

# Project OBELISC

## Functional Specifications

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## Acronym and abbreviations

Acronym	Definition
ASHP	Air Source Heat Pump
CoMCoP	Consolidation Metering Code of Practice
COP	Code Of Practice
DBO	Distribution Board intended to be operated by Ordinary persons
ENA	Energy Networks Association
ESQCR	Electricity Safety, Quality and Continuity Regulations
EVCP	Electrical Vehicle Charging Point
EAWR	Electricity at Work Regulation
IET	Institution of Engineering and Technology
IK	Impact Protection
IP	Ingress Protection
LCT	Low Carbon Technologies
LV	Low Voltage
MCT	Multi Cable Transit
MEM	Metering Equipment Manager
MET	Main Earthing Terminal
MOCOP	Meter Operation Code of Practice
NGED	National Grid Electricity Distribution
OBELISC	On Boundary Enhanced LCT Integrating Service Cabinet
PEN	Protective Earth Neutral
PENDA-O	Public Electricity Network Distribution Assembly suitable for Outdoor
PSCC	Prospective Short Circuit Current
PV	Photovoltaic
QAS	Quality Assurance System
REC	Retail Energy Code
ROHS	Restriction of the Use of certain Hazardous Substances
UK	United Kingdom
WEEE	Waste Electrical and Electronic Equipment

# 1 Document Overview

## 1.1 Project OBELISC Introduction

This document shall show the functional specifications required for the (OBELISC). The OBELISC system aims to address the growing impact of low carbon technologies (LCT) including Electrical Vehicle Charging Points (EVCP), Air Source Heat Pumps (ASHP) and Photovoltaic (PV) systems, on an aging electrical infrastructure.

National Grid Electricity Distribution (NGED) propose to install a metering cabinet on the boundary of properties that will provide the customer a three-phase connection that can facilitate connection of existing single-phase supply and LCT's that are existing or could be installed in future, whilst minimising disruption to the customer and futureproofing for load growth. This document will cover the electrical, design and safety requirements that the OBELISC will adhere to.

## 1.2 Existing System

Many of NGED customers are reliant on a single-phase incoming supply that will be designed to take a demand up to approximately 80A or 18.4 kW, with some customers using legacy 100A single phase supplies. As this is increased with the addition of LCT's this can be exceeded then requiring to be upgraded to a three-phase system which can provide a supply of 80 A per phase which in total is equivalent to 55.2 kW.

The current procedures for retrofitting a three-phase supply can present many issues to the customer and present complications with works required to the property as shown:

- Resizing the metering cabinet to enable three phase connection.
- Difficulty accessing service positions.
- Installation of new three phase cabling across the property.
- Heat rise in well insulated homes reducing the validity of the maximum rating.

The issues outlined above demonstrate the need for a more efficient and futureproof solution.

## 1.3 Proposed Solution

To address these challenges the proposed OBELISC system offers the following improvements:

- Create additional space available for new connection equipment.
- Provide a 3-phase connection point for customers.
- Reduce wiring costs.
- Reduce losses providing an increase in connection efficiency.
- Lower the disruption of the installation to the customer.
- Provide a simpler way for DNO's to manually balance loads between phases on the LV network.

## 1.4 Aim of document

The aim of this document will be to highlight the electrical, design and safety specifications that will be required to successfully design this system to relevant standards and regulations.

## 2 Standards and Regulations

This section identifies the standards and regulations that will assist in the design and installation of the OBELISC system.

### 2.1 Standards

- ▶ National Grid Standards ST: SD5D/5 - Arrangements for Low Voltage (LV) cut outs.
- ▶ National Grid Standards ST: SD5A/6 - Design of low voltage domestic connections.
- ▶ Energy Networks Association (ENA) specification T S 37-1 –Technical requirements for 400 V a.c. switchgear, control gear and fuse gear assemblies.
- ▶ ENA G81 –Framework for new low voltage housing development installation.
- ▶ Consolidation Metering Code of Practice (CoMCoP) – Minimum requirements for installation, operation and maintenance of metering equipment.

