

Category 1 Standard

S1948 Battery Backed Power Supply Equipment for Local Emergency Power Supplies

(formerly Powerlink Technical
Specification SP80702 Rev 4)

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1 Purpose

- 1.1 The purpose of this LU Standard is to apply technical requirements for equipment and systems on the LU power system through the inclusion of a technical specification, previously owned and managed by the Power Service Contractor, UK Power Network Services (UKPNS) Powerlink, as an attachment to this standard.

2 Scope

- 2.1 This Standard applies to equipment and systems on the LU power system.

3 Requirements

- 3.1 The mandatory requirements of this standard are set out in Section 7 as an attachment to this document.
- 3.2 Where an attachment refers to the 'Contractor' it should be taken to mean LU and LU Suppliers following the termination of the Power Service Contract.
- 3.3 Where the attachment refers to the 'System' it should be taken to mean the LU power system including its associated SCADA system and the operational properties.

Note: It is the intention to fully re-work this LU standard into the standards format over a period of time. While the content of the ex-Powerlink specification should not conflict with the remainder of the LU standards suite, should any discrepancies occur, these should be brought to the attention of the LU technical authority.

4 Responsibilities

- 4.1 **The Head of Power Engineering** is responsible for the technical content of this standard. Concessions in relation to this standard shall be directed to the Head of Power Engineering who has overall accountability for compliance with this standard. The Head of Power Engineering may request support from the other technical authorities when reviewing concessions or queries arising from the application of this standard.
- 4.2 **LU and LU Suppliers** shall be responsible for compliance with the requirements of this standard.
- 4.3 **Heads of Profession** are the LU technical authorities for each asset group, and shall be responsible for auditing technical compliance with this standard in accordance with the engineering asset grouping of LU Standard S1041 and with respect to the assurance of assets to which they are accountable for. They shall provide support to the Head of Power Engineering, if requested, with regard to any technical issues arising from concession requests or other queries to this standard.



5 Supporting Information

5.1 Background

- 5.1.1 From the 16th August 1998 through to the 15th August 2013 the LU power system was operated, maintained, renewed and upgraded by UKPNS Powerlink under the Power Services Contract. The contract was a Private Finance Initiative contract where UKPNS Powerlink were responsible for setting the detailed technical requirements for the LU power system.
- 5.1.2 At the start of the Power Service Contract on 16th August 1998 LU transferred its detailed technical standards for the LU power system to UKPNS Powerlink. Powerlink has owned and managed these technical standards as Powerlink technical specifications for the duration of the Power Service Contract.
- 5.1.3 The Power Service Contract ceased on the 16th August 2013 and the UKPNS Powerlink technical specifications for the LU power system were transferred back into LU as Category 1 standards.

Note: At the time this standard was produced, it was deemed necessary to utilise a non-standard for standard format. This however, does not diminish the mandatory requirements contained within the attachments.

5.2 Safety, Environment and Customer Considerations

- 5.2.1 Safety, environment and customer considerations relevant to this engineering standard are covered within the text of the attachment.

6 References

6.1 References and Abbreviations

- 6.1.1 Where references and abbreviations are used in this engineering standard they are given within the text of the attachment.

6.2 Definitions

- 6.2.1 Where definitions are used in this engineering standard they are given within the text of the attachment.
- 6.2.2 The following topic specific definitions are created:
- a) Within London Underground's Glossary of Terms (1-622)
(a Category 1 Standard);

Term	Definition	Source
LU	London Underground is the operating company of the former London Underground Limited.	a
Supplier	Supplier to London Underground, the primary organisation or individual that is selected to deliver a product, service or facility to London Underground and contracting directly to London Underground. This includes Consultants, Contractors, Infracos and PFI Contractors and excludes organisations or individuals selected by and contracting directly to them.	a



6.3 Person Accountable for the Document

Person accountable for the document
Phil Carmichael - Head of Power Engineering

6.4 Document History

Issue no	Date	Changes	Author
A1	Aug 2013	Incorporation of UKPNS Powerlink technical specification SP80702 Rev 4 as Category 1 LU standard following the termination of the Power Services Contract as per DRACCT No. 01934. No technical requirements have been changed.	G Bloch



7 Attachment - Technical Specification SP80702 Rev 4 (Ex Powerlink)

1 Introduction

This specification is for use only within the scope of the London Underground Limited (LUL) Power Service Contract (PSC). It is one of a series of specifications which mandate EDF Energy Powerlink (Powerlink) technical and associated requirements for equipment for use on The System.

