Guide to
Junction Boxes

hager

Introduction

For well over one hundred years the Wiring Regulations have provided the rules which must be followed to make sure that electrical installations are safe. The introduction of the 17th Edition of the Wiring Regulations had major implications for all Electrical Contractors, Designers and Consultants.

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Building Regulations

"Good workmanship by competent persons using the proper materials will reduce the risk of overheating or fire".

Since 2005 the Building Regulations for England and Wales have made direct reference to Electrical Installations, increasing the influence on how Electrical Equipment is installed in buildings.

Part P of the Building Regulations 2000 came into effect on 1st January 2005 and was further amended on 6th April 2006. This document states that the requirements will be met by adherence to the 'Fundamental Principles' for achieving safety given in the Wiring Regulations BS 7671 Chapter 13.

For Scotland, the Building (Scotland) Regulations 2004 apply to domestic and non-domestic buildings. Section 4.5 Electrical Safety in the Scottish Building Standards Agency (SBSA) Technical Handbook prescribes that an electrical installation should be designed, constructed, installed and tested such that it is in accordance with the recommendations of the Wiring Regulations BS 7671.

The 'Fundamental Principles' that are given in chapter 13 are intended to provide for the safety of persons, livestock and the protection of property against dangers and damage which may arise in the reasonable use of electrical installations.

It is recognised that good workmanship by competent persons using proper materials will reduce any hazards that may arise and that every item of equipment shall comply with the appropriate British Standard.

Electrical joints are a potential source of overheating and if not securely made could ultimately cause a fire. For this reason there are several regulations relating to electrical connections. Indeed this is mentioned within chapter 13 in regulation 134.1.4 'Every electrical joint and connection shall be of proper construction as regards conductance, insulation, mechanical strength and protection'

"Connections to downlighters are a common cause of non-compliance".

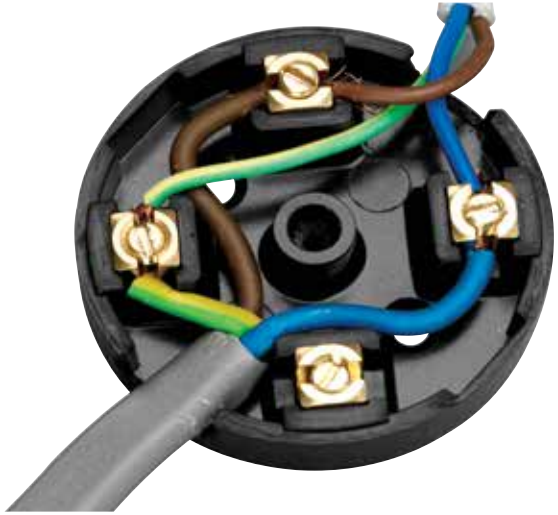
This section aims to explain some of the regulations contained within the 17th Edition Wiring Regulations, regarding the connection of conductors both for lighting and power final circuits.

Electrical Connections

The requirements of the 17th Edition Wiring Regulations concerning electrical connections are covered mostly within section 526. This section states that every electrical connection shall have durable electrical continuity, adequate mechanical strength and protection.

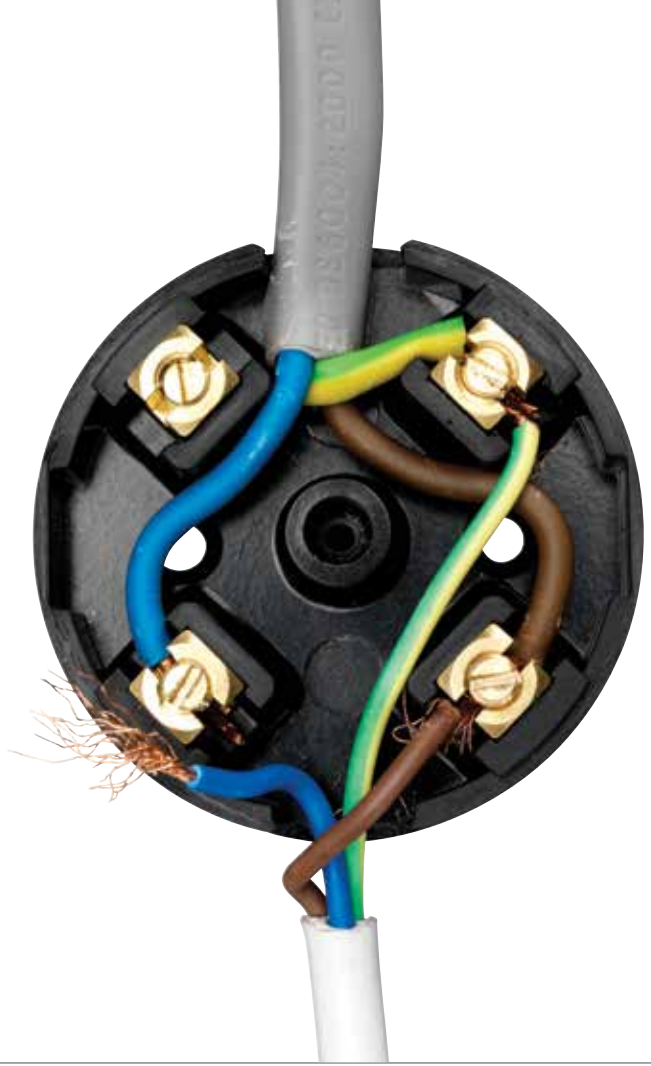
The wiring method illustrated here is a common cause of non-compliance particularly with lighting circuits and the connections to downlighters in particular.

