Front Terminal Seismic Racking Specifications, Installation Guide & Certificates

AUSTRALIA
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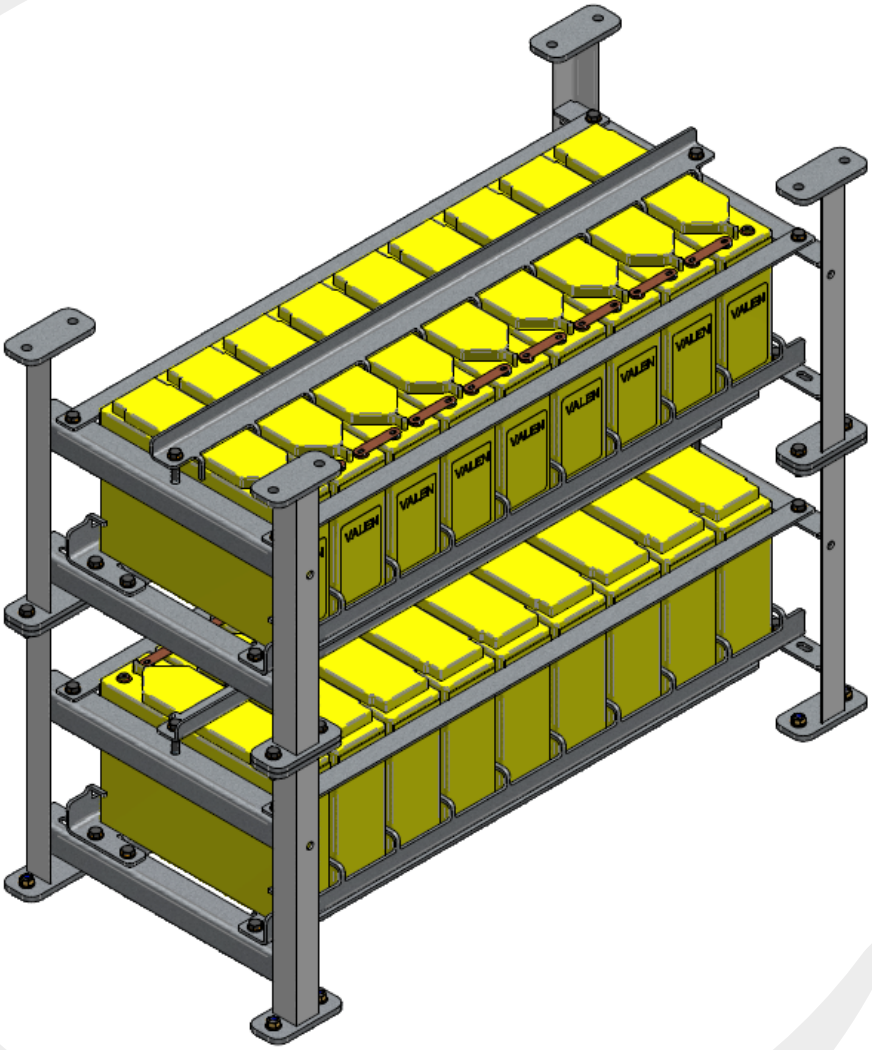
OCTOBER 2021
VERSION 1.0

110V FRONT TERMINAL SEISMIC RACK

BR FTSEIS100/9

- Designed for 110V, 48V and 24V systems, both Solar or back-up powered sites
- Design to be single or double stacked
- Electrical Engineered to AS2676 and AS3011
- Fully certified and compliant battery rack for peace of mind and safety.
- Flat packed for easy freight to site.
- Easy to assemble. Kit includes instructions and everything you need to assemble to standard.



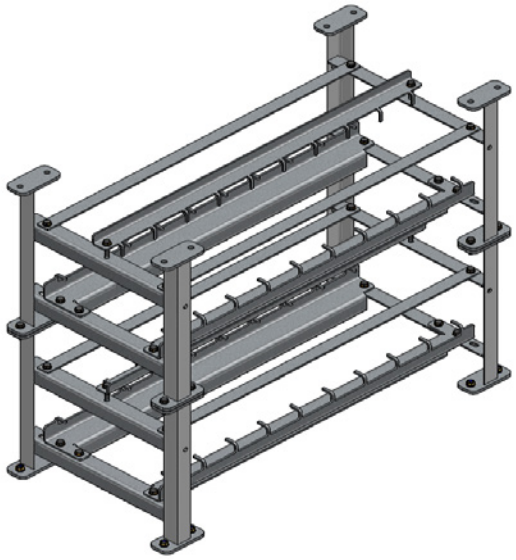
Batteries opposite installation as shown, for illustration purposes only

- Front Terminal Batteries supplied, providing easy and accurate routine maintenance checks.
- Batteries supplied with equal resistance link connectors.
- Battery Terminal caps supplied to ensure a safe installation.
- Batteries are secured with a holding bar.

