# Network Standard

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| **NETWORK** | Document No | : | NW000-S0097 |
| | Amendment No | : | 0 |
| | Approved By | : | Chief Engineer |
| | Approval Date | : | 06/07/2015 |

**NW000-S0097** **NS191 BATTERIES AND BATTERY CHARGERS IN MAJOR SUBSTATIONS**

## ISSUE

For issue to all Ausgrid and Accredited Service Providers' staff involved with Batteries and Battery Chargers in Major Substations, and is for reference by field, technical and engineering staff.

Ausgrid maintains a copy of this and other Network Standards together with updates and amendments on www.ausgrid.com.au.

Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document.

## DISCLAIMER

As Ausgrid's standards are subject to ongoing review, the information contained in this document may be amended by Ausgrid at any time. It is possible that conflict may exist between standard documents. In this event, the most recent standard shall prevail.

This document has been developed using information available from field and other sources and is suitable for most situations encountered in Ausgrid. Particular conditions, projects or localities may require special or different practices. It is the responsibility of the local manager, supervisor, assured quality contractor and the individuals involved to make sure that a safe system of work is employed and that statutory requirements are met.

Ausgrid disclaims any and all liability to any person or persons for any procedure, process or any other thing done or not done, as a result of this Standard.

All design work, and the associated supply of materials and equipment, must be undertaken in accordance with and consideration of relevant legislative and regulatory requirements, latest revision of Ausgrid's Network Standards and specifications and Australian Standards. Designs submitted shall be declared as fit for purpose. Where the designer wishes to include a variation to a network standard or an alternative material or equipment to that currently approved the designer must obtain authorisation from the Network Standard owner before incorporating a variation to a Network Standard in a design.

External designers including those authorised as Accredited Service Providers will seek approval through the approved process as outlined in NS181 Approval of Materials and Equipment and Network Standard Variations. Seeking approval will ensure Network Standards are appropriately updated and that a consistent interpretation of the legislative framework is employed.

**Notes:** 1. Compliance with this Network Standard does not automatically satisfy the requirements of a Designer Safety Report. The designer must comply with the provisions of the Workplace Health and Safety Regulation 2011 (NSW - Part 6.2 Duties of designer of structure and person who commissions construction work) which requires the designer to provide a written safety report to the person who commissioned the design. This report must be provided to Ausgrid in all instances, including where the design was commissioned by or on behalf of a person who proposes to connect premises to Ausgrid's network, and will form part of the Designer Safety Report which must also be presented to Ausgrid. Further information is provided in Network Standard (NS) 212 Integrated Support Requirements for Ausgrid Network Assets.

2. Where the procedural requirements of this document conflict with contestable project procedures, the contestable project procedures shall take precedent for the whole project or part thereof which is classified as contestable. Any external contact with Ausgrid for contestable works projects is to be made via the Ausgrid officer responsible for facilitating the contestable project. The Contestable Ausgrid officer will liaise with Ausgrid internal departments and specialists as necessary to fulfil the requirements of this standard. All other technical aspects of this document which are not procedural in nature shall apply to contestable works projects.

## INTERPRETATION

In the event that any user of this Standard considers that any of its provisions is uncertain, ambiguous or otherwise in need of interpretation, the user should request Ausgrid to clarify the provision. Ausgrid's interpretation shall then apply as though it was included in the Standard, and is final and binding. No correspondence will be entered into with any person disputing the meaning of the provision published in the Standard or the accuracy of Ausgrid's interpretation.

## KEYPOINTS

This standard has a summary of content labelled "KEYPOINTS FOR THIS STANDARD". The inclusion or omission of items in this summary does not signify any specific importance or criticality to the items described. It is meant to simply provide the reader with a quick assessment of some of the major issues addressed by the standard. To fully appreciate the content and the requirements of the standard it must be read in its entirety.

## AMENDMENTS TO THIS STANDARD

Where there are changes to this standard from the previously approved version, any previous shading is removed and the newly affected paragraphs are shaded with a grey background. Where the document changes exceed 25% of the document content, any grey background in the document is to be removed and the following words should be shown below the title block on the right hand side of the page in bold and italic, for example, Supersedes – document details (for example, "Supersedes Document Type (Category) Document No. Amendment No.").