- It can be seen that the sheath of the flex is not enclosed. This is due to the junction box connection method not facilitating an easy means of enclosing the outer sheath, a non-compliance with regulation 526.8.
- Another problem is that during installation and maintenance, mechanical strain may be placed on the terminations of the conductors within the junction box. This is due to the lack of a clamping method for the cable, a non-compliance with the regulation 522.8.5.



A further potential problem can be found within the junction box (opposite) concerning the type of conductors that are typically terminated. It is often the case in domestic installations that solid twin & cpc cables will be used for the fixed wiring with the conductor to the light fitting (or transformer if the lighting is ELV) being a flexible conductor. Care must be taken to ensure the strands of the flexible cable are secured adequately in the terminal and have not been damaged to ensure compliance with regulation 526.2

Also, as can be seen in this illustration, when the conductor was removed for inspection it is clear that some of the strands have been damaged during termination.



"Ensure that the connection method selected is fully compliant".

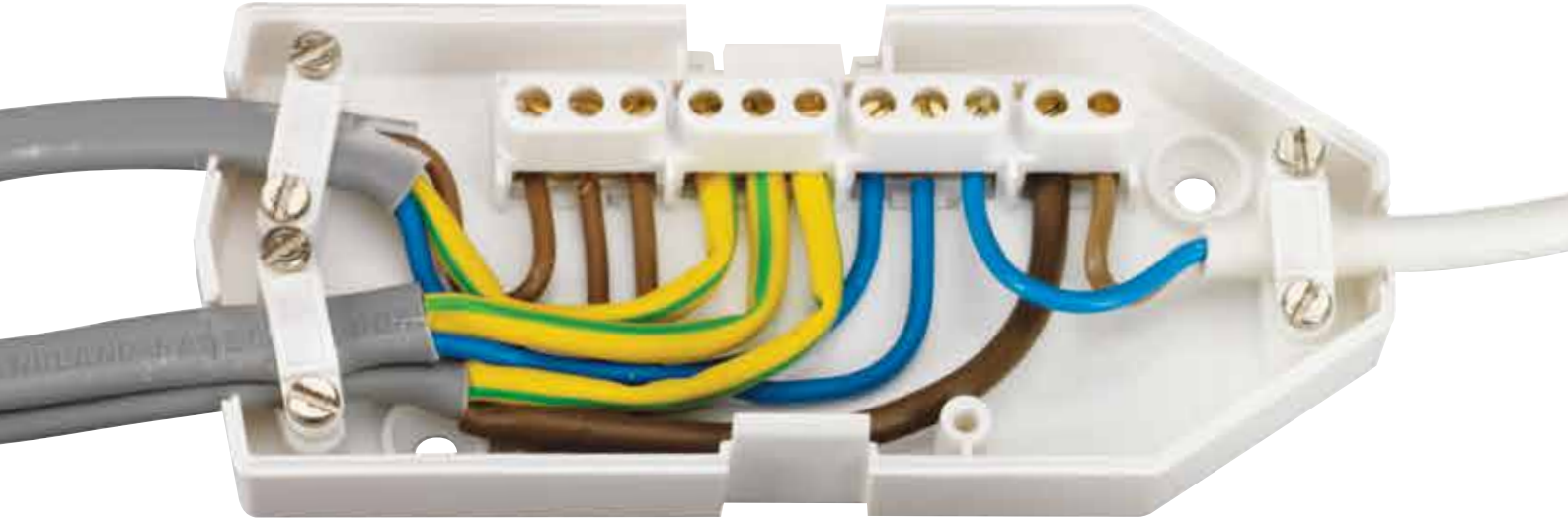
Downlighter Junction Box

When fitting recessed downlighters the following method would overcome all the issues raised previously.

