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Wiring churches: the engineer's perspective

David Haddon-Reece has been involved with the designing and installing of lighting in churches for 20 years.

Now retired, he still consults as a Lighting and Electrics Advisor to the York Diocesan Advisory Committee for the Care of Churches (Church of England). He is both a Chartered Electrical Engineer registered as an Approved Contractor (NAPIT), and an Affiliate member of ILP, which keeps his Advice up to date.
He is also a Reader – a Licensed Lay Minister – in the Church of England and a church organist.

Here, he shares his experience of working in religious buildings.

What are the top 3 considerations an installer or designer should bear in mind when wiring an architecturally delicate building, such as listed religious buildings?

- Ensure the electrical system conforms to BS7671, has an adequate main supply, and uses appropriate wiring for the building conditions. Any BASEC-approved cable type is acceptable providing it is installed according to BS7671 and by an approved contractor (an insurance requirement).

  Low-smoke, zero-halogen sheathing/serving is highly desirable. As cable runs are usually long and often at considerable height, designers must take due account of voltage drop, possible cable heating effects, and maintenance inaccessibility.

  Switching and control systems must respect the flexibility of the lighting scheme and possible future extensions.

- Install cables and fittings with sensitive regard to the architecture, as visually unobtrusive as possible and with minimum physical intervention with the fabric. In the Church of England, the inspecting architect usually has final choice of wiring routes and finish – sheath colour, painting-out, or other concealments.

- Obtain full permission from the relevant church authority. In Anglican churches, this means a Chancellor's Faculty (see below), whether or not the building is listed.

What has been the most challenging project you've worked on?

All projects offer challenge. A memorable example is St Michael and All Angels, Garton on the Wolds, East Riding, where almost every square inch of the interior is decorated: the walls with nineteenth century paintings of Biblical scenes, and roof timbers with painted patterning. For visitor/tourist viewing the walls needed diffuse lighting (triggered by person-sensors) to avoid 'veiling' reflections (glare); wall-washing was unacceptable as it would highlight surface irregularity; while for worship, congregational task lighting needed strong directed illumination.

As the wall paintings had been cleaned and conserved with a Pevsner Memorial Trust grant in 1986-91, several national heritage bodies were watching the project. The successful solution, in 2011, was to retain the old frosted globular 'schoolroom' shades, lamped with warm compact fluorescent lamps, insufficient by themselves for task lighting but suitable to

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diffuse-light the wall-paintings, supplemented with high-mounted metal halide and tungsten halogen spotlamps for worship and concerts (today we would use LED spotlamps.)

What has been your biggest achievement?

Garton-on-the-Wolds, mentioned above, was a gratifying success. Sometimes, however, the greatest satisfaction is to see a small, low-funded church improved almost beyond recognition with new lighting which enlivens its worship; and by upgrading an ancient wiring system, to satisfy legislation and bring peace of mind.

A recent modern example of an LED lighting scheme with flexible controls, entirely suited to its historic environment and worship, is the Chapel at Bishopthorpe Palace. My part was simply to guide the choice of lighting style; excellent designers (Concord Havells-Sylvania) and contractors did the rest.

How does an installer or designer ensure that permission has been granted for the wiring of an architecturally delicate building?

Before work starts, the relevant church council must seek permission, supported by technical advice from designers and contractors. Each denomination has its own rules. The **Ecclesiastical Exemption (Listed Buildings and Conservation Areas) Order 2010** is especially relevant. It exempts five denominations in England (Church of England, Roman Catholic, Methodist, Baptist, and United Reformed) from Listed Building Consent in buildings 'for the time being used for ecclesiastical purposes'.

In the Church of England this operates through the **Faculty Jurisdiction Rules 2103**. A Faculty is the Church's permission to proceed with some aspect of work, including lighting and electrics. Administered by the Diocesan Chancellor (a judge with his or her own Consistory Court, an institution founded in the reign of William I and still active), it applies to listed and non-listed churches.

A church council or other applicant makes Petition (equivalent to Planning Application) to the Chancellor, who, if he or she, guided by the Diocesan Advisory Committee, considers it appropriate, will issue a Faculty to proceed.