# KEY POINTS OF THIS STANDARD

## Scope and Risks Addressed

This standard applies to all 110V battery and battery charger systems within new Major Substations consisting of Sub-transmission and Zone Substations. Risks and associated controls include:

- ☐ Availability of trip-close-trip function after 5 hours continuous standalone supply to substation DC systems
- ☐ Support for black-start scenarios
- ☐ Separation of cabling and supply to ensure that dual battery systems are not compromised by a single point of failure

**Where to for more information?**

Section 1, 2

## Design Criteria - Batteries

Design philosophy to ensure sufficient capacity to make safe substation on loss of AC supply. In addition the ability to supply high current transient loads beyond the capability of the battery charger. The specific requirements for batteries include consideration of:

- ☐ Use of single or dual battery systems
- ☐ Isolation of cabling and control systems for dual battery arrangements
- ☐ Battery capacity, aging characteristics, number of cells, location and installation of batteries
- ☐ Suitability of different battery technologies and battery life
- ☐ Tables provided for battery duty cycles and battery application
- ☐ Identification using cell numbering
- ☐ Configuration of dual battery systems

**Where to for more information**?

Section 5.2.1

**Tools and Forms**

Annexure A – Compliance Checklist

## Design Criteria – Battery Chargers

Battery charger requirements include:

- ☐ Provision of Uninterruptible Power Supply style switch mode charger
- ☐ Type and location of chargers is addressed
- ☐ Separation of AC inputs is required where dual chargers are installed

**Where to for more information**?

Section 5.2.2

**Tools and Forms**

Annexure A – Compliance Checklist

## DC Circuits & Accommodation

DC Supply systems and other general requirements include:

- ☐ 110V DC supply cabling sized to prevent voltage drop problems
- ☐ Responsibilities for maintenance actions
- ☐ Battery cabinets in control room, battery rooms are not required

**Where to for more information?**

Section 5.2.3, 5.2.4

**Tools and Forms**

Annexure A – Compliance Checklist

# Network Standard
# NS191
# Batteries and Battery Chargers in Major Substations

## Contents

# 1.0 PURPOSE

Battery and battery charger systems must be designed for the purpose intended and to meet the requirements of all applicable standards.

The primary role of the substation battery system is to provide a source of energy that is independent of the primary ac supply, so that in the event of the loss of the primary supply the substation control systems that require energy to operate can still do so safely.

# 2.0 SCOPE

This standard applies to all 110 V battery and battery charger systems within new Major Substations consisting of Sub-transmission and Zone Substations.

# 3.0 REFERENCES

## 3.1 Ausgrid documents

- Company Form (Governance) - Network Document Endorsement and Approval
- Company Procedure (Governance) - Network Document Endorsement and Approval
- Company Procedure (Network) - Production / Review of Network Standards
- Control Room Advice No. 461
- Customer Installation Safety Plan
- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- NEG SM 04.7- Substation Battery Size, Type and Black-start Strategy
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS185 Major Substation Building Design Standard
- NS186 Major Substations Civil Works Design Standards
- NS212 Integrated Support Requirements for Ausgrid Network Assets

## 3.2 Other standards and documents

- AS 2676 - Installation and maintenance of batteries in buildings.
- AS 3011 - Electrical installations - Secondary batteries installed in buildings.
- AS 4044 - Battery chargers for stationary batteries.
- ENA Doc 001-2008 National Electricity Network Safety Code.
- IEEE 485-1997 revised 2003: Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications.
- IEEE 1115-2000 revised 2005: Recommended Practice for Sizing Nickel-Cadmium Batteries for Stationary Applications.
- IEEE 1184-2006 IEEE Guide for Uninterruptible Power Supply Systems.
- IEEE 1189-1996: Guide for Selection of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.

