THE UNIVERSITY OF SYDNEY

UPS Services Standard

Design, Engineering, Planning & Sustainability

University Infrastructure

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Author(s)	Maggie Xia

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Contents

1 Purpose

The UPS Services Standard sets out the University of Sydney's minimum requirements for the design, construction and maintenance of UPS systems. It ensures new UPS systems are energy efficient, fit-for-purpose, made from durable good-quality materials, contain no or minimal environmentally harmful substances, and are cost efficient to operate and maintain.

Applicable requirements documented in Workplace Health and Safety legislation, Disability Discrimination legislation, State Environmental Planning legislation, Commonwealth and State legislation, National Construction Codes (NCC), the Building Code of Australia (BCA) and Australian and New Zealand Standards (AS/NZS) are the minimum and mandatory compliance requirements.

Where any ambiguity exists between this standard and the aforementioned mandatory requirements then:

a. The highest performance requirements must apply.
b. Applicable requirements must follow this order of precedence:
    1. Workplace Health and Safety legislation.
    2. Safety in Design.
    3. Disability Discrimination legislation.
    4. State Environmental Planning and Assessment legislation.
    5. All other Commonwealth and State legislation.
    6. NCC, BCA and PCA.
    7. AS/NZS.
    8. This standard and other University of Sydney standards.
    9. USYD Sustainability Strategy and Policy

Use versions of all references current at the time of project certification. Where references are changed during the course of a project, provide an impact statement and request confirmation to implement.

2 Scope

This standard describes minimum requirements for design, purchase, construction, and operation and maintenance of UPS systems equipment and infrastructure for buildings and spaces owned, operated, maintained and/or managed by the University of Sydney. It applies to:

a. New building construction.
b. Refurbishment projects for University-owned spaces.
c. Refurbishments of spaces that form part of a broader medium-term (less than five years). program/plan of progressive upgrades to a University-owned building.
d. Refurbishment projects for long-term University-leased spaces.
e. Facilities maintenance services.

The standard applies to planners, project managers, consultants, contractors, sub-contractors, tenants, managing agents, University staff and others involved in the design, construction, installation, operation and maintenance of existing, new and proposed University buildings and facilities.

The UPS Standard provides:
a. A reference document to enable consistency with the design and engineering objectives.

b. Details of the minimum performance requirements for planning, architectural design and maintenance.
c. Support of the University vision for the built environment and best practice.

The Standard addresses key objectives:
a. Quality design which responds, enhances and complements the environment.
b. Appreciation of the heritage context and cultural history of the campuses.
c. Value for money in all aspects of the project.
d. The design of low maintenance buildings and environments.
e. Longevity of construction approach to design.
f. Standardization of key flashing and ancillary details.
g. Flexible design, to future proof building usage for expansion or adaption to new uses.
h. Safety in design.

All Electrical systems products and services provided or specified by designers, consultants, staff and contractors must conform to this standard.

Where specific applications are not explicitly covered, or ambiguity exists, the intent of the design standard must be satisfied. In such cases a return design brief must be provided for review and approval by the issuer of this standard or their appointed delegate who must have relevant technical competence in the subject matter. Additional more stringent requirements may apply on a project-specific basis dependent upon risk management and insurance requirements.

This standard does not cover in detail the special UPS installations for specialised medical, laboratory and research spaces which will be specifically defined in the project. Nonetheless the principles and minimum requirements of this standard must apply to these spaces.

The standard covers provision of UPS services for most University projects.

Glossary of Terms

Unless the context otherwise requires, the following definitions apply:

AS/NZS	Australian / New Zealand Standard
CCEW	Contractor's Completion of Electrical Works
COS	Central Operations Services
DB	Distribution Board
MSB	Main Switchboard
NCC	National Construction Code of Australia
UI	University Infrastructure
UPS	Uninterruptible Power Supply

3 Roles and Responsibilities

This standard is issued by UI. It is approved and signed off by the Chief University Infrastructure Officer. UI is responsible for maintaining the standard and keeping it up to date. The Standard must be reviewed biennially.