A family owned Australian business

BR FTSEIS100/9

BATTERY RACKING SPECIFICATIONS



COMPATIBLE BATTERIES

Racking to suit the following Valen Front Terminal Batteries

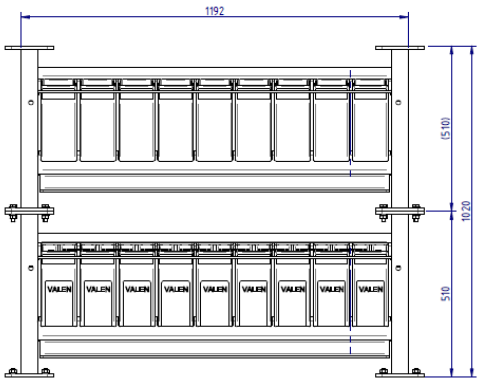
- 12 EO+FT 100
- 12 EGFT 100
- 12 EOFT 100

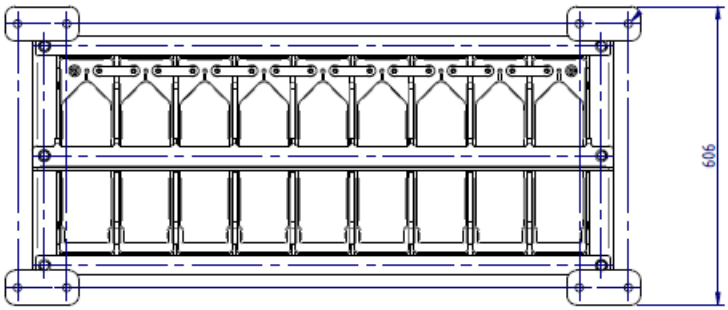
CERTIFICATIONS

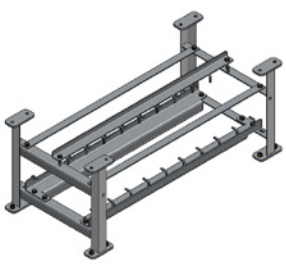
Seismic rated as per the following certifications;

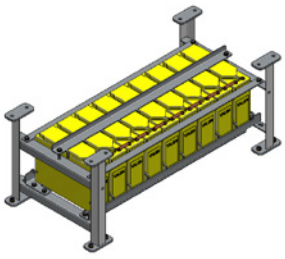
- IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations
- AS/NZS1170.0:2002 Structural Design Actions: General Principles
- AS/NZS1170.1:2002 Structural Design Actions: Permanent, Imposed and Other Actions
- NZS1170.5:2004 Structural Design Actions: Earthquake Actions – New Zealand
- AS 4100:2020 Steel Structures Code

DIMENSIONS









Specifications subject to change without notice.

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110V FRONT TERMINAL SEISMIC RACK

