

Category 1 Standard

1-124 Low Voltage AC and DC Power Supply Parameters, Characteristics and Performance Requirements

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1 Purpose

- 1.1 The purpose of this Standard is to define the characteristics and performance of Low Voltage (LV) AC and DC electrical power supplies for railway operational purposes, including aspects of reliability and maintainability. The characteristics and criteria provided are intended to be utilised by electrical distribution designers and equipment specifiers preparing project works which interface with LU low voltage supplies. This Standard is also used to define LU's minimum requirements for the matching of all LV electrical loads and equipment to LV power supplies.

Note: It should be understood that such power supply characteristics are invariably influenced by the nature of the downstream circuits and connected loads. This should be borne in mind by electrical distribution designers and equipment specifiers.

2 Scope

- 2.1 This Standard applies to all individual electrical power supplies at or downstream of the LV AC or DC Delivery Point.
- 2.2 All power supply arrangements shall be brought into compliance with this Standard as new works are undertaken.
- 2.3 This issue of the standard incorporates clauses from PEE-STD-01-001.
- 2.4 This Category 1 Standard, "Low Voltage AC and DC Power Supply Parameters, Characteristics and Performance Requirements" is excluded from the Power Service Contract.

Note: For guidance on the characteristics of the upstream power supplies provided in accordance with the Power Service Contract, designers should refer to LU Category 1 Standard 1-105.

3 Requirements

3.1 Electrical Requirements for DC Power Supplies

Note: The LU Traction Supply system is a 4-rail system, comprising two running rails and two conductor rails. Each pole of the conductor rail is connected to earth via resistors such that the positive pole to earth voltage is two-thirds of the nominal voltage above earth potential, and the negative pole to earth voltage is one-third of the nominal voltage below earth potential. There are also some non-traction loads (e.g. escalators) that are connected to the same traction supplies.

3.1.1 General

- 3.1.1.1 Except as noted below, traction power supplies to trains shall be capable of providing for the operation of a train service up to the limits imposed by the installed signalling system, using the rolling stock with traction characteristics as agreed with the relevant LU technical authority.
- 3.1.1.2 If the signalling system permits extreme "train bunching" followed by simultaneous starting of several trains, the traction power supply system may not allow trains to perform to full capability under such conditions. The exact limitations on train performance and/or the number of trains which may be permitted to start simultaneously shall be agreed with the relevant LU technical authority.



3.1.2 Voltage Tolerance

- 3.1.2.1 The DC Traction Supply system nominal voltage shall be 630V, or 750V as defined in LU Category 1 Standard 1-122 for the various Underground lines, which includes the range of operating voltages to be expected.
- 3.1.2.2 The minimum DC Traction Supply voltage at any train collector shoe shall not be less than 450V except as stated below in clause 3.4.2.3.

Note: For refurbishment or other works such as voltage measurements, LU Category 1 Standard 1-122 should be referred to for operating voltages on the network. Voltage fluctuations generally follow the rapid current changes associated with the movement of the rolling stock. Equipment utilising this supply shall be designed accordingly.

3.1.3 Insulation Requirements

- 3.1.3.1 Transient excursions above the stated maximum non-permanent voltage limits in LU Category 1 Standard 1-122 are permitted on the DC Traction Supply system, but these shall not be such as to cause interference with the correct operation of rolling stock, signalling, or communications equipment.

3.1.4 Harmonic Distortion

- 3.1.4.1 The harmonic voltage distortion (also referred to as DC ripple) present in the DC Traction Supply system as a result of proposed project works shall not be such as to cause interference with the correct operation of rolling stock, signalling or communications equipment. The maximum values of the characteristic harmonics present at the Delivery Points as a result of 12-pulse traction rectification equipment are listed in the following table, which can be used to check correct operation of connected equipment during the design process.

Harmonic	% of light-load d.c. voltage
6th	0.6
12th	2.25
18th	0.175
24th	1.25

Note: For further details of typical DC ripple associated with traction rectification equipment see BS 4417 (now withdrawn) which is applicable to some older equipment, and BS EN 50328 for newer equipment.

3.1.5 Fault Levels

- 3.1.5.1 For the purposes of designing traction equipment and systems, (including conductor rail systems, associated with the upgrade of main lines), the fault current shall be taken as a maximum of 90 kA at the point of connection of the traction feeder cables to conductor rails. This shall include all fault current contribution sources.
- 3.1.5.2 The equipment shall be designed to accommodate a let-through I^2t of $1.22 \times 10^9 \text{ A}^2\text{s}$ where I = current in Amps and t = duration in seconds.

3.1.6 Protection

- 3.1.6.1 DC protection shall be provided in accordance with LU Category 1 Standard 1-111.