4 Scope and Cost Planning

The UPS design for projects within existing buildings and new buildings must be assessed on a case by case basis and developed in conjunction with this standard.

UPS Systems within the University have ranged from 2kVA – over 200kVA. The Designer must work with the end user to determine size, battery autonomy, alarms, manufacturer, warranty and maintenance of the UPS.

The Designer/Contractor must submit workshop drawings for UI Engineers review, including UPS calculations.

5 Technical Requirements

5.1 Uninterruptible Power Supply

5.1.1 UPS Provision Policy

UPS systems generally are only provided as special end user equipment, and only provided where adequate justification can be provided for the capital cost, space and ongoing maintenance expenses. University UPS installations are typically a small UPS dedicated to a specific local purpose identified by a user. Rarely and where the cost and complexity are warranted by the criticality of the building, a large central building UPS would be required with a power distribution system.

The type, configuration and complexity of UPS system must be tailored to the load rating and criticality as defined in the UPS equipment supply section below.

Provide the complete systems including any associated works, materials, commissioning and testing required for the system to operate satisfactorily, and in accordance with this standard.

5.1.2 Black Out and Brown Outs

In the case of a critical building that meets TEFMA rating S5 by the University and is identified by UI/COS, consideration must be given to Mains Supply black out and brown out incidents from the supply authority and how this can be minimized, mitigated and eliminated.
Consult with the stakeholders and users to identify the criticality of their equipment or operations, and expectations around power supply stability and reliability.

UPS will provide a limited backup power supply, so ensure the end user understands the time frame that they must act and turn off their equipment as necessary.

5.1.3 UPS and Battery Rating

The rating of the UPS must be defined in the project definition phase. Liaise with the Users to interrogate their requirements and reach agreement on capacity, redundancy and run time. Select the UPS frame size or module quantity to provide at least 10% spare capacity and having regard that UPSs come in stepped rating ranges and footprints. Select the largest rating available for a given frame footprint and price range.

Size the batteries precisely to the total ultimate load, not the UPS frame size which will be larger. Select the number of batteries per string to provide adequate headroom to avoid testing failures if one or two batteries fail. This typically requires 42 - 44 x 12V monoblocs per string. Minimal configured 40 battery strings are very susceptible to single battery failure and expensive delays during testing, as well as long term unreliability.

Ventilation for the UPS is also to be reviewed with the UI Mechanical Services Engineer and the NCC codes for both ventilation and fire rating.

5.1.4 UPS Battery Fire Isolation

UPS Batteries (and usually the associated UPS for practical reason) must be fire isolated from the remainder of the building in accordance with NCC

In certain University buildings, laboratory installations with small UPSs dedicated to the local load, the Certifier may deem that the entire area served by the UPS is one fire / risk zone, and therefore the UPS is considered part of the single risk, not requiring separation from the laboratory area. Such an instance may apply to laboratory "grey Space" zones which are designed to accommodate specialist and potentially hazardous equipment.

Any central building UPS will require fire isolation. Seek advice from the Certifier, and approval from the Project Manager and the building manager.

5.1.5 UPS Structural Implications

Co-ordinate the structural loading implications and requirements for the very heavy UPS floor loads which range from 10-15kPa, noting that typical building floors rated at 5kPa will require major reinforcement and / or load spreading with exclusion zones.

5.1.6 UPS Maintenance Space and Ventilation

UPS batteries are large, very heavy and difficult to move safely, posing a maintenance hazard. Comply with the supplier's recommended minimum access clearances for battery replacement, noting that forklift trolleys are usually required with large turning radius areas.

UPSs generate significant heat and have high airflow requirements. Depending on the UPS size, supplementary air conditioning may be required. Ensure that the manufacturers ventilation and maintenance clearances are provided, which usually require significant clearance at the rear of the unit.

