

Category 1 Standard

1-069 Low Voltage Electrical Installations



Please read the Written Notices
attached to this standard

Issue: A3

Issue date: May 2011

MAYOR OF LONDON



Contents

Contents	2
1 Purpose	3
2 Scope	3
3 Requirements	3
3.1 Requirements for safety	3
3.2 General Requirements	4
3.3 Power Supply Redundancy	5
3.4 Battery Power Supplies	6
3.5 Control and Monitoring Equipment	6
3.5.2 Indicator lamps shall be provided where changeover panels are installed indicating supply, healthy bias of supply and availability of supplies	6
3.6 Plant Room Requirements	6
3.7 Tunnel Lighting and Power	6
3.8 Switchgear	7
3.9 Cables, Cable Management and Containment	8
3.10 Earthing and Bonding	9
3.11 Signs, Labels and Notices	9
3.12 Reliability, Availability, Maintainability and Safety (RAMS)	10
3.13 Tenants' Premises	11
4 Responsibilities	11
5 Evidence of compliance	11
6 References	12
6.2 Abbreviations	13
6.3 Definitions	14
6.4 Technical content manager	14
6.5 Document history	14
7 Attachment 1 – formerly known as procedure Ea200	16
8 Current Written Notices	19



1 Purpose

- 1.1 The purpose of this standard is to ensure that Low Voltage (LV) electrical sub-distribution systems and installations on LU premises are designed, installed, maintained and operated in a safe and effective manner.

2 Scope

- 2.1 This standard applies to all LV electrical distribution, sub-distribution, final circuits and installations on LU premises as follows:

For installations fed from the Power Service Contractor's LVAC supplies, from the Delivery Point as defined by LU standard 1-105;

- a) For installations fed from the Power Service Contractor's 630V/750V non-traction DC supplies, from the termination of the outgoing station to station DC main distribution cables at the substation switchgear and from the point of connection to any conductor rail;
- b) For installations fed by a Distribution Network Operator (DNO) to LU dedicated local High Voltage (HV)/LV transformers, from the point of isolation on the secondary side of the transformer;
- c) For installations fed from a DNO LVAC supply, from and including the outgoing cable at the DNO cut-out.
- d) For installations fed from independent power supplies other than OLBIs including the power source.

- 2.2 This standard does not apply to Off Line Battery Inverters (OLBIs), DC traction systems, to signalling supplies at 33.3Hz and 125Hz except for where an interface with the DC traction system is required for electrical and mechanical assets or OLBIs.

- 2.3 This standard replaces 1-069 A2 and incorporates the written notices LU-WN-00692 and LU-WN-00700. This category 1 standard should be used in conjunction with part 2 of the supporting electrical guidance document which provides support for the majority of this standard.

3 Requirements

3.1 Requirements for safety

- 3.1.1 Safe systems of work shall be employed on electrical systems to ensure compliance with the Electricity at Work Act as laid out in appendix 1 of this standard in conjunction with a risk analysis and job-specific method statement which limits the loss of supply to ALARP.
- 3.1.2 All LV electrical cabling and equipment installed on and used within LU premises shall be safe in both normal operation and under fault conditions and be designed to meet the requirements of BS7671.
- 3.1.3 All LV electrical distribution systems and final circuits shall be inspected and tested to meet the requirements of Part 6 of BS 7671.
- 3.1.4 In sub-surface locations bus-bars, switchgear, containment, conduit and associated fixings and fittings, cables and wiring (including those used for controls) associated with switchgear, shall be compliant with LU cat 1 standard 1-085.
- 3.1.5 Emergency lighting and emergency power system cabling shall be fire survival type.
- 3.1.6 Emergency lighting and emergency power system cabling shall be physically separated from other cabling by one of the following means:
- a) Running in separate conduits or trunking;