## 3.3 Acts and regulations

- Electricity Supply (General) Regulation 2014 (NSW)
- Electricity Supply (Safety and Network Management) Regulation 2014
- Work Health and Safety Act 2011 and Regulation 2011

# 4.0 DEFINITIONS

| | |
|---|---|
| **Accredited Service Provider (ASP)** | An individual or entity accredited by the NSW Government Trade & Investment in accordance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW). |
| **Business Management System (BMS)** | An Ausgrid internal integrated policy and procedure framework that contains the approved version of documents. |
| **DC-DC Converter** | A DC-to-DC converter is an electronic circuit which converts a source of direct current (DC) from one voltage level to another. |
| **Document control** | Ausgrid employees who work with printed copies of document must check the BMS regularly to monitor version control. Documents are considered “UNCONTROLLED IF PRINTED”, as indicated in the footer. |
| **Network Standard** | A document, including Network Planning Standards, that describes the Company's minimum requirements for planning, design, construction, maintenance, technical specification, environmental, property and metering activities on the distribution and transmission network. These documents are stored in the Network Category of the BMS repository. |
| **Review date** | Valve regulated lead acid battery. The type in use at Ausgrid use gel cells which have silica dust added to the electrolyte forming a thick putty-like gel. Due to their construction they can be mounted in any orientation and do not require regular maintenance. |
| **UPS** | Uninterruptible Power Supply |
| **VRLA battery** | Valve-Regulated Lead-Acid Battery |

# 5.0 BATTERIES AND BATTERY CHARGERS

## 5.1 General design principals

### 5.1.1 Performance criteria

Battery and battery charger systems must be designed for the purpose intended and to meet the requirements of all applicable standards.

The primary role of the substation battery system is to provide a source of energy that is independent of the primary ac supply, so that in the event of the loss of the primary supply the substation control systems that require energy to operate can still do so safely.

The battery is required to supply the DC electrical requirements of the substation, including SCADA, control, protection indication, communications and circuit breaker switching operations when there is no output from the battery charger. This may be due to a loss of AC supply to the substation or a fault in the battery charger. Under these conditions the battery shall supply the DC loads for a minimum period of 5 hours after which time the battery should then be able to supply trip-close-trip operations of a HV circuit breaker which would typically restore supply to the battery charger. The 5 hour capacity allows for ageing and a given minimum cell voltage under load at the end of discharge. There will be nominally no remaining capacity on the battery at the end of the 5 hour period if subjected to the given duty cycle at the end of its service life.

The absolute minimum requirement is that the battery has sufficient energy to allow the substation to be made safe on loss of ac supply. A secondary requirement is to provide high capacity support to the battery charger for operating high current transient loads that are beyond the charger's capability.

### 5.1.2 Design philosophy

Batteries shall have a minimum capacity that is sufficient to supply the duty cycle requirements specified in Section 5.2.1.1.

The number of batteries provided, and the physical & electrical separation of these, shall be in accordance with Section 5.2.1.2.

Where a 50 V DC supply is required for substation communications systems, this shall be supplied from the 110V DC battery via a 50V DC-DC converter.

Substation battery systems are one of the essential elements affecting Ausgrid's ability to assist in the restoration of normal power system operation from a black system condition in accordance with the National Electricity Rules. For this reason Ausgrid's procedures require the conservation of stored energy systems, including battery supplies, in the event of a black system condition. This may include the switching off of certain DC loads, and restrictions on the use of other loads, for the duration of any black system condition. In such situations, the provision of alternative means (such as generators) to supply substation auxiliary supply systems is also considered. Refer Ausgrid Control Room Advice No. 461.

## 5.2 Design Criteria

### 5.2.1 Batteries

#### 5.2.1.1 Battery type and configuration

All new batteries shall consist of valve regulated gel cell lead acid cells.

The battery cells shall be suitable for mounting on their sides.

The configuration and nominal capacity of the batteries shall be derived as follows. From a fully charged state the batteries must be capable of meeting both Duty A and Duty B as shown in the table below:

