University of Reading

LV Policy Document

Document Approval

Originator	Approved for Issue	Authorised for Issue
Richard Hill – Aecom	**LV DUTY HOLDER**	**CHIEF ENGINEER**
Signature	Signature	Signature
Name:	Name: **David Young**	Name: **Christopher Smith**
Date	Date **1st October 2012**	Date **1st October 2012**

DOCUMENT ISSUE RECORD

Issue	Description Of Amendment	Date	Originator	Approved	Authorised
1	Approved Issue by R.H.	24 Feb 12	RH	DGRY	CAS
2	Minor amendments	21 May 12	JS	DGRY	CAS
3	Metering requirements amended	30 Aug 12	RH	DGRY	CAS

Previous issues of this document are to be destroyed or marked SUPERSEDED,

Distribution:

Contents

Appendices

1. Definitions

LV Switchgear - The LV Switchgear referenced within this policy document encompasses all switchgear from the LV side of a transformer, LV switchgear within the substation, Main LV switchgear within building which would include that which serves other buildings, Sub-Distribution within the building including all final distribution boards. Any further LV switchgear beyond these distribution boards, including consumer units fed from MCB distribution boards, is excluded from the scope of this document.

Sub-Main Cabling - The Sub-Main Cabling referenced within this policy document encompasses all wiring from the LV side of a transformer, LV feeds to buildings, Sub-Distribution cabling within the building including all associated cabling and to final distribution boards. Any final circuit cabling emanating from these distribution boards, including that which may serve any consumer units fed from MCB distribution boards is excluded from the scope of this document.

2. Scope of document

This document has been produced by the University of Reading as a guide to consultants of issues to be considered / addressed when refurbishing an existing building, constructing a new building, or for commissioning surveys of the LV Infrastructure.

The LV infrastructure encompasses all wiring and switchgear from the LV side of a transformer, LV switchgear within the substation, LV feeds to buildings, Main LV switchgear within building which would include that which serves other buildings, Sub-Distribution within the building including all associated cabling and the final distribution boards. Any final circuit cabling emanating from these distribution boards, including that which may serve any consumer units fed from MCB distribution boards is excluded from the scope of this document.

3. Policy Statements

3.1 LV Switchgear

3.1.1 General

It is generally accepted that the life of LV switchgear is 25-30 years, as referenced within CIBSE Guide M. However, depending upon the construction of the switchgear and the environment in which it is installed, switchgear can last for considerably longer. Where switchgear is in excess of 25 years old a risk assessment shall be carried out to determine the safety and suitability of the switchgear for future use and therefore establish whether it should be upgraded or replaced. The risk assessment shall be carried out in accordance with the recommendations of CIBSE Guide M, Maintenance Engineering and Management for the purpose of the following:

- Identify risks
    - Business,
    - Design and Installation
    - Operation & Maintenance
    - Disposal
- Evaluate likelihood and impact
- Assign ownership of risks
- Develop risk mitigation measures and mitigation programme
- Record findings and implement
- Review assessment and update as necessary

An example Risk Assessment has been included within Appendix A to this document. For further guidance on Risk Assessments refer to CIBSE Guide M.

Switchgear should automatically be considered for replacement where the following criteria apply:

- Where spare parts are no longer readily available
- Where asbestos is present within flash guards
- Where switchgear is located in an inappropriate location
- Where access for maintenance or operation of switchgear does not comply with CDM Regulations
- Where there is a history of faults
- Where switchgear has been identified as being faulty and is beyond economical repair

3.1.2 Location Considerations

Where switchgear is located within an inappropriate location then consideration should be given to relocation. Inappropriate locations are considered to be as follows:

- In locations of restricted access height <2m.
- Where located above 2m to the top of the switchgear where operational and maintenance access could only be gained via the use of a step ladder or access platform.
- Where LV switchgear is located within the same room or enclosure as HV equipment and is not dedicated for the supply of LV services within that room or enclosure.
- Where not located within a separate room or enclosure from other services such as in the case of a combined mechanical and electrical riser cupboard, boiler room and / or Plantroom.
- Where adequate maintenance access is not available which should be a minimum of:
    - For switchgear without 'draw out' circuit breakers or equipment, 1,000mm clear space to the front of the switchgear.
    - For switchgear requiring drawn out space, a minimum 600mm clear space more than the end of the switchgear in its drawn out position or a minimum 1,000mm clear to the front of the switchgear whichever is the greater.
    - For switchboards requiring rear access via demountable panels, a minimum 600mm clear space to the rear of switchboards.
    - For switchboards requiring rear access via hinged panels, a minimum 150mm clear beyond the edge of the door in its open position or a minimum 600mm from the rear of the panel whichever is the greater.

  Please note; if further requirements are defined by the equipment supplier then the most onerous of the supplier's and the above requirements shall apply.