It can be seen here that the sheath of both solid conductors and flexible conductors for the light fitting can be secured as they enter the enclosure. This enables compliance with regulation 522.8.5 in particular where it states that there shall be no undue mechanical strain on the terminations of the conductors.

Also regulation 526.8, which requires the cores of sheathed cables from which the sheath has been removed to be enclosed, can be seen to be complied with.

"Cable clamps prevent strain on terminations for compliance with regulations".



Regulation 526.2 is complied with where the method of connection shall take account of the number and shape of wires forming the conductor. In this junction box solid conductors and flexible conductors can be terminated separately by means of the unique three plate style terminal arrangement.

Maintenance Free Connections

Junction boxes are commonly used during alterations and additions to an installation.

Regulation 526.3 requires that every connection shall be accessible for inspection, testing and maintenance. There are 6 exceptions to this rule. Exception (vi) is:
“Equipment complying with BS 5733 for a maintenance free accessory and marked with the symbol (MF) and installed in accordance with the manufacturer’s instructions”.

BS 5733 defines a maintenance free accessory as:
“An accessory which does not require further inspection, testing or maintenance after installation in a circuit, and which incorporates screwless terminals and cable clamps to secure any associated cables”.

The Electrical Safety Council Technical Manual states that “a junction box with screw terminals must be accessible”. This is to allow inspection of joints which could have relaxed or loosened over time, a potential problem with screwed terminals. So, unless provision is made for access, where boarding, carpet or other similar covering is laid over a junction box, it may not be considered accessible and maintenance free terminals should be used.

This is further reinforced in Appendix 15 of the Wiring Regulations which states “Junction boxes with screw terminals must be accessible for inspection, testing & maintenance or, alternatively, use maintenance-free terminals / connection (Regulation 526.3)”

“Junction boxes with screw terminals must be accessible for inspection”.

"Maintenance free terminals provide a solution where accessibility is an issue".

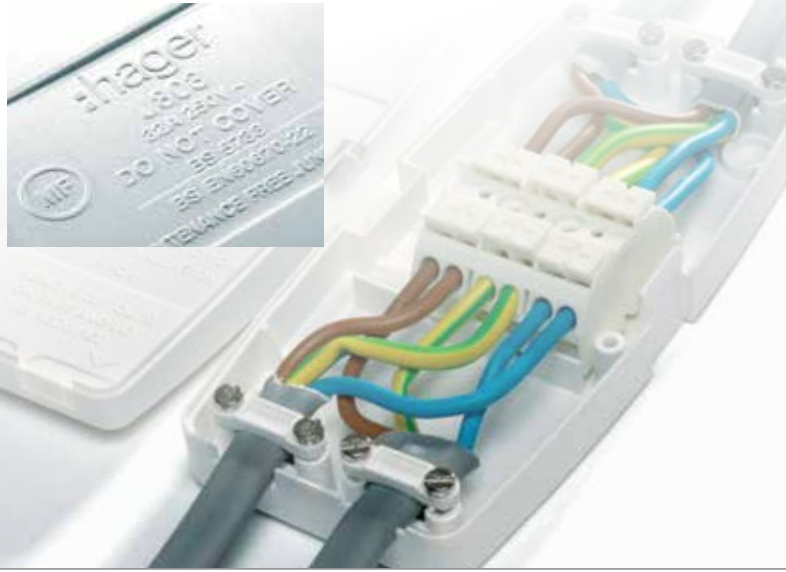
Screwless terminals do not in themselves meet the requirements of regulation 526.3. Conformity is indicated by marking the (MF) symbol and BS 5733 on the maintenance free accessory.

BS 5733 prescribes additional requirements and tests for terminals for use within maintenance free accessories, to verify that:

- Terminals have long-term connection capability
- Terminals are resistant to the effects of vibration
- Terminals withstand the effects of overloads and shall not cause ignition or damage to the mounting surface
- Terminals are sufficiently resilient to the effects of thermal shock

Hager maintenance free terminals have the additional advantages of allowing the direct insertion of solid, stranded or flexible conductors, and allowing the connection of up to four conductors from 0.5mm^2 to 4.0mm^2.