#### 2.1.1 British Standards

The following British standards shall be adhered to as a minimum requirement throughout the design, construction and maintenance of the proposed OBELISC system:

- ▶ BS EN 61439 – General safety and performance requirements for the design and construction of low voltage switchgear and control gear assemblies:
  - BS EN 61439-1 – General rules that define the service conditions, construction requirements, technical characteristics and verification requirements.
  - BS EN 61439-2 – Power switchgear and control assemblies, specifies the requirements for industrial and commercial LV power switchgear assemblies. It covers aspects such as short circuit performance, thermal limits and mechanical strength, applying to both indoor and outdoor assemblies. BS EN 61439-3 Distribution Boards for operation by Ordinary persons (DBO) covers LV distribution boards intended for use of non-technical users typically in domestic or similar environments. This defines the limits on ratings, enclosure performance and safety features.
- ▶ BS EN 60529 – Degree of protection provided by enclosure (IP Code).
- ▶ BS EN 62262 – This standard relates to the degree of protection provided by the enclosure for electrical equipment against external mechanical impacts (IK code).
- ▶ BS 7657 – Cutout assemblies that are rated up to 100 A for power supplies to buildings.
- ▶ BS 7671:2018+A3:2024– Requirements for Electrical Installations.
- ▶ BS 7870 – LV and MV polymeric insulated cables for use by electricity distribution and generation utilities
- ▶ BS 8567 – Specification for outdoor electricity meter cupboards.
- ▶ BS 13501 – Fire classification of construction products and building elements.

- ▶ BS EN 62208 – General requirements for empty enclosures for low voltage switchgear and controlgear assemblies.

## 2.2 Regulations

- ▶ Balancing and Settlement Code of Practice (COP) 8 & 9
- ▶ Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002
- ▶ Electricity at Work Regulations 1989 (EAWR)
- ▶ Waste Electrical and Electronic Equipment Regulations (WEEE) 2013
- ▶ The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations (ROHS) 2012

## 2.3 Guidance

- ▶ Memorandum of Guidance on the Electricity at Work Regulations (HSR25) – Health & Safety Executive
- ▶ Retail Energy Code (REC) - [recportal.co.uk](http://recportal.co.uk)

# 3 Functional Requirements

The OBELISC assembly shall comprise an enclosure housing a three-phase cut out and associated protective devices located at the origin of the customers installation. The enclosure shall provide dedicated space for suppliers metering equipment and shall ensure that there is segregation between DNO/metering equipment and the customer owned equipment.

The customers installation may include legacy connection to the dwelling, EVCP, ASHP and one micro generation circuit. These connections may be configured as single phase or three phase depending on the installation requirements.

The following sections outlines the functional requirements for each system component and the associated equipment necessary for the overall system to operate effectively.

## 3.1 Enclosure Requirements

- ▶ The cabinet door shall be designed for easy removal and replacement to facilitate maintenance.
- ▶ The enclosure shall provide suitable cable entry, for example through knock outs or a multi cable transit system in accordance with BS 8567.

- ▶ The enclosure casing shall be designed to allow removal or replacement without disturbing existing service cables.
- ▶ A mounting board shall be installed which meets the requirements set out in BS EN 13501-1 to support internal components and wiring assemblies.
- ▶ The meter cabinet shall be constructed generally of a chemically inert material. The material shall be:
  - substantially non-hygroscopic.
  - Resistant to normal environmental conditions, including ultraviolet radiation, dampness and abrasion.
- ▶ Necessary metal parts incorporated shall be made from non-ferrous metal or suitably protected to prevent corrosion.
- ▶ All latch components and fastening hardware shall be made from robust, corrosion resistant materials appropriate for the enclosure environment, such as engineering polymers or stainless steel that comply with industry standards.
- ▶ The overall enclosure shall be designed to have a maximum spatial envelope of 1.25m (H) x 0.75 m (W) x 0.5m(D) with consideration given to minimise the overall dimensions where practicable.

The design shall also provide:

- ▶ Sufficient space for the safe installation and operation of all necessary switchgear and any metering equipment.
- ▶ Provisions for future system expansion or integration of additional functional elements.

### 3.2 Cut-out Requirements

The following guidance is based on three phase loads of up to 69 kVA

- ▶ Three phase connections up to 100 A require a service cut out rated cut out to be fused at 100 A per phase to maintain circuit protection.
- ▶ The assembly shall accommodate fusing arrangements of up to 100A per phase with a recommended 80 A per phase as per NGED guidance.
- ▶ Single phase connections shall normally be rated at 80 A, with the provision for existing supplies fitted with a 100 A fuses and cut outs in accordance with section 1.2.
- ▶ The cut-out assembly shall be compatible with low voltage supplies with a nominal voltage up to 440 V AC.
- ▶ Cut-out assembly will contain a combination of protection devices, neutral terminals, earth terminals, ancillary terminal blocks, connecting units and anti-tamper facilities, as applicable, to provide facilities for terminating service cables and a means of protection, isolation and earthing of electricity supplies to consumer to comply with BS 7657:2022
- ▶ Materials and components shall be selected for durability and long service life under normal operating conditions and have a service life of at least 25 years consistent with current industry standards.
- ▶ The assembly shall operate across ambient air temperatures in the UK.
- ▶ Fuse carriers shall allow safe and practical operation, maintenance and replacement without the need for specialist tools.
- ▶ Be mounted at a minimum of 500mm above finished floor level to comply with CoMCoP clause 14.1.12.
- ▶ The system design shall exclude looped supply arrangements. Each service termination shall be designed to provide a single connection point.