These specifications are supported by Powerlink Work and Operating Instructions, and shall be read in conjunction with Powerlink Design documentation, as appropriate.

2 Purpose

This specification states the technical requirements for the design, manufacture and testing of 400 V, 50 Hz three phase and/or 230V, 50 Hz single phase indoor off-line battery inverters (OLBI's) and on-line battery inverters (UPS's), incorporating batteries and static bypass (including associated documentation) to be used to provide local emergency power supplies (LEPS).

3 Scope

This specification applies to new and replacement OLBI's and UPS's (and associated documentation) installed under the Emergency Supply Plan as specified in Section 5 of Schedule 5.1 of the PSC.

4 Definitions

The technical definitions given in the European, International and British Standards referred to herein apply to this specification together with the following:

British Standard	A standard published by the British Standards Institution. Its alphanumeric identity is prefixed by BS.
Charger	The device used to charge the battery in an OLBI. (For convenience this term is also used to describe the rectifier in a UPS. See also 'Rectifier'.)
Emergency lighting	Lighting provided for use when the main electricity supply to the normal lighting luminaires fails.
Equipment	Equipment including all component parts, cables, accessories and appliances.



European Standard	A standard published by the European Committee for Standardisation or by the European Committee for Electrotechnical Standardisation. Its alphanumeric identity is prefixed by EN.
International Standard	A standard published by the International Electrotechnical Commission. Its alphanumeric identity is prefixed by IEC.
Local emergency power supplies. (LEPS)	Local power supplies that are normally continuously available for emergency lighting and other essential services.
Off-line battery inverter (OLBI)	A unit comprising a combination of a charger, battery, inverter, and a static and maintenance bypass. The unit normally provides the load direct from the incoming a.c. supply via the static bypass. When the incoming a.c. supply is not present, it is capable of providing the load exclusively from its battery via the inverter. Changeover incurs a short break in the supply to the load. For the purpose of this document, this unit is referred to as an OLBI.
On-line battery inverter (UPS)	A unit comprising a combination of a rectifier, battery, inverter and a static and maintenance bypass. The unit obtains power from the incoming a.c. supply and normally provides the load via the rectifier/battery/inverter circuit. When the incoming a.c. supply is not present, it is capable of providing the load exclusively from its battery via the inverter. Changeover is effected without a break in the supply to the load. For the purpose of this document, this unit is referred to as a UPS.
Operational environment	The physical and electrical conditions under which the equipment is to operate.
Powerlink Operating Instruction	A document published by Powerlink which provides guidance on the application of the Safety Rules and to direct policy on operational limits and procedures.
Powerlink Specification	A document published by Powerlink which mandates technical and associated requirements for equipment for use on The System. Its alphanumeric identity commences with SP8.
Powerlink Work Instruction	A document published by Powerlink which describes the methods, tools and detailed procedures for the execution of physical work or inspection of Powerlink plant, equipment and buildings.
Power Service Contract	The contract awarded by LUL to Powerlink to deliver low voltage three phase and single phase power; dc power; signalling equipment power; low voltage dc power; Docklands Light Railway high voltage a.c. power; emergency power; and compressed air to prescribed delivery points.

Note: The performance requirements of the Power Service Contract are contained in LUL Standard 1-105.