**Table 1 - Configuration and Nominal Capacity of Batteries**

| Battery Type | Zone Substation (solenoid operated CBs) | | Sub Transmission Substations (solenoid operated CBs) | | Zone Substations (spring operated CBs) | |
|---|---|---|---|---|---|---|
| Load Duty | Duty A | Duty B | Duty A | Duty B | Duty A | Duty B |
| Nominal capacity | *200 Ah | | *160 Ah | | *200 Ah | |
| Discharge Current | 20 A | 20 A | 15 A | 15 A | 25 A | 25 A |
| Discharge Time | 5 hr | 2 hr | 5 hr | 2 hr | 5 hr | 2 hr |
| Followed immediately by: | | | | | | |
| Discharge Current | 150 A | 240 A | 150 A | 240 A | 35 A | 45 A |
| Discharge Time | 10 sec | 10 sec | 10 sec | 10 sec | 10 sec | 10 sec |
| End terminal voltage not less than: | 100 V | 100 V | 100 V | 100 V | 100 V | 100 V |
| Battery ageing factor | 20% | 20% | 20% | 20% | 20% | 20% |
| 50V supply via: | dc-dc converter | | dc-dc converter | | dc-dc converter | |
| Temperature operating range | +5oC to 45°C | | +5oC to 45°C | | +5oC to 45°C | |
| Service life required | >7 years | | >7 years | | >7 years | |
| Accommodation | Cabinet | | Cabinet | | Cabinet | |
| | | | | | | |
| Chemistry | VRLA | | VRLA | | VRLA | |
| Cells in series | 54 | | 54 | | 54 | |
| Float voltage (manufacturer specific) | 124.9 V (2.23 V / cell typical) | | 124.9 V (2.23 V / cell typical) | | 124.9 V (2.23 V / cell typical) | |
| Boost voltage (max) (manufacturer specific) | 135.0 V (2.41 V cell typical) | | 135.0 V (2.41 V cell typical) | | 135.0 V (2.41 V cell typical) | |

**Note:** These are nominal capacities only - actual battery capacities are dependent on discharge rates, final battery voltages and the type of loads to be supplied.

#### 5.2.1.2 Number of batteries

Substations with duplicated protection systems shall have dual (2) battery systems - one for each protection system.

Substations that do not have remote back-up protection systems shall also have dual battery systems. Substations without duplicated protection systems, and which have remote back-up protection, shall have a single (1) battery system.

Where dual battery systems are provided the batteries and associated chargers, including all associated wiring, shall be kept physically and electrically isolated to ensure that potential problems with one system do not affect the other. Each battery shall have a separate dedicated charger.

'A' and 'B' protection systems shall be supplied by different batteries and the overall substation DC load shall be distributed as evenly as possible between the two batteries, for example 'A' protection and SCADA supplied by battery 1, 'B' protection, local control, protection, indication and communications, etc supplied by battery 2.

#### 5.2.1.3 Cell Casing

Cell casings shall be clear or translucent material fitted with safety (anti-explosion) vents.

#### 5.2.1.4 Connections

All bolts, nuts, fasteners and electrical connections shall be of material that is resistant to corrosion.

#### 5.2.1.5 Cell numbering

Battery cells shall be numbered in accordance with AS2676.2 i.e. each cell shall be marked with a cell number beginning with number "1" at the positive end of the battery.

It should be noted that Ausgrid has previously numbered cells beginning at the negative end of the battery. There is no need to renumber old batteries although there will be an impact on the cell number from which taps are taken for 80V tripping tests as follows:

**Table 2 - Configuration and Nominal Capacity of Batteries**

| Battery Type | 80V Tap |
|---|---|
| VRLA AS2676 cell numbering | Cell 19 |
| VRLA Old Ausgrid cell numbering | Cell 35 |
| NiCd AS2676 cell numbering (See Note) | Cell 29 |
| NiCd Old Ausgrid cell numbering (See Note) | Cell 59 |

**Note**: NiCd battery cell numbers are given for reference purposes only.

#### 5.2.1.6 Battery charging

Battery charging is to be strictly to the manufacturer's specification with no unapproved changes to the regime.

Individual cell monitoring shall be installed, with alarms via SCADA for charging voltages and currents outside preset norms.

Charging is to be via a low ripple, UPS style switch mode charger with temperature compensation facility.

"iButton" temperature sensors are to be installed:

- on the centre cell of the centre row to monitor temperature of the cell likely to be the warmest.
- additional iButtons are to be installed on the end cell of the top and bottom row to monitor the coolest cells.

## 5.2.2 Battery chargers

### 5.2.2.1 Type

Battery chargers shall be low ripple, UPS style switch mode charger with temperature compensation facility.

Battery chargers shall comply with the Type 2 requirements of AS 4044 - Battery chargers for stationary batteries, (i.e. the charger is to be suitable for providing supply to a load with or without a battery connected in parallel) and are to be a suitable for wall and floor mounting.

Battery chargers are to be single-phase connected to facilitate connection of petrol-driven generator sets in situations of loss of ac supply (such as under "black start" conditions or other loss of ac supply).

