Recessed Light Fittings

20 Common problems to avoid

Best Practice Guidance from Elecsa

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ELECSA

Introduction

This book has been written to offer practical guidance to electricians when installing recessed lighting. It is considered by some to be long overdue.

This common form of lighting has been popular for almost 25 years, but although seen as fashionable and easy to install, has many pitfalls if design considerations and installation workmanship issues are not given careful attention. Indeed, Approved Document P, introduced in January 2005, recognises extra low voltage lighting installations as one particular field of 'notifiable work' under Building Regulations due to its many risks and inherent potential problems.

The common examples of problems shown in this book will be recognised by most practical electricians – but hopefully the guidance given will offer solutions to assist in compliance with BS7671 (2008) IEE Wiring Regulations as well as applicable Building Regulations.

It is not however intended to give definitive installation instructions that could apply to all projects, since all projects and products will have differing requirements. Instead it is aimed to act as prompt – to further thought and consideration.

It is often the case that complying with one particular issue concerning recessed lighting within buildings will often create problems of another issue. The best example of this is perhaps the requirement to fully insulate a roof or attic, yet in doing so ventilation and heat dissipation of lighting may be compromised.

It is hoped that if the Elecsa electrician is made aware of these issues, but more importantly the possible practical solutions, he or she will be able to address them during planning stage and installation work, to obtain a fully compliant installation as well as protecting his or her future liability.

Contents

1 Manufacturers' instructions

If one common problem only is to be selected from this book and addressed then it should be this one.

As experienced trades persons, we've all fallen into the trap of not reading the instruction leaflet supplied with equipment – after all, who needs instructions for things that we have done countless times before?

It is a common misconception that such instructions are only provided for the novice or DIY enthusiast, who may be installing a light fitting for the first time, and that any experienced electrician will not need this guidance.

Unfortunately, this is clearly not the case, since differing products, from differing manufacturers, installed in differing locations will have quite unique requirements that should be considered and implemented.

In all cases, by simply following manufacturer's instructions gives the electrician a fall-back position, should something fail or cause a problem. This if nothing else, will assist the contractor in protecting his or her future liability.

If such instructions are not followed, should problems ever arise, the installer will often be left on his own, with the product manufacturer declining any responsibility for the issue.

Instructions often also contain information that the user of the installation will require – long after the installation has finished and the electrician gone. It is imperative therefore that relevant information be left with the end users, and handed over as part of any contract documentation.

Again, this helps the electrician limit his future liability by ensuring end users know exactly what they should be doing when using and maintaining their installation.

Where does it say it?

Approved Document P – Building Regulations

Regulation P1 (Applying to dwellings, etc)

'Reasonable provision shall be made in the design and installation of electrical installations in order to protect persons operating, maintaining or altering the installations from fire or injury'

BS7671 (2008) IEE Wiring Regulations

Regulation 134.1.1

'Good workmanship by competent persons or persons under their supervision and proper materials shall be used in the erection of the electrical installation. Electrical equipment shall be installed in accordance with the instructions provided by the manufacturer of the equipment.'

Regulation 132.13

'Every electrical installation shall be provided with appropriate documentation, including that required by Regulation 514.9, Part 6 and where applicable Part 7'

2 Heat generation

The biggest single problem that recessed lighting poses is undoubtedly that of heat generation and the inherent risk of fire. This is particularly the case with the smaller light fittings that house the popular 'low voltage' reflector type lamps or their mains voltage equivalents. The nature of this form of lighting is that light fittings are often relatively small and compact, and thus often called to be located in tight spaces and near to lit surfaces, yet few people appreciate the high temperatures that these lamps run at. Such a high temperature heat source will obviously pose risk of ignition to combustible materials that may come in close proximity; be it in front of the lamp, behind the lamp or even the material in which the light fitting itself is mounted.

The problem and risk is further compounded by the fact that some lamp types are designed to direct much of their heat out of the back (typically 'dichroic' type) whilst others are designed to direct their heat forward (typically 'aluminium reflector' type). The trouble is that to the untrained eye the lamps look the same, and many have similar bases and lamp caps. The Elecsa electrician when selecting or installing lighting first and foremost needs to consider carefully the combination of light fitting and lamps to adequately address the issue of heat and potential fire risk to the installed location. The electrician should also consider other changes that may be reasonably expected to occur in the future, that may in conjunction with the lighting give rise to dangerous situations.

For example;

Could furnishings or curtains, etc. be placed close to the lights?

Could combustible dust and debris build up behind the lights?

Could lights in attic areas for example, have items stored near them that could fall into contact with them?

With older lath and plaster ceilings could sawdust or split timber laths remain above the light fitting and become in contact with it?

In these instances suitable additional measures such as additional guarding may well prove prudent.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 131.3.2

'Persons, fixed equipment and fixed materials adjacent to electrical equipment shall be protected against harmful effects of heat or thermal radiation emitted by electrical equipment, particularly the following consequences:

(i) Combustion, ignition or degradation of materials

(ii) Risk of burns

(iii) Impairment of the safe function of installed equipment Electrical equipment shall not present a fire hazard to adjacent materials'

Regulation 422.4.2 (relating to areas with combustible construction materials)

'Except for equipment for which an appropriate product standard specifies requirements, a luminaire shall be kept at an adequate distance from combustible materials. Unless otherwise recommended by the manufacturer, a small spotlight or projector shall be installed at the following minimum distance from combustible materials:

(i) Rating up to 100W	*0.5m*
(ii) Over 100 and up to 300W	*0.8m*
(iii) Over 300 and up to 500W	*1.0m'*

3 Proximity of wiring to hot lamps

This problem is most common when open-backed recessed light fittings are used, particularly when fittings and wiring are installed from below a ceiling and it is not possible to see behind the light fitting during installation.