BR FTSEIS155/9

- Designed for 110V, 48V and 24V systems, both Solar or back-up powered sites
- Design to be single or double stacked
- Electrical Engineered to AS2676 and AS3011
- Fully certified and compliant battery rack for peace of mind and safety.
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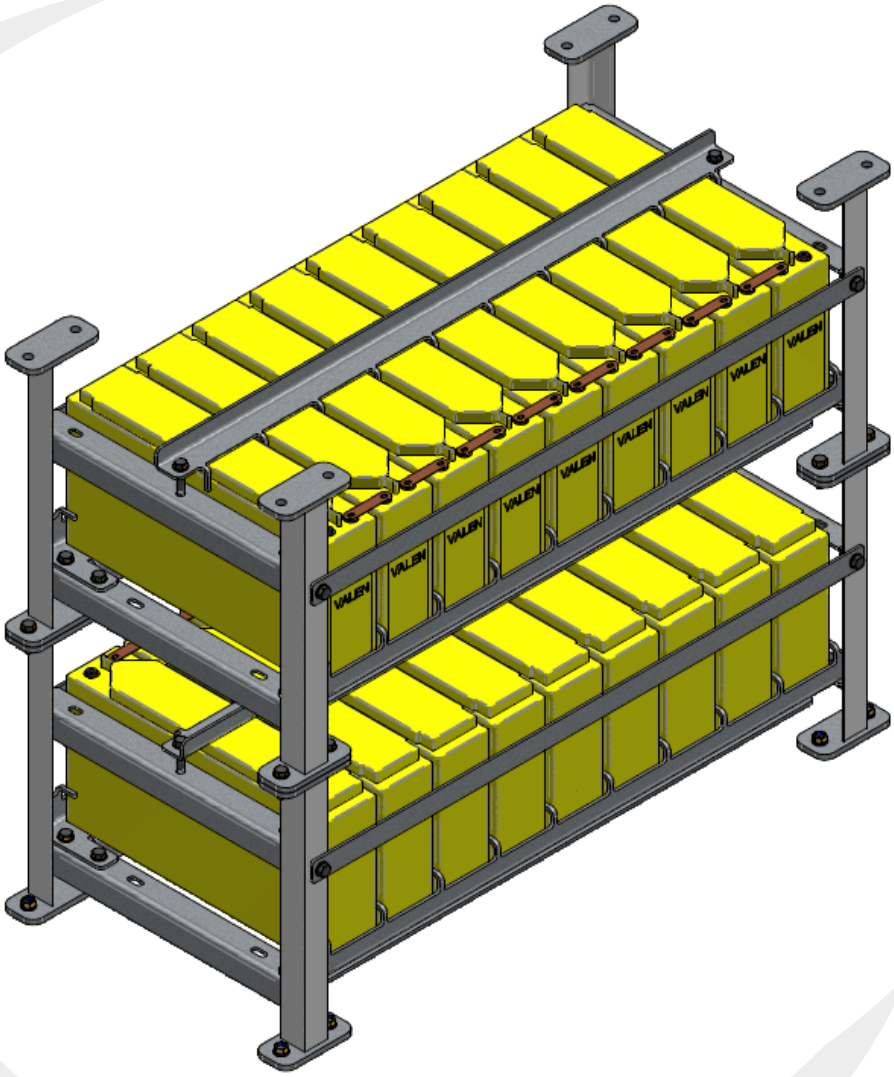

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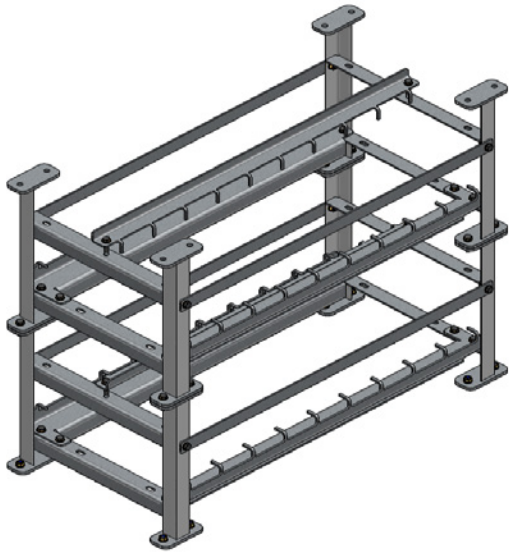
- Batteries supplied with equal resistance link connectors.
- Battery Terminal caps supplied to ensure a safe installation.
- Batteries are secured with a holding bar.

A family owned Australian business

BR FTSEIS155/9

BATTERY RACKING SPECIFICATIONS



COMPATIBLE BATTERIES

Racking to suit the following Valen Front Terminal Batteries

- 12 EGFT 155
- 12 EOFT 155

CERTIFICATIONS

Seismic rated as per the following certifications;

- IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations
- AS/NZS1170.0:2002 Structural Design Actions: General Principles
- AS/NZS1170.1:2002 Structural Design Actions: Permanent, Imposed and Other Actions
- NZS1170.5:2004 Structural Design Actions: Earthquake Actions – New Zealand
- AS 4100:2020 Steel Structures Code

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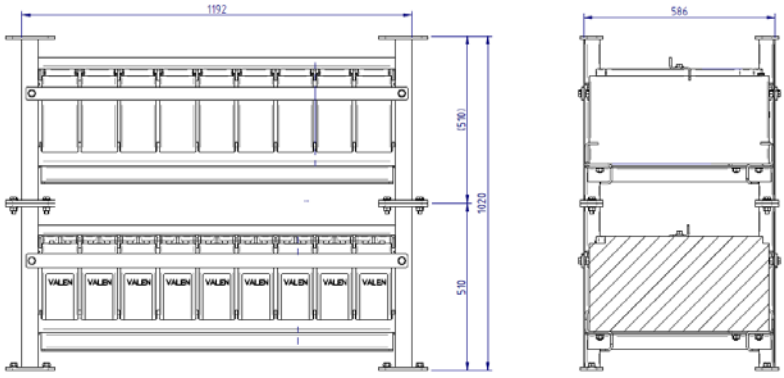