Another regulation relating to junction boxes is 521.8.3 which requires that where two or more circuits are terminated in a single junction box this shall comply with BS EN 60670-22. An accessory meeting the requirements of both standards could therefore be dual marked BS 5733 and BS EN 60670-22.



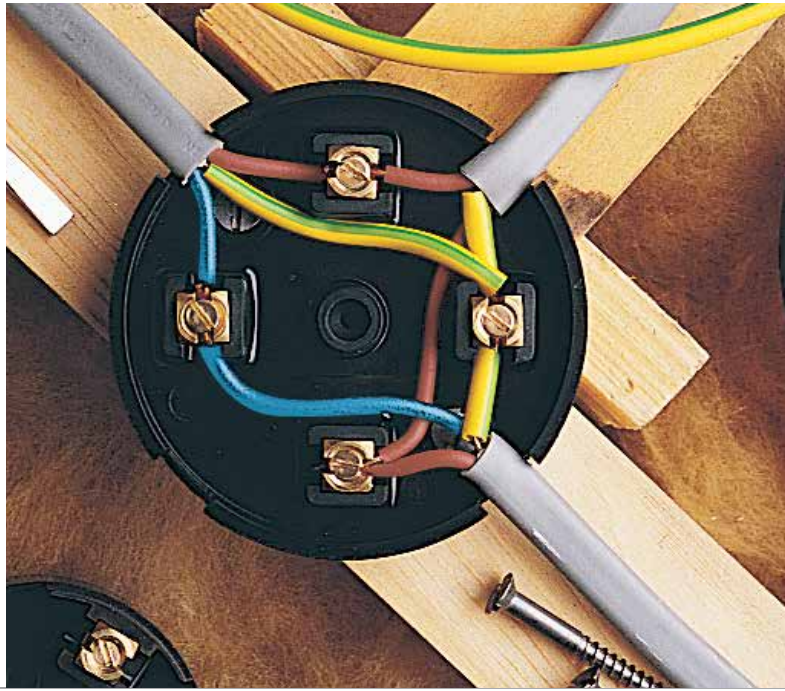
Traditional Junction Boxes

As we have discussed, unless using a solution such as maintenance free terminals, the access to electrical connections should be adequate for their safe and proper inspection, testing and maintenance. In this respect, connections should be in a location where they can reasonably be reached and where there is adequate working space.

Where connections are made in roof spaces and inter-floor spaces the enclosures containing the connections should normally be fixed and provision must be made for their access.

Providing these two constraints are complied with, then the continued use of standard circular junction boxes remains acceptable.

"Providing the enclosure is fixed and accessible traditional junction boxes are acceptable".



The requirement for accessibility applies equally to the situation where, because of damage to an existing cable, a repair is effected by the introduction of a joint.

The joint must be accessible, alternatively the joint may be made by an appropriate method, a maintenance free terminal for example.

Conclusions

Junction boxes are an integral part of virtually every electrical installation. Unfortunately these connections often do not comply with the Wiring Regulations due to incorrect product selection.

It is clear that careful consideration from designers and installers will be required to meet the requirements of the 17th Edition of the Wiring Regulations.

Training Seminars

In addition to supplying the products required to achieve compliant installation, Hager are committed to training our customers on the latest regulations. To help with the requirements of the 17th Edition we run a series of training seminars to help explain the implications, and how Hager can assist.

To register your interest please visit www.hager.co.uk/training.

City & Guilds

Product Selection Guide

Is the Junction Box accessible

YES

Is there a suitable fixing position

YES

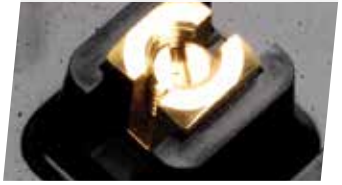
Traditional Junction Boxes are acceptable

NO

Maintenance free terminals required

NO

Cable clamping recommended



Selection Chart

Description	Nº of Terminals	Terminal Rating	Reference	Benefits / Considerations
Downlighter Junction Box	3 x 3 x 1.5mm^2 1 x 2 x 1.5mm^2	16A	J501	Provided with cable clamps and separate terminals for flex
Maintenance Free Junction Box	3 x 4 x (0.5 - 4.0mm^2)	32A	J803	Suitable for use in inaccessible locations
	4 x 4 x (0.5 - 4.0mm^2)	20A	J804	
Traditional Junction Boxes	4	20A	J201	Acceptable for locations which are accessible
	4	20A	J301	
	3	30A	J401	
	6	20A	J601	

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