### 5.2.2.2 Location

Battery charger units shall be located within the Substation Control Room, as close as practicable to the relevant battery.

### 5.2.2.3 AC Supply

For substations where two battery systems are provided, AC supply to each battery charger shall be taken from a different auxiliary AC distribution switchboard.

### 5.2.2.4 Features

Battery chargers are to have an AC input circuit breaker, battery monitor relay, DC output fuses or circuit breakers and output voltage indicator. The charger is to be operated in accordance with the battery manufacturer's recommendations.

## 5.2.3 DC supply circuits

The standard 110V DC distribution switchboards to be used shall be in accordance with Ausgrid's most recent design Type Board.

110V DC supply cabling shall be sized to prevent voltage drop problems, particularly for long cable runs.

## 5.2.4 Accommodation

### 5.2.4.1 Battery cabinets

For all new major substations:

- Batteries are to be accommodated in a cabinet within the substation control room - separate battery rooms are not required.
- Battery cells are to be mounted on their sides within the cabinet
- Cells are to be mounted in accordance with the manufacturer's recommendations regarding separation between cells to allow air-flow for cooling and for easier access for removal if necessary.
- Cabinet to be designed to facilitate front access to the batteries, with sufficient space in front of the cabinet for lifting and carrying gear for handling individual cells.
- Cabinet to be treated against electrolyte spill (electrolyte is gel and limited quantity, so spread under cell rupture is limited).
- Where multiple battery groups are provided, the batteries shall be located with sufficient separation to enable maintenance or similar activities on one battery to not adversely affect operation of the other.
- Air flow and rate of change of air to be in accordance with Australian Standards for stationary batteries.
- Air flow for cooling under normal conditions (in at bottom, out at top) and for hydrogen emission under fault conditions.

For existing substations where batteries are accommodated in a separate dedicated battery room(s), the batteries may remain accommodated in these rooms.

Battery stands and cell arrangements shall be in accordance with AS 2676 and AS 3011.

Safety signs, in accordance with AS 2676, shall be permanently displayed in appropriate prominent positions.

#### 5.2.4.2 Ventilation

The battery room or enclosure shall be ventilated, in accordance with the requirements of AS 2676, to keep the average concentration of hydrogen gas within the limits specified in AS 3011.

The preferred method to be used is natural ventilation, wherever practicable.

Also refer to Network Standards NS 185 and NS 186.

# 6.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

**Table 3 – Recordkeeping**

| Type of Record | Storage Location | Retention Period* |
|---|---|---|
| Approved copy of the network standard | BMS Network sub process Standard – Company | Unlimited |
| Draft Copies of the network standard during amendment/creation | TRIM Work Folder for Network Standards (Trim ref. 2014/21250/145) | Unlimited |
| Working documents (emails, memos, impact assessment reports, etc.) | TRIM Work Folder for Network Standards (Trim ref. 2014/21250/145) | Unlimited |

* The following retention periods are subject to change eg if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the Records Manager.

# 7.0 AUTHORITIES AND RESPONSIBILITIES

For this network standard the authorities and responsibilities of Ausgrid employees and managers in relation to content, management and document control of this network standard can be obtained from the Company Procedure (Network) – Production/Review of Network Standards. The responsibilities of persons for the design or construction work detailed in this network standard are identified throughout this standard in the context of the requirements to which they apply.

# 8.0 DOCUMENT CONTROL

**Content Coordinator** : Secondary Systems Development Manager

**Distribution Coordinator** : Engineering Information and Services Manager

# Annexure A – Sample Compliance Checklist

## Network Standard Checklist Form

## NS191 Batteries and Battery Chargers in Major Substations

| Project Identification: | |
|---|---|
| Prepared by: <Name & Position Title> | Date: |

This checklist is for internal Ausgrid use only and does not apply to ASPs or contractors who have specific compliance requirements in relation to Contestable project works. The checklist is unique for each network standard and is available within BALIN and the BMS as a separate form that can be amended as required, completed and saved in TRIM with the other project documentation.

This section is used to identify compliance checks that when applied to the work associated with this Network Standard will satisfy an audit process to establish that the requirements of the standard have been followed. It is expected that applicable items would normally be checked as Comply (Yes) as non-compliance is generally not tolerated.