Numerous examples have been noted over the years where wiring directly behind a light fitting has come into contact with usually the back of a bare lamp, with the result that the cable insulation burns through.

This has generally resulted in either complaints of 'burning smells', reports of 'lighting circuits tripping out for no apparent reason', or in some extreme cases a fire starting.

The electrician usually discovers the reason, when inspecting the lighting – and nine times out of ten it is the last fitting examined which has the problem!

The Elecsa electrician should note that even 'heat resisting cabling' (normally rated at 80 degrees C) would stand little chance of survival if placed in direct contact with a hot lamp.

In all instances the electrician should be able to ensure that all wiring is suitably rated and secured in such a manner so that contact with hot lamps is avoided.

The practicality of achieving this in all cases is difficult however, particularly where lighting is installed solely from below a ceiling with no access for inspection from above.

It is suggested that only where light-fitting and wiring installation can be checked from above the ceiling, should the decision be taken not to use totally enclosed fittings.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 522.2.1

'In order to avoid the effects of heat from external sources, one or more of the following methods or an equally effective method shall be used to protect a wiring system:

(i) Shielding

(ii) Placing sufficiently far from the source of heat

(iii) Selecting a system with due regard for the additional temperature rise which may occur

(iv) Local reinforcement or substitution of insulating material'

This picture shows a newly installed downlighter with the cable touching the bare lamp

Luckily, the problem was noted before any harm was done!

4 Proximity of transformers to hot lamps

This problem is normally encountered when a small transformer designed to feed a single ELV light fitting, is pushed up through the light fitting's mounting hole in the ceiling.

If space is limited, as is often the case, wiring, transformer, and connections are then all in close proximity to one another, and close to or in many cases, in contact with the back of the lamp.

The problems outlined in section 3 are then compounded, in that in addition to the heat generated by the lamp, heat is also generated from the transformer.

Such heat build up is detrimental to the transformer, lamp and wiring, with failure of one or more of the components expected in due course.

This generally results in either complaints of 'burning smells', reports of 'lighting circuits tripping out for no apparent reason', individual lamps not working due to transformer failure or in some extreme cases a fire starting.

To overcome this problem, the Elecsa electrician is faced with several difficulties, particularly if access from above the ceiling is restricted or impossible.

One possible solution to minimise the problem might be to try and eliminate the need for transformers altogether, by perhaps considering mains voltage lamps instead, thus designing out the possibility of transformer problems.

It is fair to say that to most people, the appearance of the actual light fittings and the lighting effect that they create is indistinguishable regardless of whether the lamp is 12 volts or mains operated.

Another option might be to locate the transformer remotely in an accessible, but well ventilated space away from the actual lights themselves.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 421.2

'Fixed electrical equipment shall be selected and erected such that its temperature in normal operation will not cause a fire. This shall be achieved by the construction of the equipment or by additional protective measures taken during erection.

The heat generated by electrical equipment shall not cause danger or harmful effects to adjacent fixed material or to material, which may foreseeably be in proximity to such equipment.

Where fixed equipment may attain surface temperatures, which could cause a fire hazard to adjacent materials, one or more of the following installation methods may be adopted. The equipment shall:

(i) be mounted on a support which has low thermal conductance, or within an enclosure which will withstand, with minimum risk of fire or harmful thermal effect, such temperatures as may be generated, or

(ii) be screened by materials of low thermal conductance which can withstand, with minimal risk of fire or harmful thermal effect, the heat emitted by the electrical equipment, or

(iii) be mounted so as to allow safe dissipation of heat and at a sufficient distance from adjacent material on which such temperatures could have deleterious effects. Any means of support shall be of low thermal conductance.'

This picture shows a transformer that was removed from directly behind an open backed downlighter

The customer complained of a 'burning plastic smell'

5 Ventilation and heat dissipation of transformers

This is another common problem that affects low extra low voltage lighting transformers, be they the small individual single light fitting type, or the larger multi-lamp group transformers.

The problem is most common however with the smaller individual transformers, which due to their compact dimensions are either pushed up through the light fitting aperture from below the ceiling, or laid in from above the ceiling.

In these instances the problem encountered is that invariably the transformer is surrounded either fully or partially by thermal insulation material, which then restricts the heat dissipation of the device, causing overheating, transformer failure or in extreme cases fire.

The problem is exacerbated due to the forever-increasing usage and performance of thermal insulation, for both energy saving and sound reduction requirements, as required by relevant other Building Regulations.

To overcome this problem, the Elecsa electrician is faced with similar issues to those described in section 4 of this book.

The first solution to consider is to try to design out the need for transformers, by perhaps selecting mains voltage lamps instead of extra low voltage.

If this is not feasible, then alternative, well-ventilated and accessible locations could be selected in which to locate the transformer.

In this latter option, consideration should be given to the effect the transformer may have on adjacent materials and equipment as well as the actual ventilation and heat dissipation requirements of the transformer itself. Extra guarding may be required.

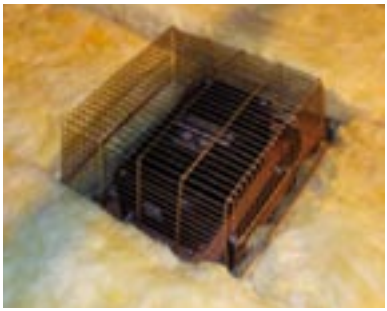
Where does it say it?

