

Category 1 Standard

S1939 High Voltage A.C. Indoor Switchboards up to 36kV for Use on The System

(formerly Powerlink Technical
Specification SP80301 Rev 3)



Please read the Written Notices
attached to this standard

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Contents

1	Purpose	4
2	Scope	4
3	Requirements	4
4	Responsibilities	4
5	Supporting Information	5
5.1	Background	5
5.2	Safety, Environment and Customer Considerations	5
6	References	5
6.1	References and Abbreviations	5
6.2	Definitions	5
6.3	Person Accountable for the Document	6
6.4	Document History	6
7	Attachment - Technical Specification SP80301 Rev 3 (Ex Powerlink)	7
1	Introduction	7
2	Purpose	7
3	Scope	7
4	Definitions	7
5	Abbreviations	9
6	Legislation and Regulations	9
7	References and Compliance with Standards	10
7.1	European, International and British Standards	10
7.2	LUL Engineering Standards	10
7.3	Order of Precedence	10
8	General Clauses	11
8.1	Safety	11
8.2	Co-ordination with Building Design	11
8.3	Spare Parts and Consumables	11
8.4	The Electrical Power Distribution System	11
8.5	The Operational Environment	11
8.6	Operation and Maintenance Manual	12
9	Main Performance and Technical Requirements	13
9.1	General	13
9.2	Noise Emission	13
9.3	External Paint Finish	14
9.4	Electrical Performance	14
9.4.1	Switching Duty and Performance	14
9.4.2	Rated Characteristics	15
9.5	Auxiliary Supplies	15
9.6	Ingress Protection	16
9.7	Reliability and Availability	16
9.8	Maintainability	17
9.9	Service Life	17
9.10	Interchangeability	17
9.11	Whole Life Costs	17
10	Other Performance and Technical Requirements	18
10.1	Resistance to Corrosion and Deterioration	18
10.2	Enclosures and Compartments	18
10.2.1	Auxiliary Equipment Compartments	18
10.3	Working at Heights	19
10.4	Labelling and Special Marking	19



10.4.1	General	19
10.4.2	Electrical Warning Signs for Equipment	19
10.4.3	Operational Labelling and Marking	20
10.4.4	Designation Labels	20
10.4.5	Rating Plates	21
10.4.6	Switchboard Line Diagrams	21
10.4.7	Main Terminal Markings	21
10.4.8	Bus zone Protection Current Transformers Service Selector Switch	21
10.4.9	Lifting	21
10.5	Cooling	21
10.6	Monitoring Equipment	21
10.6.1	Transducers	22
10.7	Auxiliary Wiring	22
10.7.1	Provision for Testing	22
10.7.2	Terminals and Terminal Blocks	22
10.7.3	Prevention of Contact with Live Conductors	23
10.8	Circuit Protection of Auxiliary Supplies, Wiring and Equipment	23
10.9	Padlocks and Keys	23
10.10	Security of Isolation	23
10.11	Isolation and Earthing Facilities	23
10.11.1	Switchboard Earth Bar and Equipotential Bonding	24
10.12	Operating Mechanisms	24
10.13	Interlocking, Safety Features and Shutters	25
10.14	Control of Circuit Breaker Operation	25
10.14.1	Local Control at the Switchboard	26
10.14.2	Supervisory Control	26
10.14.3	Intertripping	26
10.14.4	Synchronisation of High Voltage Power Supplies	26
10.15	Alarms and Indications	26
10.16	Testing Facilities	27
10.17	Main Circuit Terminal Arrangements	28
10.18	Protection Systems	28
10.18.1	Current and Voltage Transformers for Protection Systems	28
10.19	Instruments	29
10.20	Special Tools, Test Equipment, Lifting Equipment and Loose Appliances	29
11	Quality Management	29
11.1	Quality Assurance	29
11.2	Inspection and Testing	30
11.3	Type Tests	30
11.4	Factory Acceptance and Routine Test Certificates	30
11.5	Drawings	31
11.5.1	Design Stage	31
11.5.2	As Installed Drawing	31
11.5.3	System and Equipment Records	31
Appendix A	Reference Documents	32
1	Powerlink and Applicable LUL documents	32
2	European and other standards	32
Appendix B	Works / Factory Tests	34
Appendix C	Site Tests	36
12	Current Written Notices attached to this standard	37



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



Term	Definition	Source
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 SP80301 Rev 3 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 SP80301 Rev 3 (Ex Powerlink)

1 Introduction

This specification is for use only within the scope of the London Underground Limited (LUL) Power Service Contract (PSC) with EDF Energy Powerlink (Powerlink). 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 Design documentation where appropriate. This Specification shall also be read in conjunction with Powerlink Document SP80001 "Common and General Requirements for Fixed Installation Power Supply Equipment".

2 Purpose

This specification states the technical requirements for the design, manufacture and testing of 36, 24 and 12 kV rated, 50 Hz, indoor switchboards, associated equipment and documentation for use on The System to provide power for electric traction, signalling, station and depot services, Docklands Light Railway and other authorised users.

The switchboards are used to provide routine switching of the distribution systems, interruption of load and fault current and the isolation and earthing of individual circuits, transformers and busbars.