Where non-compliance is the result of specific site conditions or design decisions this needs to be identified in the notes section of the form for each non-compliance and approval sought from an appropriately authorised Ausgrid manager responsible for design approval per NS261 Compliance Framework for Network Standards.

Should additional information be available to document non-compliance decisions, these can be attached to the checklist form. The checklist and any attached explanatory notes should be saved in the project document repository.

| Item | Description | Refer Clause | Completed/ Actioned |
|---|---|---|---|
| | **Scope** | | |
| | This standard applies to all 110 V battery and battery charger systems within new Major Substations consisting of Sub-transmission and Zone Substations. | | |
| | **Design Principles and Design Criteria – Batteries** | | |
| 1 | Battery design capable of 5hours operation following loss of AC supply | 5.1.1 | Yes/No/NA |
| 2 | Battery capacity sufficient to make safe substation on loss of AC supply | 5.1.1 | Yes/No/NA |
| 3 | Batteries capable of duty cycle requirements detailed in Table 5.2.1.1 | 5.1.2 | Yes/No/NA |
| 4 | 50V supplies supplied from 110V system via DC-DC Converter | 5.1.2 | Yes/No/NA |
| 5 | All new batteries are to be VRLA Gel type capable of mounting on side | 5.2.1.1 | Yes/No/NA |
| 6 | Configuration and capacity of batteries in accordance with Table 5.2.1.1 for each type of application – Zone or Sub-transmission Substations | 5.2.1.1 | Yes/No/NA |
| 7 | Substations with duplicated protection systems will have dual battery systems | 5.2.1.2 | Yes/No/NA |
| 8 | Substation that do not have remote back-up protection will have dual battery systems | 5.2.1.2 | Yes/No/NA |
| 9 | Substation that have remote back-up protection and do not have duplicated protection systems will have a single battery systems | 5.2.1.2 | Yes/No/NA |

| Item | Description | Refer Clause | Completed/ Actioned |
|---|---|---|---|
| 10 | Where dual battery systems installed the batteries, associated chargers and wiring shall be arranged to avoid common points of failure | 5.2.1.2 | Yes/No/NA |
| 11 | Where duplicated protection systems used - A and B protection supplied by different batteries and substation DC load balanced across both batteries | 5.2.1.2 | Yes/No/NA |
| 12 | Cell casing clear/translucent and fitted with anti-explosion vents. | 5.2.1.3 | Yes/No/NA |
| 13 | All connections, bolts, fasteners, etc shall be of material resistant to corrosion | 5.2.1.4 | Yes/No/NA |
| 14 | Cells numbered starting with 1 at the positive terminal of the battery | 5.2.1.5 | Yes/No/NA |
| 15 | Battery charging strictly according to manufacturer's specification | 5.2.1.6 | Yes/No/NA |
| 16 | Individual cell monitoring installed with SCADA alarms as specified | 5.2.1.6 | Yes/No/NA |
| | **Design Criteria – Battery Chargers** | | |
| 17 | Battery chargers of low ripple UPS style switched mode with temperature compensation | 5.2.2.1 | Yes/No/NA |
| 18 | Battery Chargers comply with type 2 requirements of AS4044 – Battery chargers for stationary batteries | 5.2.2.1 | Yes/No/NA |
| 19 | Battery chargers to be single phase design | 5.2.2.1 | Yes/No/NA |
| 20 | Battery Chargers to be located in Substation Control Room | 5.2.2.2 | Yes/No/NA |
| 21 | Where dual battery systems installed the AC supply to each is taken from a different auxiliary AC distribution switchboard | 5.2.2.3 | Yes/No/NA |
| 22 | Battery charger features in accordance with Cl 5.2.2.4 | 5.2.2.4 | Yes/No/NA |
| | **DC Circuits and Accomodation** | | |
| 23 | 110V DC distribution switchboards to latest Ausgrid Type Board | 5.2.3 | Yes/No/NA |
| 24 | 110V DC supply cabling sized to prevent voltage drop problems | 5.2.3 | Yes/No/NA |
| 25 | Battery cabinet requirements met | 5.2.4.1 | Yes/No/NA |
| 26 | Ventilation requirements in accordance with AS 2676 Installation and Maintenance of Batteries in Buildings | 5.2.4.2 | Yes/No/NA |

Notes:

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