

HARMONISED COLOURS AND ALPHANUMERIC MARKING By Paul Cook

THE IEE and those represented on its joint national committee, including the Health and Safety Executive, the DTI, the NICEIC and the ECA, have been considering the change on and off since 1969 when the new cable colours were adopted in appliance flexible cables.

There were and are concerns then that a colour change would put at risk the excellent safety record of the UK with respect to electrical installations in buildings. The UK's record is without equal. Consequently the Wiring Regulations committee has moved with care.

Harmonisation of marking has continued to develop in Europe and across the world. BS EN 60046 : 2000 *Basic and safety principles for the man-machine interface, marking and identification of conductors by colours and numbers* and BS EN 60445 : 2000 *Basic and safety principles for the man-machine interface, marking and identification of equipment terminals and terminations* have enabled the adoption throughout Europe of common marking and identification for machines including the UK. European Standard HD 308 *Insulated cables and flexible cords for*

installations introduced the brown and blue colours for flexible cables in 1969 and the 2001 edition extends the scope to fixed wiring.

The UK was much involved with the adoption of the fixed wiring colours throughout Europe. As electricians who are familiar with three-phase flexible cables, what had been adopted in Europe was hardly helpful in that a three-phase cable could have black or brown phase conductors in any combination. If an indication of phase rotation was required it was necessary to apply numbered or lettered sleeves. Within the UK it was