BS7671 (2008) IEE Wiring Regulations

In addition to Regulation 421.2 considered in section 4 of this book, the following regulation should also be considered:

Regulation 421.4

'Fixed equipment causing a concentration and focusing of heat shall be at sufficient distance from any fixed object or building element so that the object or element is not subject to a dangerous temperature in normal conditions.'



This picture shows a well-installed transformer in an attic area.

It is not covered in thermal insulation and it is guarded to prevent its ventilation from ever being obstructed.

6 Light fittings being covered with thermal insulation

This is a common problem with recessed lighting, where often the requirements of Building Regulations relating to thermal performance of buildings conflicts with ventilation and fire safety requirements of light fittings.

What often happens is that the electrician installs the lighting and then another trade subsequently installs thermal insulation in close proximity or often covering completely the light fittings (and often transformers, if applicable).

The usual complaints that then result are that lamps appear to have very short lamp lives, smells of burning, or that transformers or wiring have failed. In extreme cases there is a risk of fire.

It should be noted that the Building Regulations call for a solution to allow the uninterrupted provision of thermal insulation in loft spaces or flat roofs to minimise heat loss – and this is often strongly enforced particularly on new-build work.

The Elecsa contractor therefore needs to consider this requirement when installing recessed lighting. Fortunately, several practical solutions are available that may be used to overcome these difficulties.

One solution might be to form a housing around the back of the light fitting, formed from a material that is known to be non-combustible. Careful detailing is required however, to consider fixings and ventilation. This work is often very time consuming.

Another solution is to use a proprietary cover or cap, which is manufactured from a lightweight, non-combustible, material, which provides sufficient airspace around the light fitting to avoid overheating.

With both these solutions, insulation may be laid over the top, subject to all relevant manufacturers' instructions being met. It is almost impossible to meet these requirements with flat roofs.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 559.4.1

'Every luminaire shall comply with the relevant standard for manufacture and test of that luminaire and shall be selected and erected in accordance with the manufacturer's instructions.'

Regulation 559.5.1

"In the selection and erection of a luminaire the thermal effects of radiant and convected energy on the surroundings shall be taken into account, including:

(i) the maximum permissible power dissipated by the lamps

(ii) the fire resistance of adjacent material

- at the point of installation, and

- in the thermally affected areas

(iii) the minimum distance to combustible materials, including material in the path of a spotlight beam'

Approved Document L1A – Building Regulations

Paragraph 51 (Applying to new dwellings)

'The building fabric should be constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at the joints between elements and at the edges of elements such as those around window and door openings'

(Similar requirements apply to existing dwellings – see Approved Document L1B – paragraph 52).

This picture shows a proprietary cover above a recessed downlighter, to allow insulation to be run uninterrupted over it.

7 Fire integrity of ceiling linings being compromised

This is probably the most controversial of all issues relating to recessed lighting, particularly since the introduction of Approved Document P of the Building Regulations in 2005.

The basic problem is that the majority of ceilings and wall linings are often required by Building Regulations to offer a level of fire resistance, to inhibit the spread of fire and to protect the building structure for a stipulated time during a fire. By penetrating such a lining, it is conceivable that its fire integrity may be compromised and in some instances lost altogether.

The Elecsa electrician needs to carefully consider these risks and his potential future liability if cutting into such linings to fit items such as lighting or to route wiring systems through.

Good practice and workmanship requirements would tend to suggest that suitably fire-rated light fittings could be selected and installed in all instances, thus without doubt protecting liability as far as possible. Other suitable alternatives may be used to provide equal levels of protection, such as fire hoods, boxing-in, etc, but these often prove more difficult and time consuming to fit.

Fortunately, many manufacturers now offer suitable fire rated fittings, with the result that costs are now more reasonable, and in some instances not much greater than that of a basic non-fire rated alternative. Such fittings may also assist in dealing with many of the other practical topics covered in this book.

Good definitive advice is now published by the Electrical Safety Council in their 'Best Practice Guide 5 – Electrical installations and their impact on fire integrity of buildings'.

The Elecsa electrician may ultimately safeguard his liability by only selecting fire-rated products, unless specifically instructed or advised formally, by an authoritative body such as an architect, Building Control Officer or designer that such fittings are not needed.

Where does it say it?

Approved Document B – Building Regulations

Paragraph 11.2

'If a fire separating element is to be effective, then every joint, or imperfection of fit, or opening to allow services to pass through the element, should be adequately protected by sealing or fire-stopping so that the fire resistance of the element is not impaired'.

Appendix A table A1 and A2 (specific provisions of test for fire resistance of elements of structure)

Fire resistance of structural floor in upper storey of 2-storey dwelling house- minimum provision 30 minute integrity (based on load bearing)

Similar requirement for other dwelling houses with top floor not more than 5m above ground, but increasing to 60 minute integrity if top floor is between 5m and 18m above ground.

BS7671 (2008) IEE Wiring Regulations

Regulation 527.2.1

'Where a wiring system passes though elements of a building construction such as floors, walls, roofs, ceilings, partitions or cavity barriers, the openings remaining after the passage of the wiring system shall be sealed according to the degree of fire-resistance (if any) prescribed for the respective element of building construction before penetration.'

(note – BS7671 definition of 'wiring system' does not include lights, but in most cases the openings made for lighting would be larger and more onerous than openings created for cables).

A typical fire-rated fitting being installed.

Note the intumescent sealing around the ventilation holes and the gasket to seal the fitting to the underside of the ceiling.

8 Cable selection and sizing

A problem commonly encountered with recessed lighting is the suitability of the wiring utilised – in particular the conductor cross-sectional area.

Such problems have been noted concerning not only SELV wiring serving typically 12 volt lights, but also wiring to mains operated lights or transformers.