### 3.3 Switchgear and Controlgear Requirements

- ▶ The switchgear assembly shall be rated appropriately for the nominal operating voltage of the DNO supply.
- ▶ Components shall be suitable for normal operation within the expected ambient temperature range and environmental conditions of the intended installation environment.

- ▶ The design shall include barriers or obstacles designed to protect against direct contact with equipment in adjacent functional units.
- ▶ Materials and construction shall support long term operational reliability and maintainability.

### 3.4 Metering Requirements

The OBELISC metering system shall provide accurate measurement and reliable communication of energy usage within the integrated three phase network configuration.

- ▶ The metering unit shall be designed to incorporate a three phase, four wire connection to the supply interface.
- ▶ The meter shall enable bidirectional energy measurement to support both supply and generation monitoring.
- ▶ Metering equipment shall be capable of communicating with smart metering infrastructure.
- ▶ Shall be positioned to allow safe and unobstructed access for meter operations, reading and maintenance in accordance with CoMCoP clause 14.1.12.

### 3.5 Protection Device Requirements

Protection devices shall be coordinated with upstream DNO fuses to ensure discrimination under overload and short circuit conditions, in accordance with the requirements of BS7671 wiring regulations.

The selection of customer side protection devices, such as Over Current Protective Devices (OCPD), Surge Protection Devices (SPD), or Open Protective Earth and Neutral (O-PEN) devices shall be determined based on specific installation arrangements and customer requirements.

### 3.6 Termination Requirements

Terminations within the OBELISC enclosure shall be suitable for the connection of copper and aluminium conductors, accommodating both stranded and solid formation in accordance with BS 7870, BS 6724 & BS 5467.

Terminals shall be designed to provide reliable electrical and mechanical performance under rated operating conditions. Connections shall ensure adequate contact pressure is maintained to ensure long term conductivity and to prevent loosening and overheating. The terminations shall be designed to allow for safe access and maintenance without compromising the electrical safety.

Termination design and installation shall comply with BS7671 for the end user connections and DNO and ENA specification for the supply terminations.

The enclosure shall incorporate suitable segregated and labelled termination points to facilitate DNO personnel to manually transfer single phase supply circuits between phases for load balancing purposes without having to modify the enclosure.

### 3.7 Earthing and Bonding

The enclosure and all equipment housed within shall be earthed and bonded in accordance with the requirements of BS 7671 and BS EN 61439 to ensure that no exposed conductive part can become hazardous under fault conditions, to ensure this:

- ▶ A Main Earthing Terminal (MET) shall be installed to allow the connection of all protective conductors, bonding conductors, cable armours and SPD earth connections.
- ▶ All metallic parts of the enclosure, including doors, gland plates and internal metalwork shall be bonded to the METr.

- ▶ Hinged or removable metallic components must be earthed using a flexible earth conductor.
- ▶ Where SPDs are installed the earthing connection shall be routed to the earthing connection in the shortest route practicable.
- ▶ All earthing points shall be clearly labelled to comply with the electricity at work regulations.

### 3.8 Cabling

The OBELISC enclosure shall be designed to accommodate low voltage cables that would typically be installed in a domestic setting and DNO supplied cables. The enclosure shall provide the appropriate interface to enable a safe and compliant cable termination including:

- ▶ Sufficient space to maintain the minimum bending radius of cables.
- ▶ Knock outs, gland plates or cable transits to ensure enclosures IP rating is maintained.
- ▶ Fixing points and entry options for both copper and aluminium cables.
- ▶ Fixing points shall be made of a non-corrosive material and be suitable for outdoors.
- ▶ Enclosure shall allow for future cable installation without modification to enclosure.
- ▶ Ultraviolet resistant tube with suitable fixings to allow service cables entering the enclosure.

### 3.9 Mounting

This section defines the installation and mounting requirements for the OBELISC to ensure safe operation, maintenance and long-term reliability of the system. This document specifies the required height, positioning and support conditions to protect the cabinet from external influences while complying with relevant standards and guidance.