Maintenance of UPS systems is undertaken by the UPS owner which is typically the end user and not UI/COS.

5.1.7 UPS Electrical Connection

UPS rated less than 4kVA typically require only a single phase, single input and output connection by plug socket or local isolator. The Internal bypass is considered adequate. External service bypass is not justified.

For any UPS rated more than 5kVA:

a. Provide power to the UPS system from three separate Circuit Breakers:
    i. Rectifier input supply.
    ii. Static Bypass Supply.

iii. External Manual Service Bypass Supply.

b. Provide a mechanically and electrically interlocked external service bypass switch to permit the UPS to be taken out of service and removed for repair. A rotary type multipole switch may be used up to 63A rating. Above 63A use key interlocked circuit breakers with key interlock to the UPS static by-pass control. The interlock ensures that the UPS must be transferred to static bypass before the manual bypass can be engaged.

5.1.8 UPS Equipment Supply

a. Provide UPS units using transformer-less IGBT input and output technology.
b. Provide single plane 3 phase input 1 phase output UPSs for general applications up to 10kVA.
c. For larger or more critical applications provide N+1 3ph input / output UPS using modular type UPSs where one extra spare module is installed to accommodate failure. Full dual N+N systems may only be installed with special UI permission.
d. The UPS output technology must be able to operate for short periods during mains input supply changeovers without a reference neutral. i.e. open transition 4 pole changeovers.
e. Integral Static Switch and manual service bypass switch rated for the fully equipped cabinet capacity.
f. The load power factor is defined as between 0.9 leading – 0.9 lagging, including unity. The UPS kW and kVA must be fully rated for this range.
g. Input Parameters; Power factor >0.9 / Harmonic Current Distortion < 5%
h. Synchronised operation of the UPS output with the mains supply when available.
i. UPS interface relay outputs sufficient to provide UPS group and individual major alarms to the BMS systems (normally open volt free).
j. High level interface to the BMS system via MODBUS or Ethernet card. (co-ordinate with BMS contractor).
k. Programmable Battery recharge limits.

5.1.9 UPS Battery Supply

Provide a 7-year life rated battery system using VRLA technology with pure lead plates equal to the Enersys PowerSafe SBS EON range:

a. Warranty 12 months replacement plus 5 years pro-rata.
b. Batteries must be factory manufacture date stamped not more than 12 months before the date of Site commissioning.
c. Provide single string battery for small UPS less than 10kVA.
d. Provide 2 or more battery strings for ratings >10kVA.
e. Provide detailed battery autonomy calculations at the chosen discharge rate.
f. Battery Initial Rate test - The batteries must achieve the required kW rating of the UPS output load for 20 minutes minimum, at 1.7 Volts per cell cut-off, during commissioning witness test. NOTE – Tests or ratings related to “end of life” specifications are NOT acceptable.
g. Replace any Monoblock batteries if it fails the testing parameters set out herein, or all if the batch failure clause is triggered.
h. Batteries delivered to the site must be manufactured within 10 months of the delivery date, and have an acceptable machine printed manufacturer’s label identifying this date. The requirement is that the batteries will be commissioned less than 12 months from date of manufacture, with the batteries stored on site initially fully charged from the factory.
i. Battery interconnection links and terminal insulation supplied and installed.
j. DC Circuits Breaker open & trip alarms to the BMS system either directly or via specific alarms on the UPS unit.

k. Carry out commissioning boost charge, initial short discharge and long-term float charge to prepare the batteries for testing. Record and supply the individual 12V battery boost charge and float charge voltages for verification that they are within acceptable range.