It is not often appreciated that a typical 'low voltage' lamp rated at say 50W and running on 12 volts, will draw over 4 amps, yet the same wattage lamp rated for direct mains operation will draw less than 0.25 amps from the supply.

It is a common misconception even to some electricians that 'low voltage' means low power and thus low current. The reverse is in fact the case.

The Elecsa electrician should always consider the power being drawn at any point in the lighting circuit wiring and ensure that cables are provided with adequate current carrying capacity.

Additionally, where applicable, cable de-rating factors will need to be considered, where perhaps cables run in or near thermal insulation, or are run in areas where high ambient temperatures may be expected, such as lofts.

It should also be noted that BS7671 now stipulates minimum sizes of conductors for lighting circuit wiring – both for nominal mains voltage and for extra low voltage wiring.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 524.1

'The cross-sectional area of each conductor in an a.c. circuit or a conductor of a d.c. circuit shall be not less than the values given in Table 52.3, except as provided for extra-low voltage lighting installations according to regulation 559.11.5.2.'

(The table 52.3 shows for non-sheathed and sheathed cables used on power and lighting circuits, using copper conductors, the minimum conductor cross sectional area to be 1.0 mm sq.)

Regulation 559.11.5.2

'The minimum cross-sectional area of the extra-low voltage conductors shall be:

(i) 1.5mm sq copper, but in the case of flexible cables with a maximum length of 3m a cross sectional area of 1 mm sq copper may be used.

(ii) 4mm sq copper in the case of suspended flexible cables or insulated conductors for mechanical reasons.

(iii) 4mm sq copper in the case of composite cables consisting of braided tinned copper outer sheath, having a material of high tensile strength inner core.'

Picture showing poor workmanship at a light fitting.

Amongst other things the circuit wiring has sections of unsheathed 0.5mm sq and 0.75mm sq flex.

9 Ingress of insects and foreign bodies

IThis problem is most common where recessed lighting is installed in ceilings that have open attic voids behind.

Where open-backed light fittings are utilised, the source of light at the back of the lamp will frequently attract insects from the dark void. Upon coming into contact or close proximity to the lamp, the heat often stuns the insect, and most likely kills them outright, with the result that the dead insect falls into or onto the light.

The problem is most noticeable to end users where light fittings having some form of glass cover directly under the lamp are in use – such as some forms of IP rated or moisture proof fittings. In these cases, the dead insects build up between the lens and the lamp, thus obscuring the useful downward light output.

The complaint is then raised that the light output is dropping!

Other complaints and risks attributable to this cause may be reports of 'burning smells' or in extreme cases the risk of fire.

The practical solution that the Elecsa electrician will need to consider is some form of guarding or enclosed light fitting, when installing lighting in such areas. Any such guarding would need to have adequately fine ingress protection however, to ensure that insect entry is prevented.

Other forms of foreign body entry into or onto light fittings should also be considered, and suitable preventative steps taken. Typically loose building debris, sawdust, split ceiling laths and loose fill insulation is often found to have accumulated behind or within lighting fittings, giving rise to similar problems.

Generally the use of some form of enclosed or fire-rated downlighter will often alleviate this problem, whilst also at the same time dealing with many of the other problems covered in this book.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 522.4.1

'A wiring system shall be selected and erected so as to minimise the danger arising from the ingress of solid foreign bodies. The completed wiring system shall comply with the IP degree of protection relevant to the particular location.'

Regulation 522.4.2

'In a location where dust in significant quantity is present (AE4), additional precautions shall be taken to prevent the accumulation of dust or other substances in quantities which could adversely affect the heat dissipation from the wiring system.'

Regulation 422.3.2

'Measures shall be taken to prevent an enclosure of electrical equipment such as a heater or resistor from exceeding the following temperatures:

(i) 90 degrees C under normal conditions, and

(ii) 115 degrees C under fault conditions

Where materials such as dust or fibres sufficient to cause a fire hazard could accumulate on an enclosure of electrical equipment, adequate measures shall be taken to prevent an enclosure of electrical equipment from exceeding the temperatures stated above.

Note: Luminaries marked with a " 'D' within a triangle" are designed to provide limited surface temperature.'

Picture showing the build up of debris behind an open-backed light fitting.

In this instance, loose-fill shredded newspaper used as loft insulation!

10 Dimmer switch compatibility

This problem is often overlooked and may not become apparent until some time after the lighting has been installed. Sometimes months or even years may have elapsed.

The most common complaint received is that either lighting will no longer turn on, lights flicker, or that lights go out by themselves some time after being turned on. Another common compliant is that dimmer switches, MCBs, RCBOs, transformers or sometimes just filament lamps are noisy in operation.

The problem is most common when SELV lighting is utilised, employing either wire-wound or electronic transformers or voltage converters.

Unfortunately, there is no hard and fast rules that will guarantee a solution in all instances, apart from the Elecsa electrician following manufacturers' instructions – both for the dimmer switch and the transformers / lamps.

It is common for reputable manufacturers of dimmer switches to specify typically maximum and minimum connected loads for lamps, with often the dimmer switch stated capability varying for different types of lamps of the same apparent loading.

If in any doubt, the Elecsa electrician should verify prior to installation stage that all dimmers, control gear and lamps are fully compatible with each other, as obviously call backs and replacement of components at later dates will be time consuming and costly.

Past experience of what dimmer switch and lamp / transformer combinations have previously worked well together is often helpful.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 559.4.1

'Every luminaire shall comply with the relevant standard for manufacture and test of that luminaire and shall be selected and erected in accordance with the manufacturer's instructions.'