- b) Running in multi-compartment trunking which has full-height metallic barriers between compartments;
- c) Running separate armoured cables.
- 3.1.7 Equipment which relies on automatic disconnection of supply (ADS) for fault protection shall be arranged such that any contact with exposed conductive parts under fault conditions operates the protective device within the designed time.
- 3.1.8 Residual current devices (RCDs) shall not be fitted on safety critical circuits.
- 3.1.9 Machines which can be operated by the public shall be protected by RCDs or operate at separated (or safe) extra low voltage (SELV).
- 3.1.10 The surface temperature of any electrical equipment which may be touched when in normal use shall not exceed 60°C.
- 3.1.11 Where conditions in a location may give rise to the risk of explosion from gas (including sewer gas) or flammable vapours, no electrical circuits shall pass through the location except for the final circuits associated with that location. All cables used in these areas shall be of a fire survival type.
- 3.1.12 LVAC electrical equipment shall be designed to operate safely when the declared voltage at the local main switchboard is 230/400V +/-10%.
- 3.1.13 All cabling and devices connected to the 630V/750V DC distribution system shall be capable of withstanding a 4kV pulse for one minute.
- 3.1.14 All equipment connected to the 630V/750V DC supply shall have protective devices fitted in both poles. In the case of equipment connected to the conductor rails, the protective devices shall be installed as close to the point of termination on the rails as is reasonably practicable.
- 3.1.15 All electrical equipment and its enclosures shall have IP ratings suitable for the environment in which it is installed and for the use to which it will be put. It shall be demonstrated that this issue has been considered at the design stage.
- 3.1.16 All LV electrical systems and final circuits shall be designed such that in the event of failure of any supply or individual system element, the risk of being unable to continue railway operations is limited to a level which is as low as reasonably practicable (ALARP).
- 3.1.17 Electrical switchgear and distribution boards shall be secured against unauthorised access. Where such equipment is accessible to operational staff, it shall be enclosed such that access to live parts is not possible without the use of specialist tools.

3.2 General Requirements

- 3.2.1 Alterations to LV electrical installations shall be carried out in accordance with LU category 1 standard 1-100.
- 3.2.2 Where alterations or additions are made to installations, equipment shall be selected that is consistent with that already installed at the location.
- 3.2.3 Alterations to split points in the LVAC and non-traction DC distribution networks shall be made only in agreement with the PSC.
- 3.2.4 Reduced low voltage (RLV) socket outlets to BS EN 60309-2 shall be positioned in the locations listed below such that equipment using a 15m lead can reach all points in the area where they are located:
 - a) Sub-surface station platforms, surface platforms under the canopy, booking halls and concourses;
 - b) Escalator and lift landings;
 - c) In all plant rooms.



- 3.2.5 Where miniature circuit breaker (MCB) distribution boards are provided, these shall be selected to suit the design requirements and provide spare final circuit ways equal to 25% of the design final circuit total, with a minimum of one spare way upon the completion of a new installation.
- 3.2.6 Where fuse switches are used, they shall be of a type where all three line phases and neutral are disconnected when open.
- 3.2.7 Sub distribution shall be arranged in a manner that permits sub-main cables to be isolated at the supplying location and all downstream equipment to be isolated from the supplying sub-main cables.
- 3.2.8 All electrical switchgear and final circuit distribution boards shall be installed in purpose built switchrooms, except that final circuit distribution boards may be installed in non-public areas local to the point of utilisation.
- 3.2.9 Wherever liquid filled electrical equipment is installed, means shall be provided for the containment of any leakage or spillage.
- 3.2.10 Switchrooms provided for the distribution of LV power shall be constructed and located so as to give physical security for the supplies within the room and services entering and leaving it.
- 3.2.11 Switchroom floors shall be arranged relative to external floors such that the build up of moisture in or near the equipment is prevented.

3.3 Power Supply Redundancy

- 3.3.1 Redundancy and diversity of power supplies to operational systems shall be provided in order to minimise the impact of power failures on LU services. Designs shall use LU category 1 standard 1-123 to consider the most appropriate source/s for supplying assets.
- 3.3.2 To ensure continuous supply to essential services under all potential power supply failure conditions, power distribution shall be achieved by one or more of the following means:
 - a) Normal supplies derived from the PSC's distribution network, with a secondary supply capable of powering a minimum 25% of site capacity taken from the local street LV DNO supply;
 - b) Normal supplies derived from the PSC's distribution network, with a secondary supply capable of powering a minimum 25% of site capacity taken from a DNO HV intake via a dedicated local transformer;
 - c) Normal supplies derived from the PSC's distribution network, with a secondary supply capable of powering a minimum 25% of site capacity taken from another PSC derived supply but from a diverse bulk supply point (BSP).
 - d) Normal supplies derived from a DNO HV intake via dedicated transformer, with a secondary supply capable of powering a minimum 25% of site capacity taken from the local street LV DNO where it can be demonstrated that the two supplies originate from different grid sources.
- 3.3.3 Where electrical supplies originating from separate sources are used to supply electrical systems via changeover contactors, it shall be demonstrated that the biasing of these has been determined according to site conditions and operational requirements.

3.4 Battery Power Supplies

Note: This section applies to battery power supplies which are designed for connection to multiple loads. It does not apply to battery power supplies that are self-contained within the equipment they are designed to operate.

