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Your Ref:

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Protector Aluminium
2a Page St,
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ATTENTION: Mr Stefan Ossenberg

Dear Sir

ENGINEERING DESIGN OF FIXINGS FOR PROTECTOR ALUMINIUM FLANGED END POSTS, SLIMLINE MINI POSTS, CHISEL MINI POSTS INTO TIMBER

In accordance with your request, NJA have undertaken a review of the following load testing reports by Ian Bennie and Associates:

- Test Report 2015-101-S1 "Flat Top" Fence Panel & Gate – Primrose Swimming Pool Fence Tests;
- Test Report 2018-006-S6 Pool Fence and Gate With "Chisel" Mini Posts;
- Test Report 2018-006-S7 Pool Fence and Gate With "Slimline" Mini Posts;
- Test Report 2018-006-S8-R Pool System Semi-Frameless Glass Pool Fence and Gate with Aluminium Posts.

The purpose of the review was to confirm the nature of the testing performed on the fence system elements and to design appropriate fixing details for connection to timber structures. We note the relevant points from these reports as follows:

- In all cases, the strength of the posts and footings passed the requirements of the testing;
- The testing was carried out in accordance with AS1926.1-2012 *Swimming Pool Safety Part 1: Safety Barriers for Swimming Pools*;
- The test load was 330N applied at a height of 1200mm above the finished ground level. This is in accordance with the requirements of Section B of AS1926.1-2012.

Based on the above we are able to confirm that the brackets and posts specified in the reports are compliant with the strength requirements of the code and are appropriate for use in swimming pool fences. It should be noted that the testing did not apply the loads for barriers in accordance with AS1170.1 and as such are <u>not</u> considered appropriate for use as balustrades, or in locations where the fall height ≥ 1.0m.

At the direction Protector Aluminium, NJA Consulting have determined by calculation the appropriate fixing requirements for the specified brackets to timber in accordance with the requirements of AS1926 and AS1720 *Timber Structures*. We provide our analysis as follows:

This report has been revised to include the "Flat Top" fence panel system.

1.0 FLANGED END POST FIXING

The design factors considered in our review are as follows:

- Design live loading: 330N (AS1926-1-2012);
- Design lever arm: 1200mm (AS1926-1-2012);
- Design live load factor: 1.5 (AS1170.0-2002);
- Maximum fixing size: 10mm Ø;
- Max no. fixings: 4;
- Max fixing spacing 70.5mm;

$$\frac{0.33 * 1.2 * 1.5}{0.0705 * 2} = 4.21kN/bolt$$

The design fixing pull-out tension is therefore: 4.21kN.

The required embedment for M10 Coach Screws into varying timber joint groups required to achieve the design pull out capacity was calculated in accordance with Clause 4.2.3.4 of AS1720.1-2010. The calculated embedment's are given in Table 1.1

Table 1.1: Minimum embedment depths for M10 Coach Screws

Unseasoned Timber	Embedment (mm)	Seasoned Timber	Embedment (mm)
J1	36.4	JD1	29.7
J2	45.3	JD2	36.0
J3	61.4	JD3	48.8
J4	N/A	JD4	N/A
J5	N/A	JD5	N/A
J6	N/A	JD6	N/A

Shaded cells denote excessive embedment requirement. Connection to these joint groups not recommended.

The capacity of M10 Bolt pairs with washers into varying timber joint groups was calculated in accordance with Clause 4.4.3.3 of AS1720.1-2010. The calculated capacities are given in Table 1.2.

Table 1.2: Design capacity for M10 Bolt Pairs

Unseasoned Timber	Capacity ($N_{d,j}$)	Seasoned Timber	Capacity ($N_{d,j}$)
J1	15.5	JD1	20.7
J2	12.3	JD2	15.8
J3	7.7	JD3	11.9
J4	5.0	JD4	8.8
J5	3.3	JD5	6.3
J6	1.6	JD6	4.3

Shaded cells denote combinations where the pull-out capacity per bolt pair is less than the ultimate pull out requirement (ie. 2 x 4.21kN = 8.42kN). Connection to these joint groups not recommended.