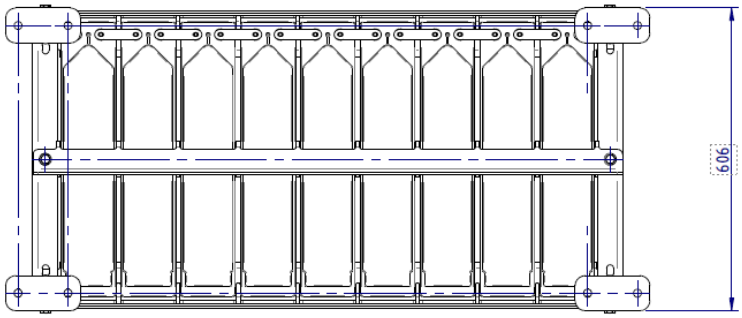

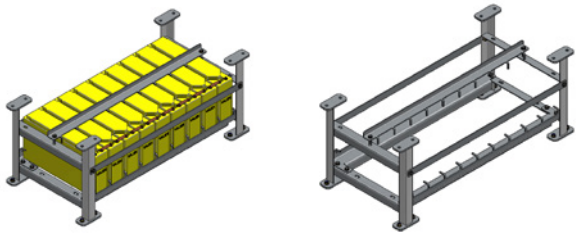

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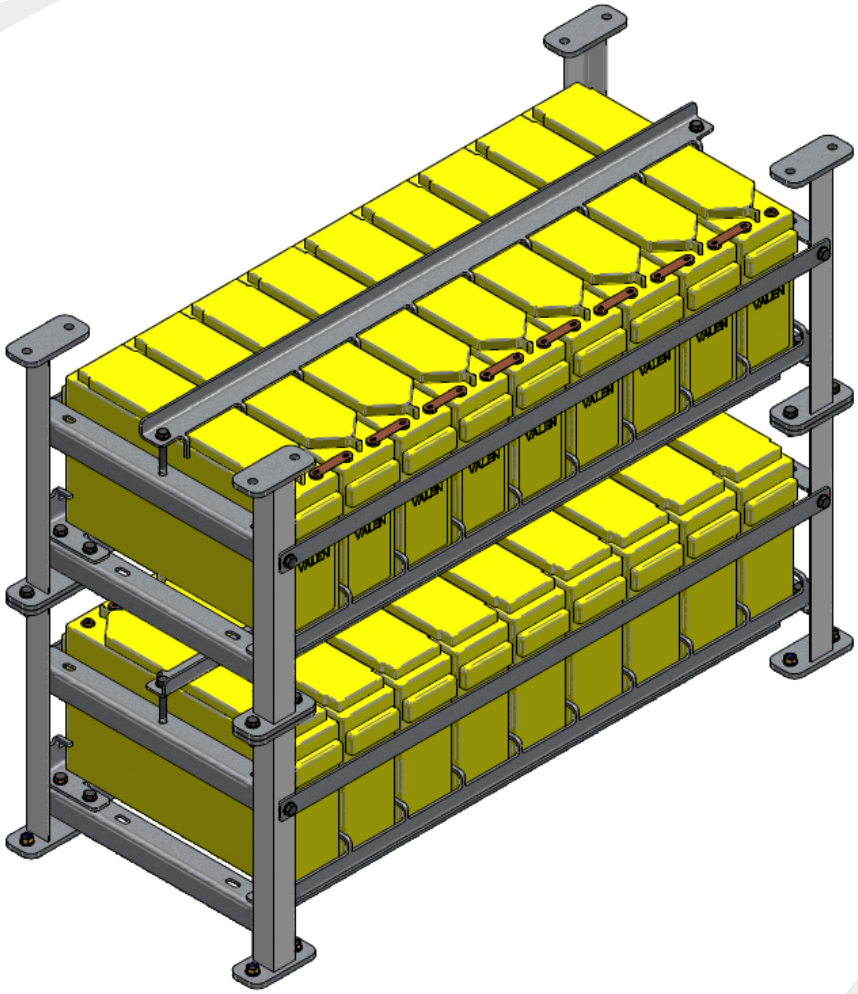
110V FRONT TERMINAL SEISMIC RACK

BR FTSEIS190/9

- Designed for 110V, 48V and 24V systems, both Solar or back-up powered sites
- Design to be single or double stacked
- Electrical Engineered to AS2676 and AS3011
- Fully certified and compliant battery rack for peace of mind and safety.
- Flat packed for easy freight to site.
- Easy to assemble. Kit includes instructions and everything you need to assemble to standard.