3 Scope

This specification applies to new 36, 24 and 12 kV rated, 50 Hz, three phase indoor switchboards, and extensions of existing equipment, associated equipment and documentation, to be installed on The System.

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.
Busbar Coupler Circuit Breaker	A circuit breaker connecting together two sections of busbars, but not duplicate busbars.
Busbar Interconnector Circuit Breaker	A circuit breaker connecting together duplicate busbars.



Conceptual and Outline Design documentation	The document(s) issued by Powerlink at the Outline Design stage defining the scope of work, specifying performance, unique operational and design requirements, and identifying service location specific electrical, environmental and interface characteristics.
Detailed Design stage	The stage at which the detailed requirements for equipment and/or work are developed. The proposed design, equipment and/or work are checked at this stage for compliance with the PSC and relevant specifications, and where necessary the concessionary request procedure is initiated.
Equipment	Equipment to include 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. Normally implemented by British Standard, and prefixed BS EN.
International Standard	A standard published by the International Electrotechnical Commission. Its alphanumeric identity is prefixed by IEC.
Operational environment	The physical and electrical conditions under which the equipment is to operate.
Outline Design stage	The stage at which the main requirements for the equipment and/or work are specified by Powerlink.
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 the LUL Standard 1-105.



The 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 all as at the Starting Date 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

LUL/LU	London Underground Limited
PSC	Power Service Contract
SCADA	Supervisory Control and Data Acquisition
Powerlink	EDF Energy Powerlink

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;
- (c) Electricity Safety, Quality and Continuity Regulations 2002
(including Electricity, Safety, Quality and Continuity (Amendment) Regulations 2006);
- (d) Construction (Design and Management) Regulations 2007;
- (e) The Railways and Other Guided Transport Systems (Safety) Regulations 2006;
- (f) Railway Safety (Miscellaneous Provisions) Regulations 1997;
- (g) The Railways and Other Guided Transport Systems (Safety) Regulations 2006;
- (h) Fire Precautions Act 1971;
- (i) Fire Precautions (Sub-surface Railway Stations) Regulations 1989;
- (j) Fire Precautions (Workplace)(Amendment) Regulations 1997 (and (Amendment) Regulations 1999);
- (k) European Union directive 2004/108/CE;
- (l) The Control of Noise at Work Regulations 2005;



- (m) Health and Safety (Safety Signs and Signals) Regulations 1996;
- (n) Provision and Use of Work Equipment Regulations 1998;
- (o) Manual Handling Operations Regulations 1992;
- (p) 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.
- (q) 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.

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.

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.

7.2 LUL Engineering Standards

The equipment shall comply with the latest edition of applicable 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 Standards, unless there is a conflict with the requirements of The Utilities Contracts Regulations, 2006.



8 General Clauses

8.1 Safety

The existing distribution system has a high degree of integrity and provides for local short time outages for maintenance and faults. However, long outages caused by the failure of the equipment may jeopardise the integrity of the distribution system, disrupt train services and give rise to risk to persons and property. Loss of power supplies to an underground railway system is of critical importance to the safety of the travelling public.

The equipment when installed shall ensure that the existing high degree of integrity of the distribution system is maintained and where practicable enhanced.

The equipment shall be safe at all times including in the event of an internal fault. Provision shall be made to ensure the safety of persons concerned in its installation, operation, maintenance, repair, testing and its eventual disposal. All items and connections for the safe operation, control and protection of the equipment shall be provided whether or not specifically mentioned. The equipment shall be capable of being operated in compliance with Powerlink document MSP/SRP/025 'Safety Rules Relating to Work/Testing on HV Electrical Equipment'.

The equipment shall be earthed, insulated, screened, enclosed, shielded and provided with interlocking and padlocking facilities, 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 BS EN 61140.

8.2 Co-ordination with Building Design

Data for heat loss from the equipment when operating at full load shall be provided. Details of the method of pressure relief where internal arcs are not contained within the switchgear must be identified. Any requirements that need to be taken into account in the building design e.g. ventilation and/or pressure relief ducting must be specified.

8.3 Spare Parts and Consumables

The extent of commonality with relevant equipment previously supplied or in service shall be indicated.

The manufacturer shall provide a list of recommended spares and consumables.

8.4 The Electrical Power Distribution 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 ac and dc delivery points.

8.5 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'.

The equipment shall be suitable for its rated characteristics when installed in the operational environment described in SP82603, and as may be supplemented by Powerlink.



8.6 Operation and Maintenance Manual

One electronic copy, in unprotected PDF format, two paper copies and one paper copy per service location, of a comprehensive operation and maintenance manual shall be supplied to Powerlink.

The manual shall 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 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) a list of installed locations with associated serial numbers. (Information to be provided by installer)

The operation 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 shall be accommodated in protective holders within the manual. Drawings reduced in size shall be clearly legible.

Typical manuals shall be submitted to Powerlink at the equipment type approval stage. Any modifications required by Powerlink shall be made and revised copies made available to Powerlink prior to delivery of the equipment.

At the end of the warranty period, any necessary modifications shall be made and sufficient copies provided for incorporation in each of the manuals previously supplied.