5.1.10 UPS Documentation

Provide the following documentation:

a. UPS and Battery Supplier Agreement documentation covering extended warranties.
b. Factory test sheets for the UPS units.
c. Manufacturer data sheets for the batteries.
d. Site commissioning and testing data for the UPS and battery systems in hard and soft copy formats, signed by the testing engineer and the client's representative.
e. UPS procedure for service bypass on a single A4 laminated page mounted immediately next to or on the UPS.
f. Approved Workshop drawings for the UPS and battery cabinets.
g. Warranty documentation for the UPS units and batteries.
h. Operations and Maintenance Manuals for the UPS system components. The electrical subcontractor will incorporate these into the project manuals.
i. Provide comprehensive soft and hardcopy Site Acceptance Test results.

5.1.11 Testing and Commissioning - General

Carry out commissioning, programming and final testing of the UPS systems including manufacturers required tests and documentation for warranty.

Carry out Site Acceptance Testing in accordance with this specification, which may be more onerous than manufacturer's standard tests. This includes onsite personnel for the duration of each test and recording instrumentation.

a. Provide an accurately adjustable Resistive Load Bank and cables for testing the UPS systems up to 110%. Load to be located to avoid damage to the site.
b. Carry out the testing with witness by the Clients representative. Repeat at an agreed time any test which have failed, after repairs or replacement.
c. Insulation resistance measurements on cables and wiring to AS/NZS 3000.
d. Phase rotation.
e. Earth resistance measurement to AS/NZS 3000.
f. Confirmation of effective earthing of the exposed metal of electrical equipment.
g. Full functional checks and operational checks on energised control equipment and circuits, including adjustments for the correct operation of safety devices.
h. Meter calibration.
i. BMS alarms verification and printed alarm records.

5.1.12 UPS Tests

Supply recording instruments to provide electronic data files for all test data. Supply technically qualified and experienced personnel to attend the tests and monitor and maintain the UPS and test equipment:

a. Carry out the Manufacturer's standard commissioning tests and complete all records and schedules.

b. Carry out UPS transition tests for mains fail, transfer to static bypass and step loads 0-100% and 100% to 0%. Record voltage and current waveforms at the transitions and include in the O&M manuals.
c. If the UPS is connected to a permanent site generator supply, test automatic operation of the UPS system on site Emergency Generator power.
d. Carry out a Soak test operation of each UPSs unit on mains power and 5% load for 48 hours. Monitor the system during the test and download the UPS fault logs. The intent is to ensure the system is stable and well run in prior to commencing full load tests.
e. After the soak test, complete Full load testing of each UPS unit at 100% with a resistive load for 4 hours on mains power.

5.1.13 Battery Tests

a. Boost/equalisation charge of the batteries to achieve cell equalisation and recording of the individual battery voltages at completion on a normal float charge. This operation may be carried out during the soak test period.
b. Carry out an initial conditioning battery discharge for 15 minutes at 75% rated load, recording the individual battery block voltages at 0, 5 and 10 minutes. This test and records will weed out defective batteries, indicate if all battery blocks are equalised and fundamentally sound, as well as conditioning / plate forming the batteries up to their initial rated capacity.
c. Carry out a witnessed Battery Autonomy test of each UPS unit:
    i. At 100% load until automatic cut-off at 1.7Volts/cell.
    ii. Record each monoblock battery voltage using a sample recording voltmeter, and the surface temperature using an infrared remote thermometer at 5 minute intervals during discharge. The Monoblock batteries must not have a deviation more than +10% in cell temperature or -5% cell voltage from the average at any time in the load test or float charge.
    iii. Immediately reconnect the mains supply and commence automatic recharge. Measure the battery monoblock voltages at 10 minutes into the recharge. Record the total system UPS input power on stable recharge to confirm the room heat load.
    iv. If any batteries fail during this test, then the test must be repeated with new replacements having been appropriately pre-cycled.
    v. If more than 10% of the batteries fail (5 in a string of 44 typical) then it shall be considered a complete “Batch Failure” and all batteries shall be replaced from a different batch and the testing repeated.