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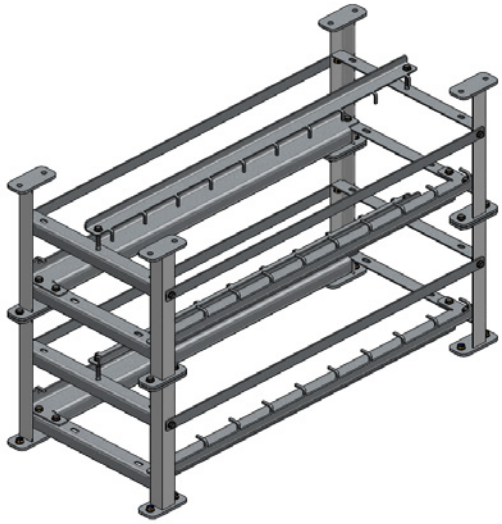
- Batteries are secured with a holding bar.

A family owned Australian business

BR FTSEIS190/9

BATTERY RACKING SPECIFICATIONS



COMPATIBLE BATTERIES

Racking to suit the following Valen Front Terminal Batteries

- 12 EO+FT 190

CERTIFICATIONS

Seismic rated as per the following certifications;

- IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations
- AS/NZS1170.0:2002 Structural Design Actions: General Principles
- AS/NZS1170.1:2002 Structural Design Actions: Permanent, Imposed and Other Actions
- NZS1170.5:2004 Structural Design Actions: Earthquake Actions – New Zealand
- AS 4100:2020 Steel Structures Code

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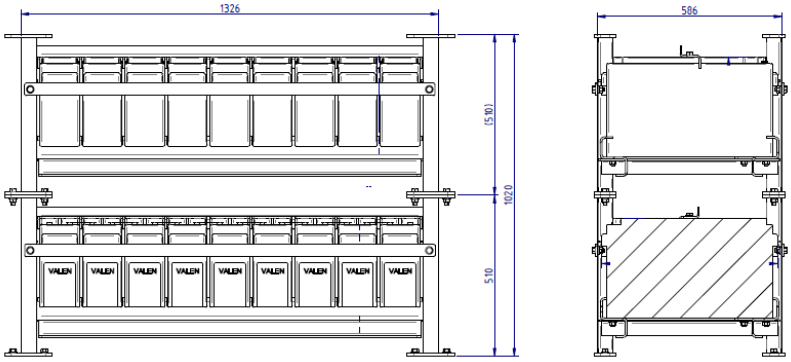

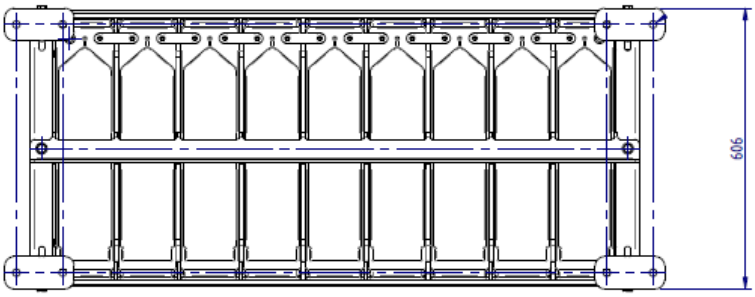

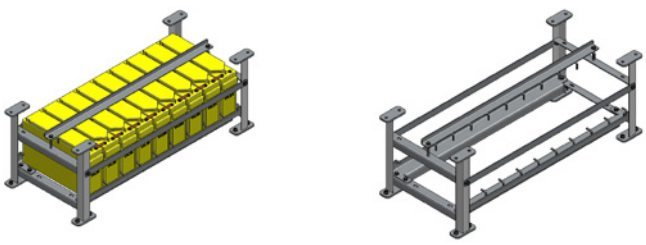

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INSTALL NOTES

- All relevant standards, including those referenced in the following certificates, however not limited to, are to be adhered to.
- Concrete and ground fastenings to be as per below.
- All Front Terminal Seismic Racks supplied by Valen Power are engineered and manufactured to IEEE693-2018 “high” level. To achieve this certification, the installer is responsible to abide by the following to achieve the High Level standard:

High Level Standard:

- ANCHOR STUDS TO BE CHEMSET REO 502+, M12 GRADE 8.8, 165MM EMBEDMENT
- MIN. CONCRETE THICKNESS = 200MM
- MIN. CONCRETE STRENGTH = 25MPa
- MIN. CONCRETE EDGE DISTANCE = 250MM

- ALL BOLTS SHALL BE OF SUFFICIENT LENGTH TO PROVIDE A MINIMUM OF ONE FULL THREAD BEYOND THE TIGHTENED NUT.