2.0 "CHISEL" MINI-POST FIXING

The design factors considered in our review are as follows:

- Design live loading: 330N (AS1926-1-2012);
- Design lever arm: 1200mm (AS1926-1-2012);
- Design live load factor: 1.5 (AS1170.0-2002);
- Maximum fixing size: 10mm Ø;
- Max no. fixings: 4;
- Max fixing spacing 70.5mm;

$$\frac{0.33 * 1.2 * 1.5}{0.0705 * 2} = 4.21kN/bolt$$

The design fixing pull-out tension is therefore: 4.21kN.

The required embedment for M10 Coach Screws into varying timber joint groups required to achieve the design pull out capacity was calculated in accordance with Clause 4.2.3.4 of AS1720.1-2010. The calculated embedment's are given in Table 2.1

Table 2.1: Minimum embedment depths for M10 Coach Screws

Unseasoned Timber	Embedment (mm)	Seasoned Timber	Embedment (mm)
J1	36.4	JD1	29.7
J2	45.3	JD2	36.0
J3	61.4	JD3	48.8
J4	N/A	JD4	N/A
J5	N/A	JD5	N/A
J6	N/A	JD6	N/A

Shaded cells denote excessive embedment requirement. Connection to these joint groups not recommended.

The capacity of M10 Bolt pairs with washers into varying timber joint groups was calculated in accordance with Clause 4.4.3.3 of AS1720.1-2010. The calculated capacities are given in Table 2.2

Table 2.2: Design capacity for M10 Bolt Pairs

Unseasoned Timber	Capacity ($N_{d,j}$)	Seasoned Timber	Capacity ($N_{d,j}$)
J1	15.5	JD1	20.7
J2	12.3	JD2	15.8
J3	7.7	JD3	11.9
J4	5.0	JD4	8.8
J5	3.3	JD5	6.3
J6	1.6	JD6	4.3

Shaded cells denote combinations where the pull-out capacity per bolt pair is less than the ultimate pull out requirement (ie. 2 x 4.21kN = 8.42kN). Connection to these joint groups not recommended.

3.0 "SLIMLINE" MINI-POST FIXING

The design factors considered in our review are as follows:

- Design live loading: 330N (AS1926-1-2012);
- Design lever arm: 1200mm (AS1926-1-2012);
- Design live load factor: 1.5 (AS1170.0-2002);
- Maximum fixing size: 12mm Ø;
- Max no. fixings: 2;
- Max fixing spacing 98mm;

$$\frac{0.33 * 1.2 * 1.5}{0.098} = 6.06kN/bolt$$

The design fixing pull-out tension is therefore: 6.06kN.

The required embedment for M12 Coach Screws into varying timber joint groups required to achieve the design pull out capacity was calculated in accordance with Clause 4.2.3.4 of AS1720.1-2010. The calculated embedment's are given in Table 3.1

Table 3.1: Minimum embedment depths for M12 Coach Screws

Unseasoned Timber	Embedment (mm)	Seasoned Timber	Embedment (mm)
J1	36.4	JD1	29.0
J2	45.0	JD2	36.0
J3	61.0	JD3	49.2
J4	N/A	JD4	72.8
J5	N/A	JD5	N/A
J6	N/A	JD6	N/A

Shaded cells denote excessive embedment requirement. Connection to these joint groups not recommended.

The capacity of a single M12 with washer into varying timber joint groups was calculated in accordance with Clause 4.4.3.3 of AS1720.1-2010. The calculated capacities are given in Table 3.2

Table 3.2: Design capacity for M12 Bolts

Unseasoned Timber	Capacity ($N_{d,j}$)	Seasoned Timber	Capacity ($N_{d,j}$)
J1	10.2	JD1	13.6
J2	8.1	JD2	10.4
J3	5.1	JD3	7.9
J4	3.3	JD4	5.8
J5	2.2	JD5	4.2
J6	1.1	JD6	2.8

Shaded cells denote combinations where the pull-out capacity per bolt is less than the ultimate pull out requirement (ie. 6.06kN). Connection to these joint groups not recommended.