Regulation 331.1

'An assessment shall be made of any characteristics of equipment likely to have harmful effects upon other electrical equipment or other services or likely to impair the supply, for example, for co-ordination with other concerned parties e.g. petrol stations, kiosks and shops within shops. Those characteristics include for example:

(i) transient overvoltages, (ii) undervoltage, (iii) unbalanced loads, (iv) rapidly fluctuating loads, (v) starting currents, (vi) harmonic currents, (vii) leakage current, (viii) excessive protective conductor current, (ix) d.c. feedback, (x) high frequency oscillations, (xi) necessity for additional connections to Earth, (xii) power factor

For an external source of energy the distributor shall be consulted regarding any equipment of the installation having a characteristic likely to have significant influence on the supply.'

Picture showing a dimmer switch damaged after being connected to an incompatible SELV lighting load.

The customer complained that the switch had always been noisy!

11 Downlighters in bathroom / shower areas – IP ratings

This problem is common particularly where lighting has been installed in a room containing a bath or shower, and no consideration has been given to the requirements of BS7671 regarding ingress protection and moisture protection.

Since 2001, BS7671 has outlined clearly defined 'zones' in bath or shower rooms based on stipulated dimensions. Each zone has in turn clearly defined requirements, in particular minimum IP ratings that need to be achieved with electrical equipment.

By simple measurement, an item of equipment, for example a light fitting, can be clearly determined as within or outside a particular zone.

The Elecsa electrician must be fully familiar with the zonal requirements of BS7671 and ensure that suitably rated lighting fittings are used.

These requirements must be made very to clear to customers, if customers wish to select or supply their own lighting, for the contractor to install.

A common concern is that many manufacturers and retailers confusingly market lighting components as 'suitable for bathroom use', but on closer inspection this may be found as only suitable for certain zones or beyond the zonal boundaries. This can be very misleading to the untrained purchaser.

It should also be remembered that the IP ratings required under BS7671 apply, irrespective of whether an item is mains or SELV operated.

A common misconception is that because a product runs at low voltage the IP requirements will not have to apply. This is not the case.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 701.512.2

'Installed electrical equipment shall have at least the following degrees of protection:

(i) In zone 0: IPX7

(ii) In zones 1 and 2: IPX4

This requirement does not apply to shaver units complying with BS EN 61558-2-5 installed in zone 2 and located where direct spray from showers is unlikely.

Electrical equipment exposed to water jets, e.g. for cleaning purposes, shall have a degree of protection of at least IPX5.'

Figures 701.1 and 701.2 of BS7671 clearly show the zonal diagrams

Note: It should be noted that the zonal requirements in BS7671: 2008 have now changed from those detailed in earlier editions of the standard. In particular zone 3 no longer exists, and the previous horizontal 'hook-over' of certain zones above other zones has now been deleted.

Picture showing a typical IP65 rated downlighter in a zone 1 location above a shower.

In this instance water jets were considered highly likely – hence the correct decision to use IP65 rating.

12 Downlighters in bathroom / shower areas – equipotential bonding

This issue concerns compliance with BS7671, when installing lighting in areas containing a bath or shower. Although not specifically aimed at recessed lighting, the bonding requirements may well apply to such lighting under certain conditions.

Common problems that have been encountered are where lighting has been installed, either as new build work or more frequently refurbishment, whereby the supplementary bonding requirement has been ignored. Consequently, the lighting installation may not be deemed to be in compliance with BS7671.

The Elecsa electrician when installing lighting in bathroom or shower areas must consider fully the requirements and where applicable, ensure that such bonding is provided as part of the lighting installation.

BS7671 under certain circumstances requires that the circuit protective conductor (cpc) of the lighting circuit is locally bonded to the cpcs of other circuits supplying equipment within a room containing a bath or a shower, and also bonded to other extraneous conductive parts, such as metallic pipework, baths, etc.

It should be noted that bonding requirements, if applicable would apply equally to circuits supplying Class I and Class II equipment.

BS7671: 2008 has introduced a subtle but fundamental change, whereby it is now permitted to omit the supplementary bonding requirements, provided that all of a set of stipulated conditions are met.

The Elecsa electrician must satisfy himself that all such conditions have been met, before electing to omit any supplementary bonding requirements.

Picture showing supplementary bonding under a bath, which is then linked on to the CPC in the bathroom lighting circuit.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 701.415.2

'Local supplementary bonding according to regulation 415.2 shall be established connecting together the terminals of the protective conductor of each circuit supplying Class I and Class II equipment to the accessible extraneous-conductive parts, within a room containing a bath or a shower, including the following:

(i) metallic pipes supplying services and metallic waste pipes (e.g. water, gas)

(ii) metallic central heating pipes and air conditioning systems

(iii) accessible metallic structural parts of the building (metallic door architraves, window frames and similar parts are not considered to be extraneous-conductive-parts unless they are connected to metallic structural parts of the building)

Supplementary bonding may be installed outside or inside rooms containing a bath or shower, preferably close to the point of entry of extraneous-conductive-parts into such rooms.

Where the location containing a bath or shower is in a building with a protective equipotential bonding system in accordance with Regulation 411.3.1.2, supplementary equipotential bonding may be omitted where all of the following conditions are met:

(i) All final circuits of the location comply with the requirements for automatic disconnection according to Regulation 411.3.2

(ii) All final circuits of the location have additional protection by means of an RCD in accordance with Regulation 701.411.3.3

(iii) All extraneous-conductive-parts of the location are effectively connected to the protective equipotential bonding according to Regulation 411.3.1.2

NOTE: The effectiveness of the connection of extraneous-conductive-parts in the location to the main earthing terminal may be assessed, where necessary, by the application of Regulation 415.2.2

13 Downlighters in bathroom / shower areas – RCD protection

This issue concerns compliance with BS7671, when installing lighting in areas containing a bath or shower. Although not specifically aimed at recessed lighting, the RCD protection requirement would almost certainly now be a requirement, for the majority of projects.