- Identification Plate to be installed by the installer.

Ref No: **C21026 revB**

VALEN
105 LOUGHNAN ST
LAKE CARGELLIGO NSW 2678
Date: 7/10/2021

C21026 revB-BATTERY RACKS
STRUCTURAL VERIFICATION CERTIFICATION

With regards to the drawings listed in the table below.

BATTERY RACKS			
Drawing No.	**Revision**	**No of Pages**	**Revision Date**
268005-12 EGFT 155 GA	D	2	06/10/21
268005-12 EO+FT 100 GA	D	2	06/10/21
268005-12 EO+FT 190 GA	D	2	06/10/21
268005-PL-01	B	1	06/08/21
268005-PL-02	B	1	06/08/21
268005-PL-03	B	1	06/08/21
268005-PL-04	B	1	06/08/21
268005-PL-06	B	1	06/08/21
268005-PL-08	B	1	06/08/21
268005-PL-09	B	1	06/08/21
268005-PL-10	A	1	06/08/21
268005-PL-11	A	1	06/08/21
268005-RACK-ASSY-01	C	1	06/10/21
268005-RACK-ASSY-02	C	1	06/10/21
268005-RACK-WM-01	C	1	06/10/21

Appropriately qualified 3rd parties were engaged to carry out an independent analysis in accordance with the following Codes of Practice:

- ✓ AS/NZS1170.0:2002 Structural Design Actions: General Principles
- ✓ AS/NZS1170.1:2002 Structural Design Actions: Permanent, Imposed and Other Actions
- ✓ NZS1170.5:2004 Structural Design Actions: Earthquake Actions – New Zealand
- ✓ AS 4100:2020 Steel Structures Code
- ✓ AS/NZS 2676.2-2020 – Guide to the Installation, Maintenance, Testing and Replacement of Secondary Batteries in Buildings
- ✓ AS/NZS 3011.2-2019 – Electrical Installations – Secondary Batteries Installed in Buildings
- ✓ IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations

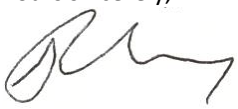
The design of the battery racks were found to be compliant with the above codes of practice as indicated in *20210791-L02-CERT-SJ* and *Battery Rack Certification Report - Rev* 1, subject to the following conditions:

1. Structure importance level 4, design life 50 years in accordance with AS/NZS1170.0:2002
2. Seismic Qualification Level “High” in accordance with IEE693-2018
3. All fabrication and installation notes on drawings shall be adhered to

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

We trust that this information is sufficient for your requirements. Please do not hesitate to contact the undersigned should you require any further information.

Yours sincerely,



Trang Imagineering Pty Ltd
Samuel Burley
BEng (Mech.) MIEAust CPEng NER

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2.2. AS/NZS 3011.2-2019 – Electrical Installations – Secondary Batteries Installed in Buildings 4

2.3. IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations 4

3. CERTIFICATION 5

1. Overview

This document provides compliance certification against three standards (see section 2 for list) for a battery rack design completed in house by Trang Imagineering. This certification details the relevant clauses assessed against the design of Trang Imagineering's battery rack.

1.1. Details Collected via Correspondence with Trang Imagineering

Detailed information of the design has been received from Trang Imagineering via email correspondence on Tuesday 15th June 2021.

The compliance assessment has been made based on the design provided in the following documents:

- 268005-12 EGFT 155 GA.pdf – Revision D
- 268005-12 EO+FT 100 GA.pdf – Revision D
- 268005-12 EO+FT 190 GA.pdf – Revision D
- 268005-RACK-ASSY-01.pdf – Revision C
- 268005-RACK-ASSY-02.pdf – Revision C
- 268005-RACK-WM-01.pdf – Revision C

Latest revisions of drawings dated 6th October 2021.

1.2. Exclusions

The following have excluded from this certification:

- Battery specific clauses as per phone discussion with Sam Burley dated Friday 4th June 2021.
- Seismic loading calculations as per email from Gordon Howard dated 12th April 2021.