4.0 "FLAT TOP" FENCE POST FIXING

The design factors considered in our review are as follows:

- Design live loading: 330N (AS1926-1-2012);
- Design lever arm: 1200mm (AS1926-1-2012);
- Design live load factor: 1.5 (AS1170.0-2002);
- Maximum fixing size: 10mm Ø;
- Max no. fixings: 4;
- Max fixing spacing 70.0mm;

$$\frac{0.33 * 1.2 * 1.5}{0.07 * 2} = 4.24kN/bolt$$

The design fixing pull-out tension is therefore: 4.24kN.

The required embedment for M10 Coach Screws into varying timber joint groups required to achieve the design pull out capacity was calculated in accordance with Clause 4.2.3.4 of AS1720.1-2010. The calculated embedment's are given in Table 4.1

Table 4.1: Minimum embedment depths for M10 Coach Screws

Unseasoned Timber	Embedment (mm)	Seasoned Timber	Embedment (mm)
J1	36.4	JD1	29.7
J2	45.3	JD2	36.0
J3	61.4	JD3	48.8
J4	N/A	JD4	N/A
J5	N/A	JD5	N/A
J6	N/A	JD6	N/A

Shaded cells denote excessive embedment requirement. Connection to these joint groups not recommended.

The capacity of M10 Bolt pairs with washers into varying timber joint groups was calculated in accordance with Clause 4.4.3.3 of AS1720.1-2010. The calculated capacities are given in Table 4.2

Table 4.2: Design capacity for M10 Bolt Pairs

Unseasoned Timber	Capacity ($N_{d,j}$)	Seasoned Timber	Capacity ($N_{d,j}$)
J1	15.5	JD1	20.7
J2	12.3	JD2	15.8
J3	7.7	JD3	11.9
J4	5.0	JD4	8.8
J5	3.3	JD5	6.3
J6	1.6	JD6	4.3

Shaded cells denote combinations where the pull-out capacity per bolt pair is less than the ultimate pull out requirement (ie. 2 x 4.24kN = 8.48kN). Connection to these joint groups not recommended.

5.0 CONCLUSION AND RECOMMENDATIONS

From our calculation review, we confirm the following:

- The Flanged End Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 4/M10 coach screws, embedded a minimum of 75mm into timber of joint groups J1, J2, J3, JD1, JD2 & JD3;
- The Flanged End Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 4/M10 bolts into timber of joint groups J1, J2, JD1, JD2, JD3 & JD4;
- The "Chisel" Mini-Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 4/M10 coach screws, embedded a minimum of 75mm into timber of joint groups J1, J2, J3, JD1, JD2 & JD3;
- The "Chisel" Mini-Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 4/M10 bolts into timber of joint groups J1, J2, JD1, JD2, JD3 & JD4;
- The "Slimline" Mini-Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 2/M12 coach screws, embedded a minimum of 75mm into timber of joint groups J1, J2, J3, JD1, JD2, JD3 & JD4;
- The "Slimline" Mini-Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 2/M12 bolts into timber of joint groups J1, J2, JD1, JD2, & JD3.
- The "Flat Top" Fence Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 4/M10 coach screws, embedded a minimum of 75mm into timber of joint groups J1, J2, J3, JD1, JD2 & JD3;
- The "Flat Top" Fence Post is compliant with the requirements of AS1720-2010 and AS1926.1 when secured with 4/M10 bolts into timber of joint groups J1, J2, JD1, JD2, JD3 & JD4;

The appropriate fixing configurations are detailed on NJA Consulting plan J180286-01 Revision A.

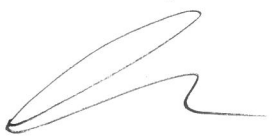
Exclusions:

The calculations and recommendations contained in this report are for the use of the structural elements for use in a pool fence system only. Additional investigation and testing are required in order to determine if the elements are suitable for use in a balustrade or other barrier type.

NJA Consulting are not responsible for the design of the timber elements of the structures to be fixed to. The designer of these elements is responsible for ensuring that the structural elements are able to resist the design loads in accordance with AS1926.1 and any other applicable code or standard.

Should you require additional information or clarification of the contents of this report please contact the undersigned.

Yours faithfully



Adam Buckley
Senior Structural Engineer
For and on behalf of
NJA Consulting Pty Ltd

Encl: J190286-01 Rev A