Where switchboards or distribution boards are installed within accessible areas i.e. not lockable risers or switchrooms, they shall be provided with lockable covers.

3.1.3 Forms of Separation

As a minimum, all new switchboards shall be of the Form 4 Type 5 configuration. Panel boards and distribution boards shall be of the Form 3b Type 2 configuration. Where existing switchboards, panel boards and distribution boards do not provide the levels of protection described above then they shall be considered, via risk assessment, for replacement. Please note however that the form of separation provided by the switchgear may vary depending upon the systems it serves. Further guidance from the University Chief Engineer and / or LV Duty Holder should therefore be sought as required.

3.1.4 Types of Protection

In general HRC type fuse or ACB protection shall be provided to the outgoing circuitry from the LV side of HV/LV sub-stations. LV switchboards shall be provided with Isolating Switch, Switch Disconnector, ACB, MCCB or HRC fuse incoming protective devices as required. MCCB or HRC outgoing protective devices shall be provided to meet discrimination requirements as necessary. All distribution boards shall be provided with circuit protection in the form of MCB/RCBO of the rating and type required to protect the final circuits in accordance with the requirements of the IEE Wiring Regulations. Refer to Appendix B for a typical electrical distribution schematic indicating the location and type of protective devices required.

For all electrical design works the system designer shall carry out a discrimination study to ensure that discrimination between the relevant protective devices is being achieved.

3.1.5 Spare Capacity

Spare capacity shall be provided within all main switchgear and distribution boards as detailed below:

	Load Rating	Spare Ways
Main Switchgear	10%	10%
Panel Boards	25%	25%
Distribution Boards	25%	25%

Note; in the case of split load lighting and power distribution boards the minimum spare capacity percentages above apply to both the lighting and power sections of the distribution board.

Where existing installations do not conform to the requirements identified above then consideration must be given for upgrade as required. In the case of LV switchboards spare capacity shall generally be provided as a minimum by a single spare cubical complete with internal wiring / busbars and cable chambers.

When sizing switchgear and equipment designers must refer to the Chief Engineer to ensure that the requirements of future projects and developments are considered and sufficient spare capacity or space for expansion is incorporated into the design as far as reasonably practicable.

3.1.6 Resilience of Supply

The requirements for the resilience of supply shall be reviewed on a case by case basis. Therefore further guidance from the University Chief Engineer and / or LV Duty Holder must be sought as required.

Where generator supplies are provided these shall be provided with a castell interlock with the mains incoming supply to prevent these supplies from being run in parallel. Where a switchboard is served from two separate transformers the incoming supply ACB supplies shall be lockable but non-interlocked.

3.1.7 Earthing

Earthing to LV installations shall be carried out in accordance with requirements of the IEE Wiring Regulations and in particular BS 7430, Code of Practice for earthing. Refer to Appendix C for a typical earthing schematic.

The location of the neutral earth link shall be clearly identifiable from the external face of the panel and shall be positioned in an accessible location.

3.1.8 Power Factor Correction & Harmonic Filtering

When refurbishment works or development works are undertaken the existing and anticipated load profiles of the electrical distribution system shall be assessed and the requirement for the provision of Power Factor Correction and Harmonic Filtering Equipment determined.

The location of Power Factor Correction and Harmonic Filtering Equipment shall be assessed on a project by project basis.

3.1.9 Surge Protection

Surge protection shall be provided to all installations in accordance with the requirements of BS EN 62305 – Design, Installation & Testing of Lightning Protection and Earthing Systems.

3.1.10 Sub-Metering

Sub-metering shall be provided to LV switchgear in accordance with the requirements of CIBSE TM 39 and with the University of Reading's overall Metering Strategy. Key requirements for the provision of electrical meters are as follows:

- Metering must be available at least at a building level and provide a breakdown for main circuits.
- Meters require a Modbus output for connection to an Automatic Meter Reading (AMR) System.
- Meters must be connected to the BMS.
- Smart meters must be used where practicable.
- Where a meter is to be used for current or future recharging (i.e. residential, halls of residence, external client, facilities etc) meters must be MID approved.
- All meters must be safely accessible to be manually read.

- All metering shall be provided with means of shorting CT's to facilitate meter removal.

The metering strategy shall be developed and agreed in accordance with the University of Reading Energy Manager.

3.1.11 Preferred Manufacturers

Preferred manufacturers shall be in accordance with the following preferred manufacturers list:

Switchgear Suppliers

- ABB
- GEC Sen-Plus
- GEC Mini-Form
- Schneider Electric
- Dorman Smith

Panel Builders

- Carville Switchgear
- Schneider Electric
- Underwoods

Meter Suppliers

- Schneider Electric Powerlogic

3.2 LV Switchrooms

3.2.1 LV Switchroom Location and Access

It is the University's preference for LV distribution switchgear to be located within the feeding LV room attached to the serving dedicated substation. Other satellite buildings should not be served from the building switchgear. Furthermore LV switchgear shall be located within a separate room or compartment to HV switchgear and transformers. Where either of these situations occur consideration shall be given to the relocation of this distribution switchgear to a separate enclosure.