Rectifier	The device used to charge the battery and provide load in a UPS. (See also 'Charger').
Section 12	The part of the Fire Precautions Act 1971 which allows the Secretary of State to make regulations about fire precautions. The Fire Precautions (Sub surface Railway Stations) Regulations 1989, were made under this part. Used here to refer to those stations subject to the provisions of 1989 Regulations.
The System	System means the electrical conductors and apparatus for the distribution and control of electricity from any Bulk Supply Points (and for the avoidance of doubt, excluding any assets belonging to any Distribution Network Operator) and from and including the Generating Stations, to and including the Delivery Points and for the production of compressed air and includes the Electrical Control Equipment, the interests in and rights in respect of the Properties granted under the Power Service Contract (PSC) but excludes LUL's Distribution System, the IT Systems (other than the SCADA System) and the Telephony Systems, the Waterloo and City Line, the District Line from Putney Bridge to Wimbledon and Gunnersbury to Richmond, the Bakerloo Line from Queens Park northwards and the interface with the System for each such part as is set out in the Performance Specification and as altered by the Contractor, any Variation, any Known Third Party Works or adoption of Third Party Works.



5 Abbreviations

ESI	Electricity Supply Industry
LEPS	Local emergency power supply
LFCD	London Fire and Civil Defence Authority
LUL	London Underground Limited
OLBI	Off line battery inverter
Powerlink	EDF Energy Powerlink
PSC	Power Service Contract
SCADA	Supervisory Control and Data Acquisition
UPS	Uninterruptible power supply

6 Legislation and Regulations

The equipment shall comply with the requirements of all relevant legislation, acts, rules, regulations or orders and amendments thereto, including:

- (a) Health and Safety at Work Act 1974;
- (b) Electricity at Work Regulations 1989;
Electricity Safety, Quality and Continuity Regulations 2002 (Including Electricity Safety, Quality and Continuity. (Amendment) Regulations 2006);
- (c) Construction (Design and Management) Regulations 2007;
- (d) The Railways and Other Guided Transport Systems (Safety) Regulations 2006 ;
- (e) Railway Safety (Miscellaneous Provisions) Regulations 1997;
- (f) Fire Precautions Act 1971;
- (g) Fire Precautions (Sub-surface Railway Stations) Regulations 1989;
- (h) Fire Precautions (Workplace) Regulations 1997 (and (Amendment) Regulations 1999);
- (i) European Union directive 2004/108/EC;
- (j) Batteries and Accumulators (Containing Dangerous Substances) Regulations 1994;
- (k) The Control of Noise at Work Regulations 2005;
- (l) Health and Safety (Safety Signs and Signals) Regulations 1996;
- (m) Provision and Use of Work Equipment Regulations 1998;
- (n) Manual Handling Operations Regulations (as amended) 1992;
- (o) Control of Substances Hazardous to Health Regulations 2002 (as amended).
For substances falling within these regulations the supplier shall provide a risk assessment covering the life of the equipment and its eventual disposal. Materials containing asbestos, chlorinated fluorocarbons (CFCs) or polychlorinated biphenyls, (PCBs) shall not be used.
- (p) The Utilities Contracts Regulations, 2006



Cognisance shall be taken of relevant sources of guidance, for example:

- (i) The Office of Rail Regulation (HM Railway Inspectorate) Railway Safety Principles and Guidance;
- (ii) The Health and Safety Executive guidance notes and other publications.

The above Legislation is correct at the date of publication of this Specification; current editions shall be applied unless otherwise noted below.

This information is not exhaustive and does not modify the legal obligations of the supplier.

When required by Powerlink, the supplier shall demonstrate compliance with current relevant legislation and regulations.

The Contractor shall provide advice to enable Powerlink to comply with all relevant legislation for the installation, operation, maintenance and eventual removal of the equipment, including as necessary, but not limited to, provision of safety signs, ancillary or emergency equipment, and appropriate procedures.

7 References and Compliance with Standards

Documents referred to by title and/or alphanumeric identity within this specification are listed in Appendix A. Some are mandatory, others provide information or guidance. Unless specified otherwise, reference shall be made to the latest editions.

In particular, this Specification shall be read in conjunction with Powerlink Specification SP80001 – Common and General Clauses for Fixed Power Supply Equipment.

7.1 European, International and British Standards

The equipment shall comply with relevant European Standards whether or not reference is made to them.

Where European Standards are absent, International Standards or national standards having currency within the European Community shall apply subject to the prior agreement of Powerlink.

Unless specified otherwise, the latest editions of standards shall apply.

7.2 LUL Engineering Standards

The equipment shall comply with the latest edition of LUL Engineering Standards where reference is made to them in this Specification.