- 3.4.1 An external bypass facility shall be incorporated in all battery power supplies to cater for maintenance and failure requirements.
- 3.4.2 Battery systems shall conform to the requirements of BS EN50091, BS EN50172 and BS EN50272.
- 3.4.3 Provision of an emergency stop function for UPS battery systems shall be provided within the room containing the batteries
- 3.4.4 Battery power supplies shall be suitable for continuous operation and have system availability no less than that provided by PSC LEPS.
- 3.4.5 In the event of failure of the main supply to battery power supplies, the battery shall be capable of supplying the full design load plus all of the system losses for the design duration.
- 3.4.6 Circuits fed from batteries shall be provided with protection no higher than the supply is capable of breaking.
- 3.4.7 Automatic monitoring of battery condition, charge state, output and temperature shall be provided. The status shall be capable of transmission to a building management system (BMS). The information shall be provided to the operator and the maintainer.

3.5 Control and Monitoring Equipment

- 3.5.1 LU category 1 standard 1-071 shall apply.
- 3.5.2 Indicator lamps shall be provided where changeover panels are installed indicating supply, healthy bias of supply and availability of supplies

3.6 Plant Room Requirements

- 3.6.1 All circuits within pump rooms shall originate from switchgear within the pump room itself and shall not supply equipment external to the room.
- 3.6.2 A 32A 400V three phase emergency pump socket to BS EN 60309-1 shall be provided in pump rooms. The socket shall be labelled "Emergency Pump Supply".
- 3.6.3 LVAC electrical sub-distribution shall be provided in readily accessible under platform voids which give access to other areas. In platform inverts which are confined spaces, a risk assessment shall be undertaken to establish if the provision of any LVAC electrical equipment is required.

3.7 Tunnel Lighting and Power

- 3.7.1 Tunnel lighting shall be connected to the CEPS and DNO supply via a changeover contactor.
- 3.7.2 Tunnel lighting switchboards shall be split so that separate sections are available to supply a section of tunnel lighting in each individual direction of travel at a given location. Additional sections shall be provided where the switchboards feed more than one line or where more than one 630V/750V DC traction supply section adjoins the location.
- 3.7.3 Individual sections of tunnel lighting shall be controlled via contactors. The tunnel lighting shall be arranged so that it switches on as follows:
 - a) When the 630V/750V DC traction supply goes off on the section in which the lighting or any part of it is installed;



- b) When a manual switch, located on the station platform adjacent to the section in which the lighting or any part of it is installed, is turned to the "on" position at all times when the 630V/750V DC traction supply is present.
- 3.7.4 Tunnel lighting shall automatically switch off when the 630V/750V DC traction supply is restored, unless the platform switch remains in the "on" position.
- 3.7.5 Where more than one 630V/750V DC traction supply section adjoins a location, additional platform switches shall be provided in order that individual control can be achieved for each section of tunnel lighting fed from that location.
- 3.7.6 The power supply to lighting at junctions and crossovers in tunnels shall be direct and not controlled by contactors or switches.
- 3.7.7 RLV power supplies shall be provided within tunnels, fed from a dedicated tunnel power switchboard.
- 3.7.8 Interlocking shall be provided to ensure that the RLV supply is not energised unless the tunnel lighting in the section concerned is switched on.

3.8 Switchgear

- 3.8.1 All Switchgear on the Class A & B Supply networks upstream of and including the main trunk switches shall meet the requirements of LU category 1 standard 1-109. All other switchgear shall meet the following parts of 1-109:
 - a) Compliance with BS EN 61439-1 (Low-voltage switchgear and control assemblies – Part 1, general rules) and 61439-2 (Low-voltage switchgear and control assemblies – Part 2, power switchgear and control assemblies)
 - b) All cubicle switchgear and panels shall be suitable for uninterrupted duty on all systems.
- 3.8.2 All 400V switchgear shall be suitable for uninterrupted duty on a nominal 400V, 50Hz, TP&N system. Main switchgear shall be to BS EN 61439 Pt 1 and refer to 1-109. For switchgear beyond the trunk switch, the type shall be selected which is best suited to the purpose, Form 4 will be adequate.
- 3.8.3 Switchgear shall be fitted with a meter where necessary to comply with Part L of the Building Regulations. The meter's memory capacity shall be agreed with LU prior to specifying the equipment.
- 3.8.4 Where switchgear is to be installed in the vicinity of areas provided with flooding systems employing gaseous or aqueous extinguishers, the construction, materials and performance shall not be adversely affected by discharge of such systems.
- 3.8.5 Switchgear shall operate without causing danger or injury when connected into the system taking account of the following:
 - a) rated voltage;
 - b) rated insulation levels;
 - c) rated frequency;
 - d) rated normal current;
 - e) rated short-time withstand current;
 - f) rated peak withstand current;
 - g) rated duration of through faults;
 - h) rated symmetrical and asymmetrical fault making current;
 - i) rated fault breaking current;
- 3.8.6 No component such as a switch handle or any other device shall protrude by more than 75 mm beyond the main body of the Switchgear.