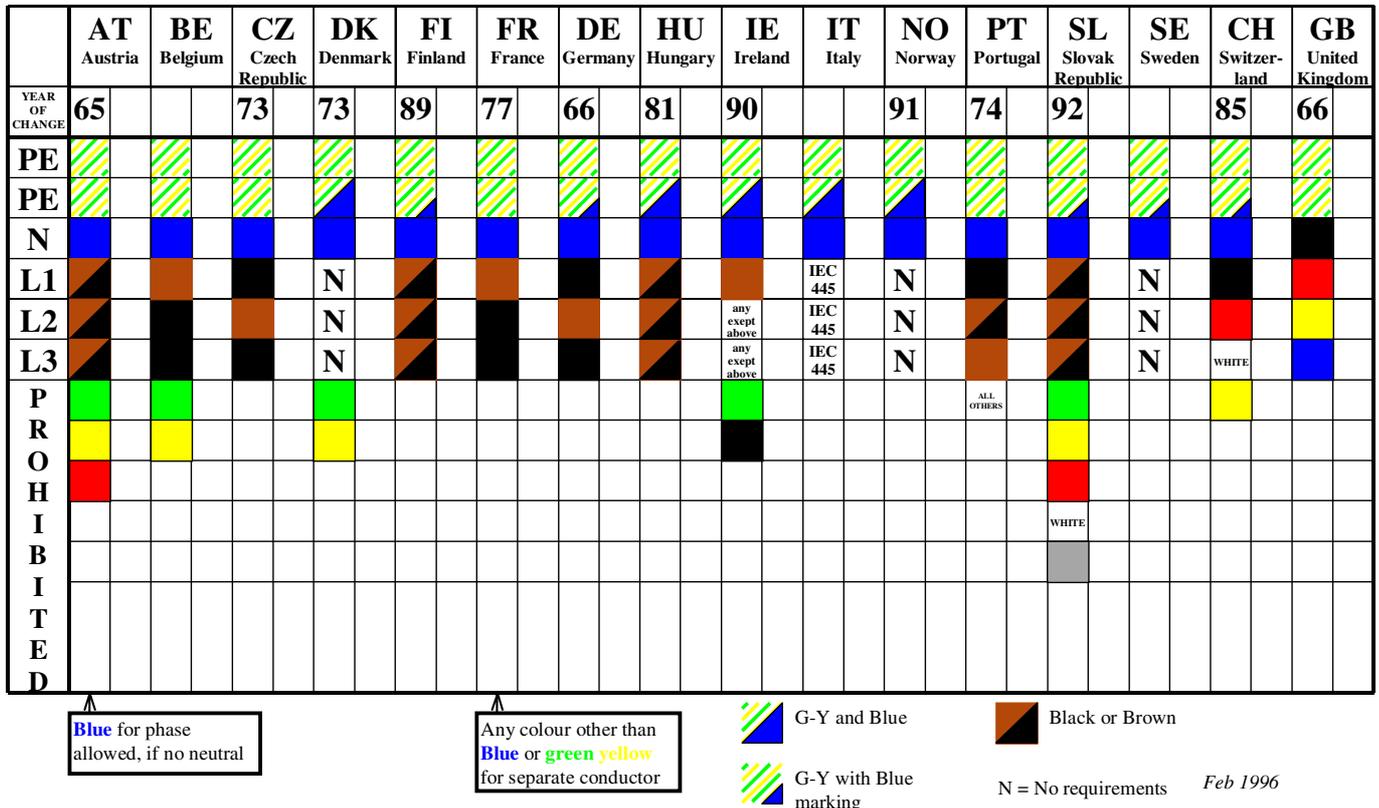


Figure 1: Fixed wiring colours in Europe

thought important that where cable cores were to be identified by colour, three separate colours should be used. As will be seen from Figure 1, every other country had adopted black and brown for phase colours as they were the preferred colours of the International Electrotechnical Commission (IEC).

The UK saw the only way forward to be to persuade the other countries in Europe to adopt three separate phase colours, proposing brown, black and grey (or perhaps pink for the third colour). The UK proposals were adopted throughout Europe and the whole of Europe will be changing its three phase colours to the brown, black and grey being introduced into the UK.

CONSULTATION

The IEE and the BSI followed the customary joint consultation procedures. The draft for Public Comment was published in March 2003 and many comments were received and considered. Not surprisingly the major concern was marking at the interface between old and new colours. Initially the Committee considered that it might be appropriate to tape old and new cables in the new colours. However, a better solution was arrived at which was the adoption of the alphanumeric marking system for old and new conductors at the interface unless there was no possibility of confusion.

ALPHANUMERIC MARKING

The alphanumeric marking system (letters with numbers) adopted was that of standards BS EN 60446 : 2000 and BS EN 60445 : 2000, the long titles of which were quoted above. The new Table 51 – Identification of conductors – includes not only colours but the new alphanumeric marking.

ALTERATIONS OR ADDITIONS TO EXISTING INSTALLATIONS

The new Amendment includes an Appendix 7 which specifically

Function	Alphanumeric	Colour
Protective conductors Functional earthing conductor		Green-and-yellow Cream
a.c. power circuit ⁽¹⁾		
Phase of single-phase circuit	L	Brown
Neutral of single- or three-phase circuit	N	Blue
Phase 1 of three-phase a.c. circuit	L1	Brown
Phase 2 of three-phase a.c. circuit	L2	Black
Phase 3 of three-phase a.c. circuit	L3	Grey
Two-wire unearthed d.c. power circuit		
Positive of two-wire circuit	L+	Brown
Negative of two-wire circuit	L-	Grey
Two-wire earthed d.c. power circuit		
Positive (of negative earthed) circuit	L+	Brown
Negative (of negative earthed) circuit ⁽²⁾	M	Blue
Positive (of positive earthed) circuit ⁽²⁾	M	Blue
Negative (of positive earthed) circuit	L-	Grey
Three-wire d.c. power circuit		
Outer positive of two-wire circuit derived from three-wire system	L+	Brown
Outer negative of two-wire circuit derived from three-wire system	L-	Grey
Positive of three-wire circuit	L+	Brown
Mid-wire of three-wire circuit ⁽²⁾⁽³⁾	M	Blue
Negative of three-wire circuit	L-	Grey
Control circuits, ELV and other applications Phase conductor	L	Brown, Black, Red, Orange, Yellow, Violet, Grey, White, Pink or Turquoise
Neutral or mid-wire ⁽⁴⁾	N or M	Blue

NOTES:
 (1) Power circuits include lighting circuits.
 (2) M identifies either the mid-wire of a three-wire d.c. circuit, or the earthed conductor of a two-wire earthed d.c. circuit.
 (3) Only the middle wire of three-wire circuits may be earthed.
 (4) An earthed PELV conductor is blue.

Table 1: Table 51 from BS 7671 : 2001 Amendment No 2 : 2004

addresses the marking at the interface between old and new installations.

Single-phase installations

An alteration or addition made to a single-phase installation need not be marked at the interface providing that:

- (1) Old cables are correctly identified by their colour, red for phase and black for neutral; and
- (2) The new cables are correctly identified by the colours brown for phase and blue for neutral.