- ▶ Cabinet shall be positioned to avoid undue exposure to flooding and standing water.
- ▶ Cabinets shall be positioned to ensure they are not in direct exposure to possible direct impact from hazards.
- ▶ Mounted to allow unrestricted access to the internals to comply with BS 7671.
- ▶ Mounted to ensure that they are stable.
- ▶ Be mounted onto a surface that is firm, level and is non-combustible.
- ▶ The mounting frame shall be made from materials that are ultraviolet resistant, non-combustible and of a material that is not degraded external influences.

## 4 Environment

This section will highlight the requirements for the equipment with regards to the environmental factors that could affect the design and operation.

The enclosure shall be designed and constructed for permanent outdoor installation that will take into consideration environmental conditions with exposure to rain, snow, frost, humidity, dust, ultraviolet exposure and temperature variations. It is recommended that the enclosure shall have a minimum IP rating of IP44 to prevent access to live parts and protect against external influences although this rating alone does not ensure complete weatherproofing, suitable ventilation shall be incorporated to allow adequate airflow while preventing the entry of vermin and insects through appropriate barriers,

To further protect internal equipment from the effects of moisture or water ingress, the design shall incorporate a sloped roof, drip channels around door openings, drain hole(s) and internal baffles to redirect any unwanted water.

These measures will minimise the effect of direct water exposure to live parts to ensure normal and long-term operation.

To maintain safe environmental conditions inside the enclosure an anti-condensation heater shall be included. The anti-condensation heater shall be supplied from the consumer side. The internal heater shall activate automatically with use of a thermostat to ensure that condensation cannot form on energised parts.

The OBELISC shall:

- ▶ Be dust proof such as to not interfere with satisfactory operation of the apparatus.
- ▶ Shall protect against water jets from any direction having no harmful effects on the equipment.
- ▶ Shall be able to dissipate heat and control condensation by removing internal moisture.
- ▶ Be suitable for operation in ambient air temperatures from -25°C to +40 °C.
- ▶ The enclosure shall be resistant to ultraviolet damage, moisture, frost and normal temperature conditions for the region of installation.
- ▶ Have suitable seals and protection relevant to environment that it is installed.

## 5 Safety

The design of the OBELISC shall ensure that all relevant standards and regulations are adhered to. The design shall minimise risk to personnel during operation, inspection and maintenance. The OBELISC shall meet the following safety requirements:

- ▶ Be designed to minimise the risk of electric shock, fire, or accidental contact with live parts.
- ▶ The layout and access shall support safe inspection, operation, and replacement of components.
- ▶ Shall provide suitable warning signs and markings visible under all lighting conditions.
- ▶ Materials used shall be non-combustible or flame retardant and suitable for the environment.
- ▶ Comply with the safety principle of BS EN 61439 and other relevant standards.

## 6 Access and Security

The OBELISC system shall be designed to provide safe, secure and controlled access for authorised personnel only. To ensure that the system is compliant the cabinet shall:

- ▶ Include separate compartments to segregate DNO equipment from the metering and customers owned equipment.
- ▶ Allow for 24-hour access for authorised personnel.
- ▶ Enclosure shall be lockable; doors and panels maintain their integrity when underground movement and vibration occur.
- ▶ Enclosure shall require a specialist tool or key such as Tri-head, penta-head or square key for access after it has been locked as this is considered tamper proof preventing access from the general public.
- ▶ The enclosure shall achieve the minimum recommended impact rating of IK10 for outdoor use to prevent vandalism.
- ▶ A tamper resistant lockable mechanism fitted to prevent access.
- ▶ The design shall allow for clear identification and safe access route in all-weather condition.
- ▶ Ensure accessibility for consumers and authorised personnel with restricted mobility and/or vision by incorporating appropriate design measures such as suitable operating heights and adequate identification of operational interfaces and indicators.

## 7 Manufacturers Tolerances

The OBELISC shall be designed and manufactured to ensure precise dimensional and quality tolerances to ensure reliability, consistency and compliance with standards. As such the product will comply with the following:

- ▶ All manufacturing processes and tolerances shall comply with BS EN 61439.
- ▶ Electrical creepage and clearance distances shall comply with BS 61439
- ▶ Enclosures shall be manufactured to relevant DNO and ENA requirements for low voltage equipment.

## 8 Testing

The testing of the product shall determine that the mechanical, electrical and environmental conditions are satisfactory to comply with BS EN 61439-1 section 10 (low voltage switchgear assemblies).

- Impact test shall not be less than 12 KJ/m<sup>2</sup>.
- Conduct type testing in house or at an accredited lab with a witness from NGED.
- All type test results will be documented proving compliance with relevant standards.
- Prototype testing will be conducted at a location selected by NGED for field tests.
- DNO/MEM shall conduct visual inspections when required to access the enclosure. As per CoMcoP.
- Tests shall be conducted on completed installations to ensure it is safe to energise as stated in the ENA Engineering Recommendation G81 Part 3 section 8.