Changes in the new BS7671: 2008 have resulted in a requirement for all equipment in all parts of the location to be RCD protected at a level of 30 mA. By definition, this would include mains operated lighting fittings, and associated switching.

The Elecsa electrician should ensure that if installing any form of mains lighting or control into the location, that such RCD protection is now provided, if the project is to comply with BS7671: 2008.

Quite how this RCD protection is provided will vary from job to job.

In new build, or more extensive work for example, such RCD protection may well be installed centrally within a consumer unit, usually to achieve compliance with other BS7671 requirements, such as protecting cables buried in walls.

With more localised work, perhaps relegated to just the bathroom area, the Elecsa electrician may decide to meet the RCD requirement by covering only his lighting circuit work with an RCD – for example, by intercepting an existing non-RCD protected lighting circuit, via a 30mA RCD fused connection unit.

Whichever method is selected, the Elecsa electrician must be in a position to ensure that as a minimum the work that he or she is responsible for complies fully with BS7671 in this respect.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 701.411.3.3

'Additional protection shall be provided for all circuits of the location, by the use of one or more RCDs having the characteristics specified in Regulation 415.1.1

NOTE: See also Regulation 314.1 (iv) and 531.2.4 concerning the avoidance of unwanted tripping.'

Regulation 415.1.1

'The use of RCDs with a rated residual operating current (I delta n) not exceeding 30mA and an operating time not exceeding 40mS at a residual current of 5 x (I delta n) is recognised in a.c. systems as additional protection in the event of failure of the provision for basic protection and/or the provision for fault protection or carelessness by users.'

Picture showing BS7671: 2008 compliant consumer unit, with 30mA RCBO protection on majority of circuits – including lighting circuits serving bathroom and shower areas.

14 Choice of lamp type and ensuring correct initial fitment and replacement

This is now becoming a growing common problem, not only during initial installation, but also increasingly during maintenance and future replacement of lamps.

In recent years, particularly since the advent of the mains operated GU10 type lamp, fire rated light fittings and low energy lamps, the choice of the correct lamp for a light fitting has become more critical than ever before.

Incorrect lamp type within a recessed downlighter will often result in poor lighting performance, greatly reduced lamp life, damage to the fitting itself and wiring and in extreme cases, the risk of fire.

The Elecsa electrician should ensure that correct lamps are fitted initially, fully in line with the lighting fitting manufacturer's instructions.

Equally as important, end users and customers must be made fully aware of specific requirements for future replacement lamps.

Best practice would be that as a minimum, the Elecsa electrician leaves end users with manufacturers instruction and preferably in addition some actual spare lamps of the correct type.

It is unfortunately the case, that whilst originally the lighting industry attempted to design non-interchangeable lamp bases for different types of lamp, such standardisation has not been fully embraced across the industry.

The most often encountered example is that concerning the so-called 'heat forward' aluminium reflector lamps and the 'heat out behind' dichroic reflector lamps. To the untrained eye they appear very similar, yet were designed and developed to achieve totally different objectives.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 134.1.1

'Good workmanship by competent persons or persons under their supervision and proper materials shall be used in the erection of the electrical installation. Electrical equipment shall be installed in accordance with the instructions provided by the manufacturer of the equipment.'

Regulation 132.13

Every electrical installation shall be provided with appropriate documentation, including that required by Regulation 514.9, Part 6 and where applicable Part 7.'

Picture showing an aluminium reflector lamp and dichroic reflector lamp – same lampholder and fully interchangeable.

Vastly different heat dissipation pattern, but which is which?

15 Energy efficiency and the building regulations

This issue concerns the conservation of fuel and power requirements of the Building Regulations, applicable to all new build dwellings, and from April 2006 to existing dwellings being refurbished, rewired, or having lighting generally replaced.

It is now a statutory requirement that a certain proportion of all lighting being installed must be deemed to be energy efficient. The Building Regulations deem such lighting to operate at an 'efficacy of greater than 40 lumens per circuit watt' and 'have lampholders that can only accept such energy efficient lamps'.

It is accepted that any form of lighting that uses an incandescent filament, would not be classified as low energy under the Building Regulations, no matter what size, voltage, shape or rating.

The Elecsa electrician must therefore ensure that whenever recessed lighting is being installed, particularly where a project is notifiable, that the low energy requirements are met or exceeded.

The proportion of low energy lighting required to satisfy Building Regulations is defined as 'not less than the greater of one fitting in every four being low energy' and 'one low energy fitting being provided in every 25 sq m of floor space worked in' - (the latter condition excluding garages).

It is worth remembering that the regulations will only apply to the area being affected by the work. If a whole house is being re-wired, then the total number of lighting points and floor area must be taken into account to calculate the low energy lighting quantity.

If only say, a kitchen is being refurbished, then just the kitchen parameters need to be considered. In this latter example, if such low energy lighting were deemed impractical, then established best practice would be to ensure that the minimum quantity of low energy lights required for the kitchen works are implemented elsewhere in the dwelling as part of the project overall.

Where does it say it?