2. Compliance

The Trang Imagineering battery rack has been assessed for compliance against relevant clauses in the following standards:

- AS/NZS 2676.2-2020 – Guide to the Installation, Maintenance, Testing and Replacement of Secondary Batteries in Buildings
- AS/NZS 3011.2-2019 – Electrical Installations – Secondary Batteries Installed in Buildings
- IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations

2.1. AS/NZS 2676.2-2020 – Guide to the Installation, Maintenance, Testing and Replacement of Secondary Batteries in Buildings

Clause 3.6 Battery Enclosure Construction

- The enclosure or shelving that the batteries are to be installed in/on shall be capable of supporting the battery load without excessive deflection or deformation. Deflection should be less than 3mm per metre of unsupported length.
    - Clause noted. Mechanical assessment by others.
- Ventilation compartments of the enclosure/shelving should be spaced as far apart as possible.
    - Battery compartment design is open style, complying with ventilation requirements. Battery rack not to be enclosed within another compartment.
- A horizontal clearance of 25mm shall be maintained between the sides of the battery and any apart of the enclosure.
    - Comply Rack open style and clearance met.
- Sufficient clearance should be maintained between the tops of battery cells and the enclosure to allow application of test equipment.
    - Battery rack design exceeds IP1X test requirement and is deemed to be compliant.

Clause 3.9 Arrangement of Cells or Monobloc

- Subsection (a): Load-bearing members of the battery rack should support at least 20 % of the base area of the cell container.
    - Mechanical assessment of load bearing member not in scope of this assessment.
- Subsection (b): Battery rack shall be no more than two tiers.
    - General arrangement complies with two tiers.
- Subsection (d): When more than one rack section is used, each section should be rigidly jointed and that connections between cells at different sections of the same stand should be flexible.
    - General arrangement complies with rigidly bolted tiers.

Clause 3.10 Battery Stands

- Subsection (a): Deflection under load should not exceed 3mm.
    - Clause noted. Mechanical assessment by others.
- Subsection (b): The base area of the cell shall be contained within the rack.
    - General arrangement complies.
- Subsection (c): The battery installation shall be limited to two rows of cells.
    - General arrangement complies.
- Subsection (d): The overall height of the battery installation shall not exceed 2m.
    - General arrangement complies,

- Subsection (e): Horizontal restraining bars be installed at the front and back of the battery stand.
    - General arrangement complies.
- Subsection (g): The stand shall be painted with an electrolyte resistant paint or similar material.
    - Clause noted. Finished surface protection to be detailed by others and to comply.

2.2. AS/NZS 3011.2-2019 – Electrical Installations – Secondary Batteries Installed in Buildings

Clause 2.1.4 Arrangement of Cells

The space between adjacent cell containers shall be at least 3mm for heat dissipation regardless of the cell arrangement used.

General arrangement complies.

Clause 2.2.2 Battery Room Layout and Floor Area

- Subsection (b)(iv): The minimum vertical clearance between any part of a cell and the tier above shall be half the distance to the rearmost terminal of the battery or 75mm, whichever is the greater, and shall not exceed 200mm for vertically mounted cells.
    - General arrangement complies.

2.3. IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations

Compliance with IEEE 693-2018 is achieved through seismic load calculations (to be performed by others) that satisfy the requirements contained within Appendix J specific for battery racks.

J.3.3 Battery Rack Qualification Methods

The seismic analysis is to be completed by others.

J.6.4 Battery Rack Design Requirements

The battery rack shall be mounted to a structural floor with sufficient strength to resist lateral and overturning loads.

Clause noted. Structural analysis and compliance to be met by the client/installation provider.

J.9 Seismic Identification Plate

A seismic identification plate shall be mounted to the battery rack. The plate shall be arranged as follows:

Seismic Qualification Plate: Trang Imagineering			
IEEE 693-2018	Date:	Qualification Level (Low, Moderate or High)	Report Number
Qualification Method: Static Analysis			

Clause noted. Assessment of qualification level is to be completed by the customer/installation designer.

3. Certification

The design meets all the requirements of the following standards based on the clauses listed in the above review. Other requirements within these standards, namely mechanical and seismic assessments are not in the scope of this assessment and will be done by others.

- AS/NZS 2676.2-2020 – Guide to the Installation, Maintenance, Testing and Replacement of Secondary Batteries in Buildings
- AS/NZS 3011.2-2019 – Electrical Installations – Secondary Batteries Installed in Buildings
- IEEE 693-2018 – IEEE Recommended Practice for Seismic Design of Substations

Signed off by:

Sam Wasil – Electrical Engineer

Date 11/10/21

Allan Fogarty – Senior Electrical Engineer

Allan Fogarty
C=AU, E=allan@iaeng.com.au, O=IA Engineering, OU=MIEAust CPEng NER, CN=Allan Fogarty
2021.10.11 11:21:04+11'00'

CALARE CIVIL
CONSULTING ENGINEERS

20210791
7 October, 2021

Trang Imagineering Pty Ltd
74 Astill Drive
ORANGE NSW 2800

Attention: Sam Burley

Dear Sam

RE: Battery Racking Seismic Certification – IEEE 693:2018 and NZS1170.5:2004

We certify that we have checked the structural design of the proposed structure rated for the design loading criteria listed below as shown on the following drawings subject to the following provisions:

- Welds to be 6mm CFW Category SP Manual Metal Arc (using B-E49XX, A-E42 or A-E46 electrodes) or Gas Metal Arc Welds (using A-G42, A-G46 B-G49, W50 consumables);
- All bolts to be M12 8.8/S unless noted otherwise.

