Reduced Low Voltage - Frequently Asked Questions

Q. What is a Reduced Low Voltage (RLV) system?
A. Reduced Low Voltage is defined in the Wiring Regulations (BS7671:2008) as “A system in which the nominal line to line voltage does not exceed 110V and the nominal line to earth voltage does not exceed 63.5V”.

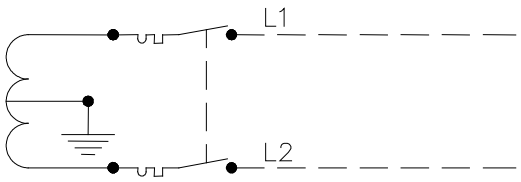
Q. What are the benefits of an RLV system?
A. The significant benefit of this system is the reduced shock risk associated with having a lower voltage between live conductors and earth. On single phase systems the maximum shock risk to earth is 55V and on three phase systems the maximum shock risk to earth is 63.5V. Since the introduction of RLV systems in the 1960s, it is believed that no one has died purely as a result of an electric shock from an RLV supply. This cannot be said of conventional mains-rated systems where the shock risk is 230V.

Q. Where should an RLV system be used?
A. RLV should be used to feed portable equipment and temporary lighting on construction sites and similar installations. Its adoption was first recommended in CP1017:1969, the Code of Practice for Distribution of Electricity on Construction sites and its continued use is re-stated in the current version of the Code of Practice: BS7375:2010. BS7375 also references B4363 (Distribution Assemblies for RLV Electricity supplies for Construction and building sites) as the standard governing RLV equipment.

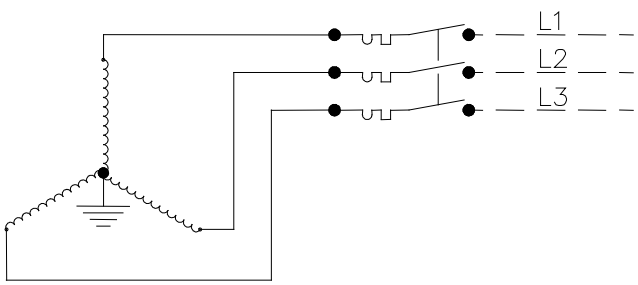
Q. Do the Wiring Regulations recognise RLV systems?
A. Section 704 of BS7671 (the 17th Edition Wiring Regulations) recommends RLV is used on sites to feed socket outlets up to and including 32A, supplying hand-held equipment. In addition, RLV is “strongly preferred” to supply portable and local lighting up to 2kW. Section 704 also states that the Regulations should be read in conjunction with BS7375.

Q. How is an RLV system generated and connected?
A. Double wound transformers (or suitable generators) with the correct secondary earthing arrangement are needed to provide RLV supplies. The single phase and three phase output winding configurations are as detailed below.

Single Phase 110V CTE Supply



Three Phase 110V NE Supply



Note that the single phase arrangement provides an output that is centre-tapped to earth and not neutral earthed and that the star point of the three phase arrangement is not brought out to make a neutral conductor. There are no neutral connections in RLV systems and installations must be configured and referenced to earth as shown above, with all live conductors individually protected against overcurrent i.e. DP MCBs to protect single-phase circuits and TP MCBs to protect three-phase circuits.

Q. Can three-phase site transformers be used to supply single-phase loads?
A. Yes. 2P+E 110V sockets can be fed from a suitable three-phase transformer. Multiple 2P+E sockets should be connected in balance across the output of the transformer i.e. L1/L2, L2/L3, L3/L1.

Q. What arrangement of protective devices is required?
A. For single phase circuits it is necessary to provide double pole protection since both poles are at a voltage above earth. This applies whether the system is purely single phase or whether it is a single phase supply derived from two poles of a three phase system. For three phase circuits, because the star point is never taken out to provide a neutral conductor, triple pole MCBs are adequate to fully protect the system. Please see the above diagrams for typical arrangements.

Q. Are RLV systems used in applications other than on Construction Sites?
A. The safety benefits of RLV systems have caused many non-construction organisations to adopt RLV. These include: the MOD for tent lighting; London Underground for cleaners' sockets and to supply ticketing machines / gates; Network Rail to supply power tools in Depots, Sheds and Workshops, as well as to supply temporary trackside lighting; many other sectors where operatives use hand held power tools or temporary lighting. Transformers and distribution assemblies have been developed to meet the needs of other market sectors.

Q. Aren't RLV systems more expensive than LV systems?
A. RLV systems do require the installation of suitable transformers, which is clearly an additional cost. However, to provide an acceptable level of protection to users of portable 230V equipment, higher specification cable would have to be used and high sensitivity RCD protection would have to be widely deployed. In a construction environment, the expected life of transformers is far longer than RCDs and transformers are inherently reliable. They can also be moved from job to job, which minimises the cost of providing RLV systems after the initial investment.
On large temporary lighting installations, the savings achieved through adopting an RLV supply are considerable. The use of PVC flexible cable to supply 110V luminaires is much quicker and more cost effective than wiring 230V fittings in SWA cable, conduit or screened flexible cable. The use of flexible cable also makes it easier to relocate fittings on site and to strip-out temporary installations at the end of a job.

Q. Are 110V power tools and luminaires readily available?
A. Most power tools, portable plant and a wide range of luminaires are available in 110V, to buy or hire. Some specialist pieces of equipment may not be available at 110V but this tends to be the exception and not the rule.

Q. Isn't a 230V supply protected by a 30mA RCD as safe as using RLV equipment?
A. The Wiring Regulations does accept that 230V sockets protected by 30mA RCDs can be used to supply portable equipment and temporary lighting on UK sites. However, susceptibility of RCDs to damage and / or failure does not make this approach the preferred option. An RLV system is fail safe and transformers do not need to be tested every day to ensure they are providing protection. If you can obtain an output from a correctly made RLV transformer, the line to earth shock voltage cannot exceed 63.5V and users cannot be exposed to unexpected risk. If an RCD fails, for whatever reason, users are at risk.

Q. What are the disadvantages of RLV?
A1. The lower voltages between line and earth mean that lower currents flow under fault conditions. Although this is beneficial in terms of reducing the stresses placed immediately on the wiring system, it can mean that overcurrent devices do not trip quickly enough to meet the disconnection times stated in the regulations. It may be necessary to incorporate RCD protection to ensure that disconnection times are met.

A2. Volts drop is a greater problem on RLV systems than on mains LV systems. Consideration needs to be given to the length of 110V circuit and the size (cross section) of cables. There are Volts Drop calculators on our website for extension leads, lighting circuits and PowerLine.

Q. How do I calculate the earth fault loop impedance associated with a transformer providing an RLV system?
A. Calculating the earth fault loop impedance downstream of the transformer is straightforward, provided that the correct formula is used and the required parameters are known. To assist with the calculation, a spreadsheet is incorporated within the Electrical Calculator on our website www.blakley.co.uk (in the Product Data section). To complete the calculation you will need to know the rating, voltage ratio and impedance voltage of the transformer, the primary circuit impedance and the secondary circuit impedance.