}} \quad (\mathbf{N_{Rd,c}})$$



$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$ Eq. (7.1)

$$N_{Rk,c} = 10.67kN \cdot \frac{12{,}000mm^2}{14{,}400mm^2} \cdot 0.950 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 8.45kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h^{1.5}_{ef} = 7.7 \cdot \sqrt{30.0N/mm^2} \cdot \left(40mm\right)^{1.5} = 10.67kN$$ Eq. (7.2)

$$\Psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} = 0.7 + 0.3 \cdot \frac{50mm}{60mm} = 0.950 \leq 1$$ Eq. (7.4)

$$\Psi_{re,N} = 1.000$$ Eq. (7.5)

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_n}{s_{cr,N}}} \Longrightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Eq. (7.6)

$$\Psi_{ec,Nx} = \frac{1}{1 + \frac{2 \cdot 0mm}{120mm}} = 1.000 \leq 1 \qquad \Psi_{ec,Ny} = \frac{1}{1 + \frac{2 \cdot 0mm}{120mm}} = 1.000 \leq 1$$

$$\Psi_{M,N} = 1.00 \geq 1$$ Eq. (7.7)

| $N_{Rk,c}$ kN | $\gamma_{Mc}$ | $N_{Rd,c}$ kN | $N_{Ed}$ kN | $\beta_{N,c}$ % |
|---|---|---|---|---|
| 8.45 | 1.50 | 5.63 | 0.86 | 15.2 |

| Anchor no. | $\beta_{N,c}$ % | Group N° | Decisive Beta |
|---|---|---|---|
| 1 | 15.2 | 1 | $\beta_{N,c;1}$ |
| 2 | 15.2 | 2 | $\beta_{N,c;2}$ |
| 3 | 15.2 | 3 | $\beta_{N,c;3}$ |

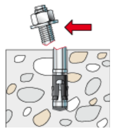
# Resistance to shear loads

| Proof | Action<br>kN | Capacity<br>kN | Utilisation $\beta_V$<br>% |
|---|---|---|---|
| Steel failure without lever arm * | 0.09 | 8.73 | 1.0 |
| Concrete pry-out failure | 0.09 | 5.63 | **1.5** |
| Concrete edge failure | 0.09 | 7.08 | 1.2 |

* Most unfavourable anchor

## Steel failure without lever arm

$$V_{Ed} \leq \frac{V_{Rk,s}}{\gamma_{Ms}} \qquad (\mathbf{V_{Rd,s}})$$



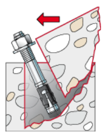
$$V_{Rk,s} = k_7 \cdot V^0_{Rk,s} = 1.00 \cdot 13.10kN = 13.10kN$$ Eq. (7.35)/ (7.36)

| $V_{Rk,s}$<br>kN | $\gamma_{Ms}$ | $V_{Rd,s}$<br>kN | $V_{Ed}$<br>kN | $\beta_{Vs}$<br>% |
|---|---|---|---|---|
| 13.10 | 1.50 | 8.73 | 0.09 | 1.0 |

| Anchor no. | $\beta_{Vs}$<br>% | Group N° | Decisive Beta |
|---|---|---|---|
| 1 | 1.0 | 1 | $\beta_{Vs;1}$ |
| 2 | 1.0 | 2 | $\beta_{Vs;2}$ |
| 3 | 1.0 | 3 | $\beta_{Vs;3}$ |

## Concrete pry-out failure

$$V_{Ed} \leq \frac{V_{Rk,cp}}{\gamma_{Mc}} \qquad (\mathbf{V_{Rd,cp}})$$



$$V_{Rk,cp} = k_8 \cdot N_{Rk,c} = 1 \cdot 8.45kN = 8.45kN$$ Eq. (7.39a)

$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$ Eq. (7.1)

$$N_{Rk,c} = 10.67kN \cdot \frac{12{,}000mm^2}{14{,}400mm^2} \cdot 0.950 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 8.45kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 7.7 \cdot \sqrt{30.0N/mm^2} \cdot \left(40mm\right)^{1.5} = 10.67kN$$ Eq. (7.2)

$$\Psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} = 0.7 + 0.3 \cdot \frac{50mm}{60mm} = 0.950 \leq 1$$ Eq. (7.4)

$$\Psi_{re,N} = 1.000$$ Eq. (7.5)