For a typical general arrangement drawing of an HV/LV switchroom refer to Appendix C.

All switchrooms are to be provided with suited locks in accordance with University of Reading requirements. The University of Reading Chief Engineer shall be consulted to confirm the specification of the suited locks.

3.2.2 Switchroom Size Assessment

During refurbishment or redevelopment works switchrooms shall be assessed to determine whether the overall size is appropriate for the equipment installed. This assessment shall consider the potential for future expansion and whether there is scope to reduce the overall room size and release area to adjoining spaces.

3.2.3 Means of Escape

All switchrooms shall be provided with a primary entrance and a secondary emergency escape. Where this is not available consideration shall be given to how this can be provided.

3.3 Sub-Main Cabling

3.3.1 General

It is generally accepted that the life of LV cabling should be in excess of 30-35 years, as referenced within CIBSE Guide M. However, the type of electrical cabling installed, the electrical loading applied and the external environmental conditions present will affect this period. Regular testing and inspection in accordance with the requirements of the IEE Wiring Regulations should identify any issues with cabling performance at an early stage and allow these to be addressed as required. However, LV cabling should automatically be considered for replacement if any of the following criteria apply:

- Where there is a history of faults
- Where cabling is of the PILC or Lead Sheathed type
- Where the location or routing of sub-main cabling is known to compromise future development plans on the campus.
- When the maximum current rating of the cable is no longer adequate to meet the requirements of the installation.

3.3.2 Replacement of Legacy Cabling

Designers shall note that legacy PILC cabling from the 1960's is present on site. This forms the main distribution from the original substations within the central areas of the campus. The following buildings are known to be served by this form of cabling:

- Physics
- Engineering
- HumSS

- Geography
- Maths
- IT Services
- Whiteknights House
- Blandford Lodge
- URS / CEM
- CEM
- Geo-Sciences
- AMS

Additional areas affected at the Earley Gate area of the Whiteknights Campus are as follows:

- TOB1
- The Citadel

Note; other areas away from the main campus may also be served via legacy cabling.

Legacy cabling is to be replaced and designers shall consult with the Chief Engineer to understand how their projects may be affected by these works and / or whether elements of these works need to be included within their projects.

4 Designer Responsibilities

The overall strategy for and master planning of the University of Reading LV distribution network shall be defined by the University of Reading's Chief Engineer.

The Electrical Consulting Engineer shall translate this strategy or master plan into specifications and drawings, where relevant, of physical requirements to be provided by the project.

The University of Reading's Chief Engineer shall brief the Electrical Consulting Engineer on the particular University requirements for the following in relation to the LV infrastructure:-

- Network Resilience
- Emergency Power
- Equipment Standards
- Metering Strategy
- Site Constraints
- Programme
- Update of existing Record Information

The Electrical Consulting Engineer is responsible for ensuring that the University requirements are incorporated into the scheme design and subsequently installed in accordance with good trade practice and Industry recognised standards. Should there be any conflict of standards or practice, the University will consider the issue on its own merits and advise the Electrical Consulting Engineer accordingly.

Refer to Appendix D for the schedule of responsibilities in relation to the LV Infrastructure.

5 Standards

The standards and guidance applicable to LV services installation and refurbishment are summarised below:

- The University of Reading Standard Electrical Specification (under review)
- The University of Reading Capital Projects Manual
- The University of Reading Code of Practice for Safe Working on LV Systems
- BS 7430, Code of Practice for Earthing
- BS 7671, IEE Wiring Regulations
- National Joint Utilities Guides for the positioning and colour coding of Utilities underground apparatus
- The Electricity Safety, Quality and Continuity Regulations
- BS EN 60034, Rotating Electrical Machines
- BS EN 60439, Low Voltage Switchgear and Controlgear Assemblies
- BS EN 60529, Degrees of protection Provided by Enclosures
- BS EN 60947, Low Voltage Switchgear and Controlgear
- BS EN 62053, Electrical Metering Equipment (A.C.)
- BS EN 62208, Empty Enclosures for Low-Voltage Switchgear and Control Gear Assemblies
- BS EN 62305 – Design, Installation & Testing of Lightning Protection and Earthing Systems.

Please note; whilst the above list does include the main standards applicable to the LV services installation the list is not an exhaustive and further reference should be made to relevant documentation and standards which relate to the smaller components of the LV services installation.

6 References

- University of Reading Capital Projects Manual
- CIBSE Guide M – Maintenance Engineering and Management, 2008.

7 Bibliography

- CIBSE Guide M – Maintenance Engineering and Management, 2008.