Approved Document L1A – Building Regulations (new build dwellings)

Paragraph 43

'Reasonable provision would be to provide in the areas affected by the building work, fixed energy efficient light fittings that number not less than the greater of:

(a) one per 25 sq m of dwelling floor area (excluding garages) or part thereof: or

(b) one per four fixed lighting fittings

A light fitting may contain more than one lamp'

Approved Document L1B – Building Regulations (existing build dwellings)

Paragraph 45

'Reasonable provision would be to provide in the areas affected by the building work, fixed energy efficient light fittings that number not less than the greater of:

(a) one per 25 sq m of dwelling floor area (excluding garages) or part thereof: or

(b) one per four fixed lighting fittings

This assessment should be based on the extension, the newly created dwelling or the area served by the lighting system as appropriate to the particular case.'

Picture showing a typical low energy reflector lamp.

Note that Building Regulations Approved Documents L1A and LIB would only be met if its matching light fitting could not be fitted with incandescent filament lamps as well.

16 Resistance to the passage of sound and the building regulations

This issue has come to prominence in recent years since the introduction of Approved Document P, in January 2005, which requires that all relevant associated Building Regulations be complied with, when undertaking notifiable work in dwellings.

One such component of the Building Regulations requires that dwelling houses and rooms within be constructed to provide reasonable resistance to sound from other rooms or other buildings, with floor construction in particular being seen as a key element in achieving this.

The Building Regulations recognise that as well as using specified products and solutions, sound transfer will occur through the smallest of gaps and voids, and as such stress the importance of good workmanship to avoid such issues. The relevant Approved Document also notes quite clearly that the installation of recessed downlighters into certain ceiling constructions can reduce the resistance to the passage of airborne and impact sound.

The Elecsa electrician needs to be aware of these requirements, when installing such lighting, particularly on new-build or notifiable work, where self-certification may mean that full Building Regulations compliance is being certificated in the electrician's name.

Fortunately, many practical solutions are available in this respect, the easiest being the use of proprietary sealed light fittings – often fire rated fittings. It is usually found that by satisfying the fire rating requirements, sound issues are dealt with simultaneously. – The Elecsa electrician should of course check with the manufacturer that this is the case.

The actual installation workmanship of the light fitting is however most critical, in order to achieve a fully compliant solution. For example, if installing such fittings into a textured or uneven ceiling, suitable attention must be given to ensure that the ceiling surface and light fitting bezel meet together with no appreciable gaps.

Where does it say it?

Approved Document E – Building Regulations

Requirement E1

Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjacent buildings'

Requirement E2

'Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that –

(a) internal walls between a bedroom or a room containing a water closet, and other rooms;

and

(b) internal floors, provide reasonable resistance to sound'

Diagram 3-2 and part footnote (relating to separating floors for new buildings)

'Installing recessed light fittings in ceiling treatments A to C can reduce their resistance to the passage of airborne and impact sound'

Picture showing a downlighter offering virtually no sound resistance properties.

Appreciable gaps will exist around the lamp and the eyeball, allowing noise from the room to easily pass into the floor void above.

17 Resistance to the passage of moisture and the building regulations

This issue has come to prominence in recent years since the introduction of Approved Document P, in January 2005, which requires that all relevant associated Building Regulations be complied with, when undertaking notifiable work in dwellings.

One such area is the need to avoid excessive moisture-laden air transfer into roof voids in particular, which may in turn lead to problems of condensation, mould, damp and building fabric decay.

Such moisture resistance is traditionally achieved by good sealing of different parts of the building coupled with adequate ventilation.

In terms of the sealing requirements, the Building Regulations note that a key element in this respect, is to ensure that all penetrations and gaps for such items as pipes, wiring, etc, are filled on completion of work – particularly in areas of high humidity such as kitchens and bathrooms.

The Elecsa electrician needs to be fully aware of these requirements, when installing recessed lighting – particularly as it is now so popular in such rooms.

With new build work in particular, where statutory compliance must be achieved, then a solution must be found. Similarly, with existing buildings, particularly bathrooms, shower rooms and kitchen areas (which by definition will involve notifiable work), the Elecsa electrician must ensure that the finished project can be described in Building Regulation terms as 'no less compliant than before the work started', in order to generate compliant self-certification.

Again, as with the sound resistance issue, practical solutions are now easy to achieve, by selecting suitably sealed and rated light fittings.

Workmanship will again play a crucial role, regarding the sealing of holes and gaps, in order that moisture and air passage be inhibited sufficiently.

Where does it say it?

Approved Document C – Building Regulations

Paragraph 6.12

'To avoid excessive moisture transfer to roof voids, gaps and penetrations for pipes and electrical wiring should be filled and sealed; this is particularly important in areas of high humidity, e.g. Bathrooms and kitchens. An effective draft seal should be provided to loft hatches to reduce inflow of warm air and moisture.'

A typical fire-rated light fitting that also meets the requirements for inhibiting moisture passage.

Note the sealing ring between the lamp and the fitting and the sealing gasket between fitting and the ceiling.

18 Enclosure of wiring connections

This issue is still a fairly common problem, despite the general tightening up of electrical installation standards in dwellings, following the introduction of Approved Document P in January 2006.

It has been fairly common, but incorrect practice, to install recessed lighting by using open wiring connectors pushed up into the ceiling void for the necessary terminations, branches and joints in the wiring. In some instances, the joints have been bound up in insulation tape, and in others, just left open.

Neither is acceptable to BS7671, and indeed would never have been acceptable to meet earlier editions of the standard. BS7671: 2008 and its predecessors have always required that wiring connections be fully enclosed, either within a recognised wiring accessory, compliant equipment enclosure or within some other form of enclosure constructed from a material proven to be non-combustible.

It is worth remembering that the requirement for enclosed wiring connections applies, regardless of voltage. It has been a common misconception that 12 volt SELV wiring is safe and thus does not need enclosing to the same standard as mains wiring.