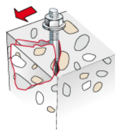
$$\Psi_{ec,N} = \frac{1}{1+\frac{2e_n}{s_{cr,N}}} \Rightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Eq. (7.6)

$$\Psi_{M,N} = 1.00 \geq 1$$ Eq. (7.7)

| $V_{Rk,cp}$ kN | $\gamma_{Mc}$ | $V_{Rd,cp}$ kN | $V_{Ed}$ kN | $\beta_{V,cp}$ % |
|---|---|---|---|---|
| 8.45 | 1.50 | 5.63 | 0.09 | 1.5 |

| Anchor no. | $\beta_{V,cp}$ % | Group N° | Decisive Beta |
|---|---|---|---|
| 1 | 1.5 | 1 | $\beta_{V,cp;1}$ |
| 2 | 1.5 | 2 | $\beta_{V,cp;2}$ |
| 3 | 1.5 | 3 | $\beta_{V,cp;3}$ |

## Concrete edge failure



$$V_{Ed} \leq \frac{V_{Rk,c}}{\gamma_{Mc}}$$ **( $V_{Rd,c}$ )**

$$V_{Rk,c} = V^0_{Rk,c} \cdot \frac{A_{c,V}}{A^0_{c,V}} \cdot \Psi_{s,V} \cdot \Psi_{h,V} \cdot \Psi_{\alpha,V} \cdot \Psi_{ec,V} \cdot \Psi_{re,V}$$ Eq. (7.40)

$$V_{Rk,c} = 5.32kN \cdot \frac{11{,}250mm^2}{11{,}250mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.999 \cdot 1.000 \cdot 1.000 = 10.63kN$$

$$V^0_{Rk,c} = k_9 \cdot d^{\alpha}_{nom} \cdot l^{\beta}_f \cdot \sqrt{f_{ck}} \cdot c_1^{1.5}$$ Eq. (7.41)

$$V^0_{Rk,c} = 1.7 \cdot \left(8mm\right)^{0.100} \cdot \left(50mm\right)^{0.069} \cdot \sqrt{30.0N/mm^2} \cdot \left(50mm\right)^{1.5} = 5.32kN$$

$$\alpha = 0.1 \cdot \sqrt{\frac{l_f}{c_1}} = 0.1 \cdot \sqrt{\frac{50mm}{50mm}} = 0.100 \qquad \beta = 0.1 \cdot \left(\frac{d_{nom}}{c_1}\right)^{0.2} = 0.1 \cdot \left(\frac{8mm}{50mm}\right)^{0.2} = 0.069$$ Eq. (7.42/7.43)

$$\Psi_{s,V} = 0.7 + 0.3 \cdot \frac{c_2}{1.5c_1} = 0.7 + 0.3 \cdot \frac{75mm}{1.5 \cdot 50mm} = 1.000 \leq 1$$ Eq. (7.45)

$$\Psi_{h,V} = max\left(1; \sqrt{\frac{1.5c_1}{h}}\right) = max\left(1; \sqrt{\frac{1.5 \cdot 50mm}{150mm}}\right) = 1.000 \geq 1$$ Eq. (7.46)

$$\Psi_{\alpha,V} = \sqrt{\frac{1}{\left(cos\ \alpha_V\right)^2 + \left(0.5 \cdot sin\ \alpha_V\right)^2}} = \sqrt{\frac{1}{\left(cos\ 88.9\right)^2 + \left(0.5 \cdot sin\ 88.9\right)^2}} = 1.999 \geq 1$$ Eq. (7.48)

$$\Psi_{ec,V} = \frac{1}{1+\frac{2}{3}\frac{e_v}{c_1}} = \frac{1}{1+\frac{2 \cdot 0mm}{3 \cdot 50mm}} = 1.000 \leq 1$$ Eq. (7.47)

$$\Psi_{re,V} = 1.000$$

| $V_{Rk,c}$ kN | $\gamma_{Mc}$ | $V_{Rd,c}$ kN | $V_{Ed}$ kN | $\beta_{V,c}$ % |
|---|---|---|---|---|
| 10.63 | 1.50 | 7.08 | 0.09 | 1.2 |

| Anchor no. | $\beta_{V,c}$ % | Group N° | Decisive Beta |
|---|---|---|---|
| 1 | 1.2 | 1 | $\beta_{V,c;1}$ |
| 2 | 1.2 | 2 | $\beta_{V,c;2}$ |
| 3 | 1.2 | 3 | $\beta_{V,c;3}$ |

# Utilization of tension and shear loads

| Tension loads | Utilisation $\beta_N$ % |
|---|---|
| Steel failure * | 3.4 |
| Pullout failure * | **17.6** |
| Concrete cone failure | 15.2 |

| Shear Loads | Utilisation $\beta_V$ % |
|---|---|
| Steel failure without lever arm * | 1.0 |
| Concrete pry-out failure | **1.5** |
| Concrete edge failure | 1.2 |