7.3 Order of Precedence

The order of precedence shall be Powerlink standards, including specifications, work and operating instructions, LUL Engineering Standards and then European and Other Standards, unless there is a conflict with the requirements of The Utilities Contracts Regulations, 2006.



8 General Clauses

8.1 Safety

OLBI's and UPS's are required to be available for providing local emergency power supplies (LEPS) in the event of the failure of other power supplies. UPS's are also required to provide power in the normal supply mode. Failure of the LEPS supplied via OLBI or UPS could result in serious accident or loss of life. OLBI's and UPS's shall provide a high degree of reliability and availability, including in the event of failure of other power supplies.

The equipment shall be, provided with interlocking and padlocking facilities, earthed, insulated, screened, enclosed, shielded as necessary for safety. Safe and appropriate access shall be provided for installation, operation and maintenance purposes. The equipment shall provide protection against electric shock in accordance with EN 61140 and electrical values after isolation shall comply with Clause 8.2 of EN 61140.

8.2 System Assurance

The supplier shall co-operate with Powerlink, where required, to enable Powerlink to undertake a System Assurance analysis for the equipment as part of the LEPS installation. The preferred hierarchy for providing input data shall be:

- (a) data from other similar applications of the same product;
- (b) data from other dissimilar applications of the designed product, suitably normalised for the new application; and
- (c) the use of generic reliability databases.

Data provided shall include hazard analysis, Reliability, Availability and Maintainability analysis and shall enable Powerlink to prepare hazard analyses, reliability block diagrams, failure modes and fault tree analysis.

8.3 The Electrical Power Distribution Systems

8.3.1 Powerlink System

Electrical power for LUL electric traction, signalling, station and depot services, Docklands Light Railway and other authorised users is taken from bulk power supply points and distributed through high and low voltage distribution systems to a.c. and d.c. delivery points. The System is capable of being supplied, under emergency conditions, by Generation at Powerlink Greenwich Generating Station.

8.3.2 Public Network

Local emergency power supplies (LEPS) (including 25% of lighting at defined stations) are supplied from the local Distribution Network Operator Public Network.

The LEPS loads will be supplied via the Equipment defined by this Specification, under defined conditions of failure of the Powerlink and/or Public network systems.



8.4 The Operational Environment

Details of the physical and electrical environment of the power systems are provided in Powerlink Specification SP82603 'Physical and Electrical Environment of The System'. Details of the physical environment are included in Appendix D for ready reference, the preferred ambient being 20°C.

8.5 Operation and Maintenance Manual

The manufacturer's information for operation, installation and maintenance, in English, shall be provided with the equipment (in a permanent storage pocket inside the door) and the contents shall follow the principles of BS EN 60947 (IEC 62271-1), Clause 5.3, and BS 6423. The "information for operation" shall be provided in a separate handbook to that for installation and maintenance.

The manual shall be comprehensive and include all aspects necessary for installation and the safe and effective testing, operation and maintenance of the equipment throughout its specified service life.

The manual shall contain only relevant information and shall include:

- (a) a description of the equipment and major components, including construction, functioning and rating;
- (b) the method of installation;
- (c) operating instructions, including routine testing, isolation, earthing and safety procedures to satisfy Powerlink Safety Rules;
- (d) recommendations for condition monitoring to assist in optimising maintenance intervals;
- (e) maintenance instructions including any special or safety precautions, lifting and handling instructions, fault finding, measurements of wear, testing and overhaul procedures and their frequency;
- (f) operating, maintenance, testing and disposal, safety instructions and warnings required to ensure continuing compliance with current safety and other applicable legislation;
- (g) setting ranges and adjustments for the equipment, including its protective devices;
- (h) drawings and data enabling component parts to be identified for future procurement;
- (i) full instructions for the decommissioning, replacement and environmental disposal of redundant equipment, batteries and lubricants.

In addition, the Installer shall provide a list of installed locations with associated serial numbers, under each contract.

Separate generic and site specific manuals shall be prepared with content and format of each as agreed with Powerlink.

The Operations and Maintenance manual shall be of size A4 loose leaf design with sturdy hard covers. Where practicable, drawings shall be of size A4. Drawings in excess of size A4