In reality, although 12 volt SELV wiring will give no appreciable electric shock risk, an overheating or loose termination even at 12 volts may still cause enough heat build-up to start a fire. At reduced voltages, the currents are proportionally higher for the same power transfer; therefore the risks of fire are actually higher.

The Elecsa electrician should fully recognise this requirement, and ensure that all wiring terminations and joints associated with recessed lighting are fully enclosed, either within proprietary terminal chambers on light fittings and/or within enclosed junction boxes at all other positions.

Existing lighting incorporating unenclosed wiring terminals may still often be encountered. In these instances replacement, with modern fittings offering enclosed wiring would be best practice.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 421.7

'Every termination of a live conductor or connection or joint between live conductors shall be contained within an enclosure selected in accordance with Regulation 526.5.'

Regulation 526.5

'Every termination and joint in a live conductor or a PEN conductor shall be made within one of the following or a combination thereof:

(i) A suitable accessory complying with the appropriate product standard

(ii) An equipment enclosure complying with the appropriate product standard

(iii) An enclosure partially formed or completed with building material which is non-combustible when tested to BS476-4.'

Regulation 526.9

'Cores of sheathed cables from which the sheath has been removed and non-sheathed cables at the termination of conduit, ducting or trunking shall be enclosed as required by Regulation 526.5.'

Picture showing poor wiring practice – unenclosed wiring in an attic, following a 2006 bathroom lighting refurbishment.

Here, the joint is surrounded in combustible shredded newspaper loft insulation!

19 Accessibility to wiring connections

This issue is normally encountered alongside the requirement for enclosed connections outlined in the previous chapter.

The problem is most prevalent, when lighting wiring has to be installed before a ceiling construction is completed, with often the completion of the ceiling boarding then rendering connections and terminations inaccessible.

Another common occurrence is where lighting junction boxes are installed in a floor void, serving lights in a room below, and subsequently the floor is covered in some form of finishing, again rendering the connections inaccessible.

The Elecsa electrician needs therefore to recognise what BS7671 actually requires, and plan the installation accordingly to preferably make all such connections fully accessible.

Best practice is of course to avoid all joints wherever practicable.

BS7671 requires that all joints and terminations comprising screwed or bolted connections be accessible. Such accessibility may not preclude junction boxes under floors, provided that their location is identified clearly and permanently somewhere, and that access can be granted reasonably easily without the need for extensive furniture, floor covering and floor boarding removal or destructive damage to finishes.

A joint taking the form of perhaps compression (crimped) or soldered connections, by definition would not need such accessibility for BS7671 compliance, although the requirements for suitable enclosure would of course still apply.

The Elecsa electrician's best course of action is to if possible avoid any such joints, but if needs dictate, then to make them accessible at lighting point positions. Obvious care in workmanship would be needed however, to ensure that any such joints are not subject to harm from heat, compression, abrasion, etc.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 526.3

'Every connection shall be accessible for inspection, testing and maintenance, except for the following:

(i) A joint designed to be buried in the ground

(ii) A compound-filled or encapsulated joint

(iii) A connection between a cold tail and the heating element as in ceiling heating, floor heating or a trace heating system

(iv) A joint made by welding, soldering, brazing or appropriate compression tool

(v) A joint forming part of the equipment complying with the appropriate product standard'

Picture showing a light fitting, with inaccessible connections between the fixed house wiring and the heat resistant wiring tails provided on the fitting.

In this instance, breaking the ceiling was the only way of accessing the terminations.

20 Accessibility to lamps and transformers

This issue is normally encountered after final 'finishing works' to a project. Other trades such as decorators or builders, who often in good faith are unaware of potential problems they are contributing to or causing, regularly undertake such finishing work.

The most common problem in this respect is where recessed lighting is painted or mastic sealed around, often for aesthetic reasons.

The problem does not then materialise until sometime in the future, when a lamp needs changing, transformer needs accessing, etc. To gain access then causes damage to the decoration, with often edges of the ceiling breaking away. A much bigger patching up and redecoration job then results.

The Elecsa electrician needs to be aware of this issue, and take all reasonable steps to try to overcome it.

Often the choice of light fitting itself will play an important role in its future maintainability. Many good quality light fittings are designed with maintenance in mind, whereby access to lamps and sometimes even transformers behind can be gained, without disturbing the ceiling itself.

Many fittings on the market however, do not offer this facility, with access to lamps, etc, only being granted by forcing the whole fitting out of the ceiling. A customer will not thank an electrician for installing this sort of light fitting!

Assuming that a good, accessible light fitting can be selected, the Elecsa electrician needs to do the best to make other trades and possible end users aware of the need to maintain accessibility.

If possible, best practice is to finally fit all such '2nd fix items' after the work of other trades such as painting has finished. Commercial work and time pressures will often prevent this however.

Where does it say it?

BS7671 (2008) IEE Wiring Regulations

Regulation 132.12

'Electrical equipment shall be arranged so as to afford as may be necessary:

(i) sufficient space for the initial installation and later replacement of individual items of electrical equipment.

(ii) accessibility for operation, inspection, testing, fault detection, maintenance and repair.'

Regulation 513.1

'Except for a joint in cables where Section 526 allows such a joint to be inaccessible, every item of equipment shall be arranged so as to facilitate its operation, inspection and maintenance and access to each connection. Such facility shall not be significantly impaired by mounting equipment in an enclosure or compartment.'

A good quality sealed downlighter, where access to the lamp is gained by simply unscrewing the trim bezel.

The rest of the fitting remains undisturbed in the ceiling, resulting in quick, easy and clean maintenance.

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