* Most unfavourable anchor

# Resistance to combined tensile and shear loads

**Utilisation steel**

$$\beta_{N.s} = \beta_{N,s;1} = 0.03 \leq 1$$
$$\beta_{V.s} = \beta_{Vs;1} = 0.01 \leq 1$$
$$\beta_N^2 + \beta_V^2 = \beta_{N,s;1}^2 + \beta_{Vs;1}^2 = 0.00 \leq 1 \quad \text{Eq. (7.55)}$$

**Utilisation concrete**

**Proof successful**

$$\beta_{N,p} = \beta_{N,p;1} = 0.18 \leq 1$$
$$\beta_{V.cp} = \beta_{V,cp;3} = 0.02 \leq 1$$
$$\beta_N^{1.5} + \beta_V^{1.5} = \beta_{N,p;1}^{1.5} + \beta_{V,cp;1}^{1.5} = 0.08 \leq 1 \quad \text{Eq. (7.56)}$$

# Information concerning the anchor plate

## Base plate details

Plate thickness specified by user without proof t = 5 mm

Profile type None

# Technical remarks

The transmission of the anchor loads to the supports of the concrete member shall be shown for the ultimate limit state and the serviceability limit state; for this purpose, the normal verifications shall be carried out under due consideration of the actions introduced by the anchors. For these verifications the additional provisions given in the current design method shall be taken into account.
As a pre-condition the anchor plate is assumed to be flat when subjected to the actions. Therefore, the plate (if present) must be sufficiently stiff. The C-Fix anchor plate design is based on a proof of stresses and does not allow a statement about the stiffness of the plate. The proof of the necessary stiffness is not carried out by C-Fix.

During the design process, the following hints and warnings were issued:

- Filling Washer Required

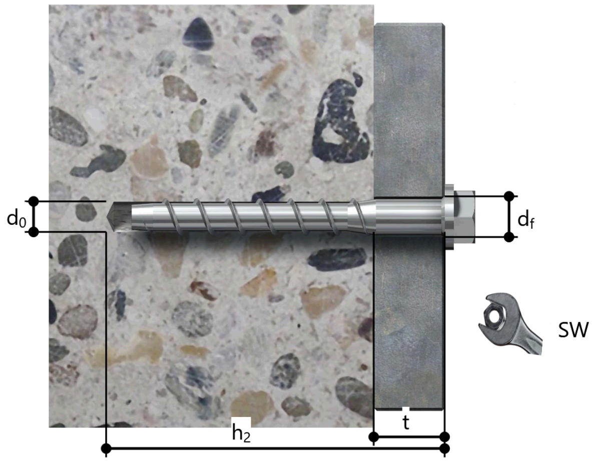
# Installation data

## Anchor

| | | | |
|---|---|---|---|
| **Anchor system** | **fischer Concrete screw ULTRACUT FBS II** | | |
| Anchor | Concrete screw with hexagon head and washer<br>FBS II 8x70 20/5 US TX,<br>zinc plated steel, with filling disc | Art.-No. 536852 |  |
| Accessories | FFD 26x12x6<br>Blow-out pump ABG big<br>Quattric II 8/100/165<br>The calculation consists a special washer. With the filling washer it is assured that the gap between plate and anchor is eliminated and the shear load is transfered to every anchor in equal parts. | Art.-No. 538458<br>Art.-No. 567792<br>Art.-No. 549988 | |

## Installation details

| | |
|---|---|
| Thread diameter | - |
| Drill hole diameter | $d_0$ = 8 mm |
| Drill hole depth | $h_2$ = 80 mm |
| Calculated anchorage depth | $h_{ef}$ = 40 mm |
| Installation depth | $h_{nom}$ = 50 mm |
| Drilling method | Hammer drilling |
| Borehole cleaning | Clear the borehole with a hand blower. |
| Installation type | Push-through installation |
| Annular gap | Annular gap filled |
| Maximum torque | - |
| Socket size | 13 mm |
| Base plate thickness | t = 5 mm |
| Total fixing thickness | $t_{fix}$ = 11 mm |
| Tfix,max | $t_{fix, max}$ = 20 mm |

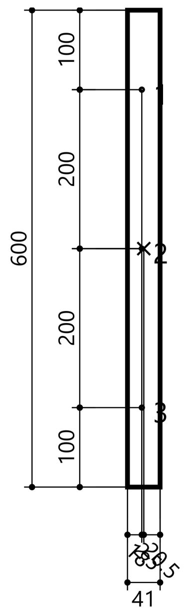


## Base plate details

| | |
|---|---|
| Base plate material | Not available |
| Base plate thickness | t = 5 mm |
| Clearance hole in base plate | $d_f$=12 mm |

## Attachment

| | |
|---|---|
| Profile type | None |




## Anchor coordinates

| Anchor no. | x<br>mm | y<br>mm |
|---|---|---|
| 1 | -2.5 | 200 |
| 2 | -2.5 | 0 |
| 3 | -2.5 | -200 |