## 9 Packaging

Packaging shall protect the metering cabinet from mechanical damage, moisture, dirt and ultraviolet damage.

The packaging used shall allow for units to be stacked and transported without causing any damage to the unit or components. Packaging shall be 100% recyclable where possible.

## 10 Storage

The OBELISC shall be designed and constructed for storage without degradation at warehouse and site conditions prior to installation. The enclosure and all components shall be able to withstand storage temperatures of between -5°C and +40°C without deterioration of the enclosure or equipment. The product shall be suitable for storage indoors in locations that are clean, dry and free from corrosive or combustible materials. The enclosure shall also be capable of outdoor storage provided that it is stored to protect against direct exposure to sunlight, rainfall and standing water.

## 11 Transport and Delivery

The OBELISC shall be designed to withstand transportation and handling conditions with no detrimental effect on the enclosure or internal equipment. The design shall ensure that all components, fixings and assemblies remain secure and undamaged when subject to transportation and delivery conditions.

The enclosure and its components shall be cable of withstanding ambient transportation temperatures between -5°C and +30°C without effecting material performance or enclosure functionality.

## 12 Installation

This section defines the design requirements of the OBELISC to ensure ease and safety during installation. The product shall be designed to allow straightforward installation suitable by two persons using standard tools in order to minimise site assembly time and the need for specialist installation methods.

The OBELISC shall incorporate the following installation features:

- ▶ Shall be designed to allow for mounting on a plinth, wall or suitable structure as required by site specific conditions.
- ▶ All fixings shall be accessible without need for specialist tools.
- ▶ Lifting and mounting features shall be integrated into enclosure to allow for safe and accurate installation.
- ▶ The enclosure shall be designed to allow installation by two persons with a typical installation duration not exceed four hours under normal conditions.
- ▶ The product shall include clear labelling and markings to ensure correct installation.
- ▶ The product shall be capable of installation in compliance with all relevant standards and regulations.

## 13 Service Life

The OBELISC shall be designed and constructed as to achieve an estimated life cycle of equal or greater than that of the electrical switchgear and shall be no less than 25 years, this shall be in accordance with BS EN 61439 and ENA G81 part 2 section 6 on materials.

BS 7657:2022 section 8.1.1 states that the design life of the metering and cutouts should be of a minimum of 25 years. The defined service life shall cover all critical aspects of the enclosure including structural integrity, corrosion protection, mechanical protection, electrical components and safety.

## 14 Decommissioning

The OBELISC shall be designed to enable safe and efficient decommissioning at the end of its service life. The design shall ensure that all components can be isolated, accessed and removed without effecting the safety of personnel, the integrity of the enclosure or the electrical system.

The OBELISC shall meet the following requirements:

- ▶ Allow for safe electrical isolation of all live parts.
- ▶ All connection and isolation points clearly marked.
- ▶ Shall be constructed using recyclable materials where possible to allow for responsible end of life waste management.
- ▶ Shall maintain mechanical stability during partial or full disassembly.
- ▶ Be designed to allow for the dismantling of the enclosure using standard industry tools.

## 15 Disposal

The OBELISC shall be designed to enable safe and environmentally responsible disposal or recovery at the end of its service life in compliance with UK environmental legislation. The product shall use materials that minimise environmental impact and allow for separation, recycling and the reuse of components when available.

The OBELISC shall comply with all applicable UK legislation, including The Waste Electrical and Electronic Equipment (WEEE) Regulations 2013 to ensure that the electrical and electronic components can be classified, collected and processed through appropriate recycling systems. OBELISC shall be compliant with the Restriction of the Use of Certain Hazardous Substances (RoHS) Regulations 2012 to ensure that the concentration of any restricted substances does not exceed the permitted limit.

Disposal of the enclosure and its components shall be achieved through a recognised waste management process, ensuring compliance with relevant statutory and environmental requirements.

## 16 Quality Assurance

Quality Assurance provides a structured and systematic approach to ensure that all aspects of the OBELISC design, manufacture and installation comply with the requirements of ISO 9001 as well as all applicable project specific standards and regulations.

The Quality Assurance System (QAS) shall verify that all design activities associated with the OBELISC are conducted in accordance with the approved specification and documented design procedures. The QAS shall ensure the design complies with the relevant regulations, standards and guidance documented in section 2.1 of this document.

All quality records including as-built records, drawings, inspection reports and test results shall be maintained to provide traceability and evidence of compliance. These records shall demonstrate that the OBELISC system has been developed, verified and approved with compliance with ISO 9001 and relevant standards.