5.1.14 Maintenance

Carry out site inspection & maintenance at 3 months, 6 months and 12 months from date of accepted system testing completion.

Record individual battery float voltages, UPS input and output voltages, currents and power.

5.1.15 Building Management and Control System Monitoring

The UPS must provide connection to the Building Management and Control System (BMCS) monitor the following functions:
a. Status.
b. Fault.
Contractor must provide a high level interface (HLI) with MODBUS or BACnet output.

6 Commissioning

Comprehensive pre-commissioning, commissioning and quality monitoring must be specified by the consultant/designer and builder.

A project specific commissioning plan is to be developed and provided to the University for review and approval.

Detailed testing and commissioning records must be provided for each system and each component as appropriate. All such records must be witnessed and verified by the project consultant/head contractor prior to witness commissioning by UI engineers

Project handover plan must be developed by the consultant/designer to allow the system to be handed over to The University. A 12-month building tuning process will commence at Project handover with systems monitored monthly, reported and assessed quarterly, and include assessment of feedback from the occupants.

A project specific commissioning plan is to be developed and provided to the University for review and approval. UI have developed an **Electrical Services Commissioning Checklist (UI-ENG-F021)** which should be used as a minimum guide when preparing the project specific commissioning plan.

Do not conceal or permanently energize works that require inspection and test prior to entering service.
Provide contract notice to the University to witness all testing and commissioning activities.
Provide Inspection & Test plans for University approval at least two weeks prior to any tests.

7 Safety in Design

The contractor must consider risk during the design. A design safety report must be submitted to the relevant UI Project Manager for every design project. Contractors must confirm, so far as it is reasonably practicable (SFAIRP), that the structure is without risks to health and safety.

Design risks must be considered for the asset lifecycle covering construction, operational and maintenance, refurbishments, and decommissioning.

The design safety report must include the following:

a. Description of design element.
b. Description of potential risks and hazards associated with the design element.
c. A low/medium/high risk assessment considering likelihood and consequence.
d. Proposed measures to eliminate risks where practicable.
e. Control measures to mitigate and manage design risks.
f. Nominating responsibilities for managing the design risks.

This may be provided as a design risk register where appropriate and must include results of any calculations, testing and analysis etc.

8 Documentation and Records

8.1 Design Documentation

Prior to commencing construction of new or refurbishment projects, the consultant/contractor must fully investigate and document the requirements for each Electrical system required to be installed, altered or modified as part of the project works.

This must include:

a. Return Brief defining the systems proposed and any deviations from this specification;
b. Electrical maximum demand calculation spreadsheet.
c. Battery run time calculation spreadsheet.
d. Computer design calculation files for circuit breaker grading study, fault levels, voltage drops and cable calculations.
e. Budget calculations.
f. Applications to Supply Authorities, and their responses.
g. Designers statutory compliance certificates.
h. Requests for all variations to this Standard submitted using the **UI Request for Dispensation Form (UI-ENG-F001).**
i. Complete the Design & Construct checklist using the **UI Design & Construct Electrical Services Checklist Form (UI-ENG-F009).**

These documentations must be provided by the consultant/contractor in electronic copy format and approved by the University.

8.2 Completion Documents

At the completion of all projects, the following documentation must be provided for electrical service installed or altered as part of the project works:

a. O&M manual(s).
b. As-built drawings (including schematics and block plans).
c. System schematics.
d. Complete As-built drawings, including all workshop drawings updated to As Built status.
e. Electrical and wiring diagrams.
f. Asset schedules and labelling (as per the Asset Identification and Labelling Standard).
g. Commissioning test results.
h. Product manufacturer specific information.
i. Licensed versions any computerised software required to program and monitoring systems.
j. Details of all usernames and passwords required to access all equipment and software.
k. Warranty schedules for all major items of equipment, including but not limited to switchboards, switchgear.
l. Maintenance requirements for all items of equipment.
m. Building User Guide.
n. System functionality and operation description.
o. System set point values.
p. Installers Statutory certificates.
q. Supply authority completion forms and inspection records, including the CCEW (completion certificate).
r. Contractors completed self-regulated Inspection & Test plans for the energization of new works (replacing Supply Authority Inspectors attendances for inspections in 2018)