Although there can be heavy penalties for contravention, including fines and restitution orders, the Advisory process offers petitioners a wealth of free expert guidance on church matters.

What are your top tips for minding costs on such a project?

- From the start, follow expert advice. This focuses the project and reduces the risk of expensive mistakes or subsequent alteration.

- Prepare a thorough audit of current and future needs for wiring and lighting, including:

    - maximum projected electrical use, and hence intake capacity;
    - access for maintenance and system expansion; and
    - convenient lighting control positions, and sufficient power outlets.

- Design the scheme completely before applying for permission.

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- Choose the highest specification your funds can manage. Investment in quality will pay off both in performance and a longer service life with lower maintenance.

Can you give examples of lighting or wiring of religious buildings that you've seen that you thought could be significantly improved upon (without naming and shaming!)?

Many, alas. Church councils are conservative, and often financially poor, contrary to general public opinion. Lighting and wiring are usually low priority 'Cinderella' aspects, so equipment tends to be kept in use far longer than it should be.

Some churches still have their original wiring, perhaps from the 1930s, more or less in working order, and upgrade is very satisfying. For instance, until 2007, St Matthew's church (Listed Grade II), Grosmont, North Yorkshire, had original lead-sheathed wiring, ancient cast-steel switch-fuses, and even two wirewound stage dimmers. After total rewiring and effective relighting, a rare bespoke 1930s glazed mahogany cabinet containing porcelain fuses and Bakelite switches was kept as an historical display object.

Apart from the desirability of new technology, causes for upgrading include:

- old mineral-insulated cable (ie no silicone impregnation) chemically attacked by masonry salts with subsequent low insulation resistance;
- rodent-attacked cable sheaths;
- well-meaning but unauthorised amateur additions;
- failure of voltage operated circuit breakers through corrosion or loosening of the earth circuit (circuit protective conductor), or even its disconnection (on occasions, strimmed away from earth electrodes in churchyards!).

All need improvement. The fundamental lesson, sometimes hard to put across, is that, irrespective of Listed status, special architecture, or religious purpose, the installation must satisfy the Electricity at Work Regulations 1989 by conforming with the Wiring Regulations, BS7671.

Grosmont St Matthew before rewiring. Picture courtesy of D Haddon-Reece.

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Grosmont St Matthew after rewiring. Picture courtesy of D Haddon-Reece.

When designing the lighting for a church, what is the biggest priority in terms of satisfying the client and the congregation?

To create lighting that will enhance worship, enliven and beautify the architecture, and quite simply help people see better.

We should not forget that as service providers, places of worship come within the Disability Discrimination Act 2005. Although the DDA has not yet been legally tested in respect of lighting (and deciding a test level will be very difficult) we should create an acceptable basic lighting level throughout, adding increased light where necessary to create a liturgical focus – by accent lighting on the altar, pulpit, lectern and font, for instance. CIBSE's lux level guidance is often used.

How have technical advancements, such as LED lighting, changed the way installations are designed?

Very positively. Superseded general service tungsten lamps, and high wattage tungsten halogen lamps (often 300 or 500 watts), have no alternative except low energy replacement. LED lighting is increasingly being installed. Manufacturers have responded with high quality spot- and flood-lamps and a number of firms offer computer-aided design. Designers and church authorities are taking care, however, not to admit 'sports-pitch' or general-purpose wide-angle floodlighting with poor colour rendering and the risk of dazzle.

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Have you seen a reduction in your energy bills with moving to low energy lighting?

Yes. When compact fluorescent lamps (cfls) became available, simple arithmetic showed the kilowatt-hour advantage of replacing, say, high wattage tungsten halogen lamps with low energy types. Prompted also by environmental considerations, some churches rushed to install cfls, but their poor colour rendering and loss of luminous output in cold surroundings often disappointed. Another option is metal halide lighting, but long strike/restrike times are disadvantageous, and the colour rendering can be harsh in an intimate historic environment.

Reduced running costs of low energy lighting are welcome, increasingly through LED schemes, and it is becoming easier to convince church councils that long lamp life and low maintenance will eventually offset high purchase and installation costs, especially where a concomitant wiring upgrade is involved.

References:

General: CIBSE guidance notes.

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