The new colours are already found in appliance flexes and lighting pendants, so electricians are familiar with the relationship between the old and new colours in single-phase installations. For this reason it is considered that there is no need to mark at the interface for single-phase installations marked in the correct colours. However a caution notice is to be fixed on or near the consumer unit or fuseboard from which the circuit is supplied.

The IEE is not a body responsible for the opinions expressed.
 ©2004: The Institution of Electrical Engineers.
 All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without the permission in writing of the publisher. Copying of articles is not permitted except for personal and internal use. Multiple copying of the content of this publication without permission is always illegal.

Three-phase installations

There has always been concern regarding the use of blue for neutrals in three-phase installations as in the UK we have for many years used blue as a phase identification. This was probably the reason for the considerable delay in adoption of the new colours.

The recommendation in Appendix 7 is that where an alteration or addition is made to a two- or three-phase installation wired in the old colours with an addition or extension in the new colours, unambiguous identification is required and cores shall be marked as follows:
 Neutral conductors – old and new conductors = N
 Phase conductors – old and new conductors = L1, L2, L3

Function	Old conductor		New conductor	
	Colour	Marking	Marking	Colour
Two-wire unearthed d.c. power circuit				
Positive of two-wire circuit	Red	L+	L+	Brown
Negative of two-wire circuit	Black	L-	L-	Grey
Two-wire earthed d.c. power circuit				
Positive (of negative earthed) circuit	Red	L+	L+	Brown
Negative (of negative earthed) circuit	Black	M	M	Blue
Positive (of positive earthed) circuit	Black	M	M	Blue
Negative (of positive earthed) circuit	Blue	L-	L-	Grey
Three-wire d.c. power circuit				
Outer positive of two-wire circuit derived from three-wire system	Red	L+	L+	Brown
Outer negative of two-wire circuit derived from three-wire system	Red	L-	L-	Grey
Positive of three-wire circuit	Red	L+	L+	Brown
Mid-wire of three-wire circuit	Black	M	M	Blue
Negative of three-wire circuit	Blue	L-	L-	Grey

Table 2: Table 7E from Appendix 7
 Example of conductor marking at the interface for additions and alterations

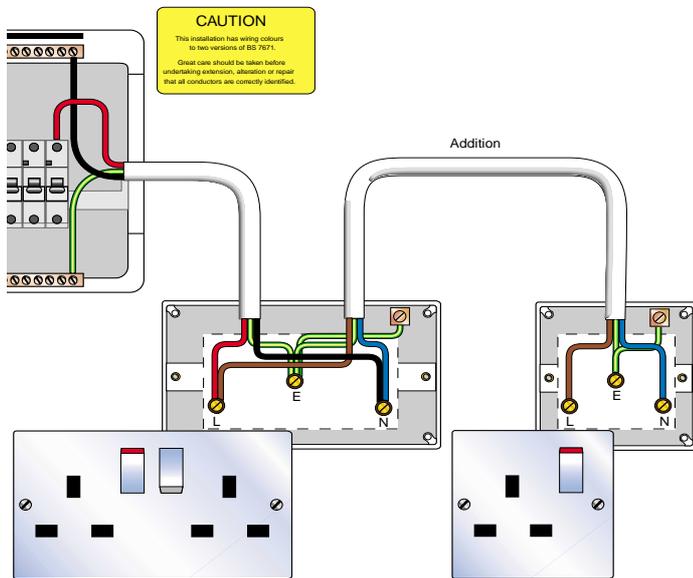


Figure 2: Extension to a single-phase installation showing caution notice and absence of interface marking (courtesy of NICEIC)

The adoption of this marking removes the ambiguity that is always of concern where colours alone are used. See Figure 3 for examples.

DC INSTALLATIONS

Interest in d.c. installations has not been as great as it is now since the a.c./d.c. changeovers carried out by the supply companies in 1960s. D.c. power supplies are now a significant feature of IT installations. The D.C. Users Forum, on behalf of the industry, expressed its concern that particular attention had to be given to d.c. installations. As a result marking was introduced for d.c. and Appendix 7 was particularly amended to include guidance for d.c. installations.