s. Certification of (Design/Install) compliance to The University Standards, Australian Standards and NCC.
t. As-Built single line diagrams to be permanently fixed to the wall in Regional or Main Switchrooms. Minimum size A1 or as required to be legible, anti-reflective laminated.
u. Laminated A4 Operating Procedures for special equipment such as castell key interlock arrangements, manual transfer operations, fuelling instructions of diesel tanks and UPS service bypass operation.

This documentation must be provided by the contractor in both electronic and hard copy formats and approved by the University prior to Practical Completion being granted.

9 Assets and Warranties

Assets are to be tagged in accordance with the COS Universities Asset & Labelling Standard for the purpose of maintenance and operation of University Assets. For refurbishment projects the project manager is to provide the existing asset list to the contractor to ensure modified and redundant equipment are captured in the contractors submitted asset list.

Each asset required to be collected can be found in the Asset Form **COS-ASSET-F001**, each asset required to be coded will be identified by a unique equipment code.

The equipment code will be one the three following types:
a. Virtual asset (This is a concatenation ***Building Code*** - ***Floor*** - ***Room Number***)
b. Item count asset (This is a concatenation ***Building Code - Floor - Room number***)
c. Unique bar code asset (Unique bar code in the million series number affixed to the asset)

Asset lists are to be submitted prior to practical completion of the project for review and approval by COS.

Equipment Warranties are to be provided for a minimum of 12 months from the date of practical completion. Warranties are to be provided as certificates as part of the O&M from the supplier of the equipment. It is the responsibility of the installation contractor to ensure all maintenance\servicing required to the equipment is provided to ensure warranties are valid at the end of the project DLP period.

10 Defects and Liability Period

Consultants/designers must include in the project specification detailed requirements for the defects and liability period following completion of the fire services installation.

The contractor must include and allow for recommissioning of all major plant and equipment in the last month of the 12-month defects and liability period and confirm they achieve the original design requirements.

In addition, all commissioning must be witnessed by UI Engineering staff with commissioning reports/results formally submitted to UI Engineering. Commissioning reports/results must be formally submitted to Sydney University UI engineering.

10.1 Maintenance and Testing

For Electrical systems installed as part of a refurbishment project of an existing building, regular statutory maintenance and testing must be carried out by the University essential services maintenance contractor during the Defects Liability Period (DLP).
The installation contractor must provide a comprehensive handover and the required completion documentation at Practical Completion.

All defects arising from regular statutory maintenance and testing performed during the DLP will be documented and passed onto the installation contractor for rectification. The installation contractor must be responsible for all defect rectification works identified during the DLP.

Prior to the completion of the DLP, the installation contractor will perform all annual maintenance procedures in the presence of the University essential services maintenance contractor and provide documentation confirming the provision of all statutory maintenance has been performed during the DLP.

11 Operations and Maintenance Manuals

Consultants/designers must include in the project specification detailed requirements for operation and maintenance manuals, including system description, operation procedures, testing and commissioning records, maintenance instructions, product support information and recovery protocols for any computer related systems. Contractors must provide these to the satisfaction of the consultant/designer. Providing a collection of manufacturers' brochures and catalogues is not acceptable to the University.