Drawing No.	Description	Revision
268005-12 EGFT 155 GA	12 EGFT 155 RACK GA	D
268005-12 EO+FT 100 GA	12 EO+FT 100 RACK GA	D
268005-12 EO+FT 190 GA	12 EO+FT 190 RACK GA	D
268005-PL-01	HOLD DOWN BAR	B
268005-PL-02	RACK MAIN BEAM	B
268005-PL-03	HOLDING BAR	B
268005-PL-04	HOLDING BAR	B
268005-PL-06	BASE PLATE	B
268005-PL-08	RACK MAIN BEAM	B
268005-PL-09	HOLD DOWN BAR	B
268005-PL-10	ANLGE PLATE BATTERY RACKS	A
268005-PL-11	ANLGE PLATE BATTERY RACKS	A
268005-RACK-ASSY-01	12 EO+FT 190 RACK ASSY	C
268005-RACK-ASSY-02	BATTERY RACK ASSY	C
268005-RACK-WM-01	RACK END WELDED	C

This review has been carried out in accordance with the following Standards Australia (SA) and Standards New Zealand (SNZ) Codes of Practice:

- AS/NZS1170.0:2002 Structural Design Actions: General Principles
- AS/NZS1170.1:2002 Structural Design Actions: Permanent, Imposed and Other Actions
- NZS1170.5:2004 Structural Design Actions: Earthquake Actions – New Zealand
- AS 4100:2020 Steel Structures Code
- IEEE 693:2018 IEEE Recommended Practice for Seismic Design of Substations

Calare Civil Pty Ltd
ABN 41 050 057 933
170 Rankin Street
Bathurst NSW 2795

Tel: 02 6332 3343
Fax: 02 6331 8210
Email: bathurst@calare-civil.com.au
Web: www.calare-civil.com.au

The following design criterion has been adopted:

- Structure Importance Level 4 (post disaster recovery structure, emergency and medical facilities and building containing hazardous materials) in accordance with Table 3.2 of AS/NZS1170.0;
- Annual Probability of Exceedance (AEP) as follows in accordance with Table 3.3 of AS/NZS1170.0:
    - Earthquake has been designed for an AEP of 1 in 2500 years for Ultimate Limit State (50 year structural design life for an Importance Level 4 Structure)
- AS/NZS1170.1: Super-imposed dead load to structure G = 10.95 kN (18 batteries weighing 62 kg each in the worst case scenario) + self-weight of frame;
- NZS1170.5: Annual Probability of Exceedance (AEP) of 1 in 2500 years for Ultimate Limit State Earthquake Design and Spectral Shape Factor $C_h(T)$ = 3.0 (maximised for soft soil in a worst case scenario), Hazard Factor Z = 0.6 (maximised for Otira and Arthur's Pass in a worst case scenario) and Return Period Factor for Ultimate Limit State R_u = 1.8 for an Importance Level 4 Structure.
- IEEE 693:2018: High Seismic Qualification Level

We note that the structure as depicted in the drawings listed above is sufficient to withstand the loadings described above for the specified Annual Probabilities of Exceedance (AEP) listed. The structure has been designed in accordance with the performance requirements of NZS1170.5 for the Equivalent Static Method described in Section 6 of NZS1170.5. The AEP's listed above have been selected in accordance with Table 3.3 of AS/NZS1170.0 for an Importance Level 4 structure. It is noted that the structure has also been analysed for acceptable deflection and deformation under the prescribed Earthquake AEP of 1 in 500 years for SLS2 (Importance Level 4 structure) and is within acceptable limits. The structure is also adequate to withstand the forces required for High Seismic Qualification Level required by IEEE 693:2018. Under the loadings listed above. the structure is sufficient to withstand the imposed loads and continue to function.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

We trust that this information meets your requirements. Please do not hesitate to contact the undersigned should you require any further information.

Yours faithfully,
CALARE CIVIL PTY LTD

Sean Johnson
BE MIEAust.