IMPACT ASSESSMENT

The IEE has prepared an impact assessment of the colour change. This describes the development of the change, the work in Europe and the changes made following the public consultation. It is available on the IEE website: www.iee.org/cablecolours

16th Edition IEE Wiring Regs BS7671
 leading to the City & Guilds 2381 or 2391 exams

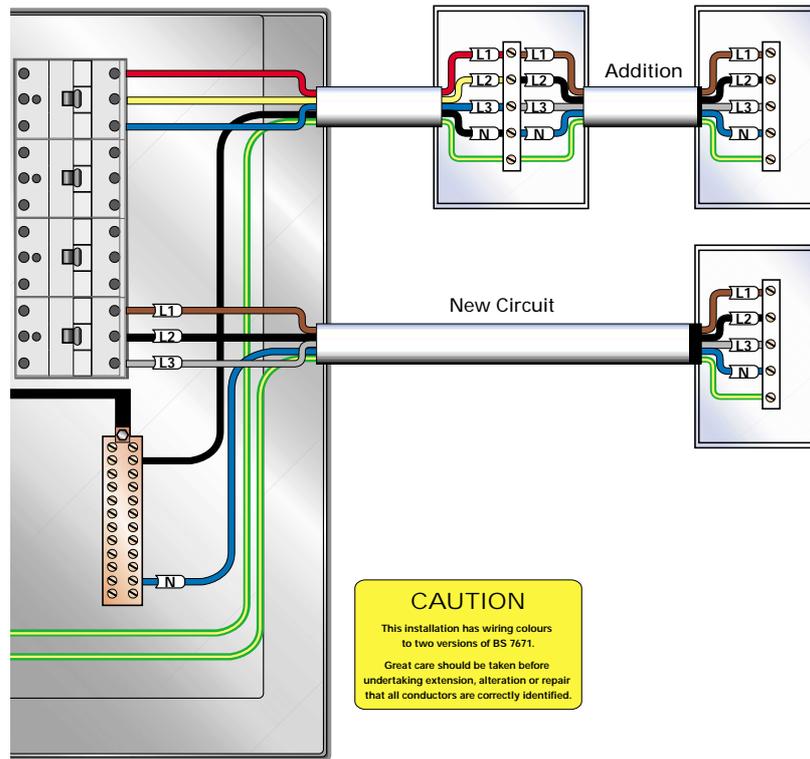
Courses throughout the UK see www.iee.org/courses

All-inclusive cost which covers Exam entry, course notes, lunch and all refreshments.

Places are limited, so to join these successful IEE courses (excellent pass rate) please call as soon as possible:-

IEE Courses Unit, Tel +44 (0)1438 767288 Fax +44 (0)1438 767288
 email courses@iee.org

Figure 3: Addition to a three-phase installations showing alphanumeric marking and caution notice.



wiring@iee.cd!

UNTANGLE THE WIRING WEB

NOW AVAILABLE ON CD ROM "THE IEE WIRING REGULATIONS" 16th EDITION.
A fully searchable & structured electronic tool, hyper-linked and cross-referenced for extreme ease of use.

CD ROM INCLUDES:

- All IEE guidance on wiring regulations and installations, including BS 7671, all seven Guidance Books and the two Codes of Practice.
- 53 minutes of video to aid understanding.
- An extensive collection of related material including illustrative articles.
- Provision to print relevant sections.
- IEE forms for Microsoft Word and Adobe Acrobat.
- With the full or business version of Acrobat, save the forms data, use the IEE plug-in to search for and retrieve completed forms.
- Link to PowerPoint, with sample C&G lectures.

MINIMUM SYSTEM REQUIREMENTS:

Pentium PC with CD drive,
Windows 9x, ME, NT, 2000 or XP, 5mb on hard disk or 230mb for complete download.

PRODUCT SUPPORT:

CD Rom Installation Helpline: +44 (0)1438 767 385
Technical Queries Helpline: Details on CD

SALES HELPLINE: +44 (0)1438 767 327

MORE INFORMATION & ORDER FORM:

www.iee.org/technical

SINGLE WORKSTATION Version 5 CD ROM £350 +VAT
NETWORK VERSION ALSO AVAILABLE

For further details please contact The Institution of Electrical Engineers:
Tel: +44 (0)1438 767 328, Fax: +44 (0)1438 742 792, Email: sales@iee.org



UPDATES ON THE WEB!