The O&M manuals must be submitted in the format outlined in **Operation and Maintenance Manuals Standard**. The **O&M Manuals Folder Template** must be used to submit the final O&M manuals. O&M manuals must be provided electronically in the zip folder via a USB and a large file downloadable link or platform. **O&M Manuals Review Checklist** must be submitted with O&M manuals package. For more information refer to the **Operation and Maintenance Manuals Standard.**

Contractors must submit the university designed **Asset Management Master Asset Data Capture Spreadsheet (COS-ASSET-F001)** designed for recording operational and maintenance activities including materials used, test results, comments for future maintenance actions and notes covering asset condition. Completed logbook pages recording the operational and maintenance activities undertaken for Practical Completion and during the Defects Liability Period must also be provided. For more information refer to the **COS Asset Identification and Labelling Standard**.

Facilities Maintenance must establish, document and implement procedures for operation and maintenance of UPS services, plant and equipment to ensure UPS services are fit-for-purpose, provide secure, efficient, safe and reliable electrical power, and comply with requirements of this standard.

12 Authorization of Variations

Project managers, consultants, contractors, commissioning agents and facilities maintenance personnel must ensure compliance with these requirements is achieved.

Variations to this standard must only be considered where:

a. The University Standard's requirement cannot physically or technically be achieved.

b. The alternative solution delivers demonstrated and proven superior performance for the same capital and life cycle cost or better.

Consultants and contractors must identify and justify requirements of the standard that do not apply to the project or which need to be varied and these which must be approved by the issuer of this standard. Formal requests for all variations to this Standard must be submitted using the **UI Request for Dispensation Form (UI-ENG-F001)**. The issuer of this standard or their delegated authority must review and consider requirements of stakeholders from clients, projects and facilities management before deciding whether to approve variations. Their formal sign-off is required for acceptance of any non-compliances and departures from this standard's requirements.

13 Quality Control

13.1 Design Standard Compliance

Compliance with requirements of this standard must be checked throughout the design, construction and commissioning phases of projects by UI' services consultant. Any issues or deviations from this standard must be reviewed and approved in writing by the author of this standard.

Competent UI consultants and representatives must check compliance with this standard during design reviews and formal site inspections. Any non-conformances with requirements of this standard must be documented and provided to the UI Project Manager for issue to contractors and their consultants.

Project Managers must maintain a formal register of non-conformances and manage close out of outstanding non-conformances. Contractors and their consultants issued with non-conformances must take appropriate corrective actions. The UI Project Manager must ensure:

a. Proposed corrective actions are implemented.
b. Close out of non-conformances in relation to this standard is formally approved and signed off by the author of the standard or their delegate.

13.2 Design Standard Certification

Contractors and Consultants must certify compliance to the design standard by submitting a company Design Certification Form to the UI Project Manager at each of the following project phases:

a. Design and Documentation.
b. Tender.
c. Construction.

Notwithstanding UI' internal quality control processes, contractors and their consultants must implement their own robust quality assurance and control procedures to ensure compliance with requirements of this standard.

13.3 Construction Compliance

Consultants and contractors are expected to include check sheets for each system component detailing each item that needs to be checked, tested and verified during the installation process. Such check sheets must be completed and verified by the project consultant/contractors, including the identification of any defects and the closing out of such defects.

Designers must request samples of all accessories, fittings and apparatus proposed for use in the works to be submitted for approval. Only those items that are accepted may be installed on site. Submit the manufacturer's product data for proprietary equipment, including:

a. Technical specifications and drawings.
b. Verification Reports.
c. Performance and rating tables.
d. Recommendations for installation and maintenance.
e. Schedule of proposed major products that are not specified as proprietary items.
f. Product certification.

13.4 Acceptance

The University will only accept projects as complete when all of the above have been carried out, submitted and verified.

The above standards are not an exhaustive list of the relevant requirements. The consultant/contractor must incorporate all relevant standards and Authorities requirements into project specific design, documentation and installation.

14 Document Amendment History

Revision	Amendment	Commencing
1.0	First Issue	18 August 2020
2.0	Second Issue a. Added reference to USYD Sustainability Strategy and Policy. b. Added battery run time calculation to be submitted as part of the design documentation. c. Added reference to O&M Standard.	December 2023