CORE ELECTRICS · MODULE 2 · DAY 2 · 17/09/2026

Design, Special Locations, Lighting & Three-Phase

Study notes from the Module 2 Day 2 webinars. The morning finishes cable design with correction factors, then covers ring and radial circuits, spurs, kitchens, heat-resistant cables, old and new cable colours, bathrooms, IP codes and cables in gardens. The afternoon covers lighting circuits (one-way, two-way and intermediate switching), ELV/SELV lighting and three-phase supplies and boards.

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Book reference page numbers appear in highlighted tags like this.

"New" = current orange / green-orange editions. "Old" = previous brown / green-brown editions. Page numbers are as the tutor gave them on screen. Tab them in your books, but remember you **can't write** in them.

AM Design & special locations

01 Correction factors (Ca, Cg and more)

Yesterday's shower example had **no correction factors**. In real installations, the environment around a cable can reduce how much current it can safely carry, so we **correct** for it and usually end up with a bigger cable.

$$Iz = In \div (Ca \times Cg \times Ci \times Cc \times Cf \ldots)$$

Only multiply in the factors that **apply** to the question, then pick a cable whose tabulated rating **It ≥ Iz**.

FACTOR	WHAT IT CORRECTS FOR	WHERE TO FIND IT
Ca	**Ambient temperature** around the *cable* (not the room). Tables are based on 30 °C, where the factor is 1.	OSG Table F1 · BS 7671 Table 4B1
Cg	**Grouping**: several circuits run bunched together along the same route	OSG Table F3 · BS 7671 Table 4C1
Ci	**Thermal insulation** around the cable	OSG · BS 7671
Cc	Cable **buried in the ground** (in a duct or direct): factor **0.9**	BS 7671 only
Cf	Circuit protected by a **BS 3036 rewireable fuse**: factor **0.725**	BS 7671 only

In exam or homework questions you'll be **given** the temperature and the number of grouped circuits. You don't measure them. In the exam the tutor expects mainly **Ca, Cg and Ci**.

On-Site Guide · Appendix F · Table F1 ambient temperature factors (Ca) · **p.184** new · p.168 old

On-Site Guide · Table F3 grouping factors (Cg) · **p.186** new

On-Site Guide · Iz formula and some factors · **p.183** new

BS 7671 · Appendix 4 · list of symbols Ca, Cg, Ci, Cc, Cf (incl. Cf 0.725 and Cc 0.9) · **p.452** new · p.424 old

TUTOR: HIGHLIGHT CF AND CC

BS 7671 · Table 4B1 ambient temperature factors · **p.469** new · p.441 old

BS 7671 · Table 4C1 grouping factors · **p.471** new · p.443 old

READING TABLE 4C1

Choose the **arrangement** row. The shower cable isn't on a ladder, a tray, or a single layer on a wall or floor, so it's **"bunched in air, on a surface, embedded or enclosed"**. Then read across to the **number of circuits**. "Grouped with two other circuits" means **3 circuits in total**.

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02 Worked example: shower with factors

YESTERDAY'S QUESTION, WITH FACTORS ADDED

```
8.5 kW shower · domestic · flat T&E · reference method 102 · 20 m run
BS EN 60898 circuit breaker
NEW: ambient temperature 35 °C · grouped with 2 OTHER circuits (3 in total)
```

WORKING

```
1) Ib = P ÷ V = 8500 ÷ 230 = 36.96 A
2) In = 40 A Type B          (Ib ≤ In ✓)

3) Correction factors
   Ca (70 °C thermoplastic, 35 °C)        = 0.94
   Cg (3 circuits, bunched/enclosed)       = 0.70

4) Iz = In ÷ (Ca × Cg) = 40 ÷ (0.94 × 0.70) = 60.79 A

5–6) T&E, method 102, need It ≥ 60.79 A
   10 mm² → 47 A  ✗
   16 mm² → 63 A  ✓  → 16 mm² twin and earth

7) Voltage drop: 16 mm² → 2.8 mV/A/m (max 5% = 11.5 V)
   VD = (2.8 × 36.96 × 20) ÷ 1000 = 2.07 V ✓

Answer: 16 mm² T&E on a 40 A Type B.
(Without the factors it was 10 mm².)
```

Remember `Ib ≤ In ≤ Iz ≤ It`. You **don't** make the protective device bigger to fix it. You **upsize the cable**, because the device must still operate before the cable overheats.

> **IF IT STILL FAILS**
>
> Flat twin and earth only goes up to **16 mm²**. If 16 mm² doesn't pass, **re-route** the cable (for example, away from insulation or other circuits) or use a **different type** of cable.

BS 7671 · Appendix 4 · Table 4D5 70 °C flat T&E (It and mV/A/m) · **p.484** new · p.456 old

On-Site Guide · Table F6 (same values, handier) · p.193 new

Electrician's Guide to the Building Regs · T&E current ratings table by reference method · **p.41** new · p.37 old

Voltage drop limits in BS 7671

BS 7671 · Appendix 4 · Table 4Ab voltage drop: 3% lighting, 5% other uses · **p.458** new · p.430 old

THE VD FORMULA ITSELF IS ONLY IN THE ON-SITE GUIDE. LEARN IT FOR THE 18TH EDITION EXAM.

EXTRA: THE LARGEST MV/A/M YOU CAN USE (FOR INTEREST ONLY)

```
max mV/A/m = (max VD × 1000) ÷ (Ib × L)
           = (11.5 × 1000) ÷ (36.96 × 20) = 15.55 mV/A/m
→ any cable at or below 15.55 mV/A/m passes volt drop on this run.
You won't be asked to do this in the exam. You'll pick the value from the
table.
```

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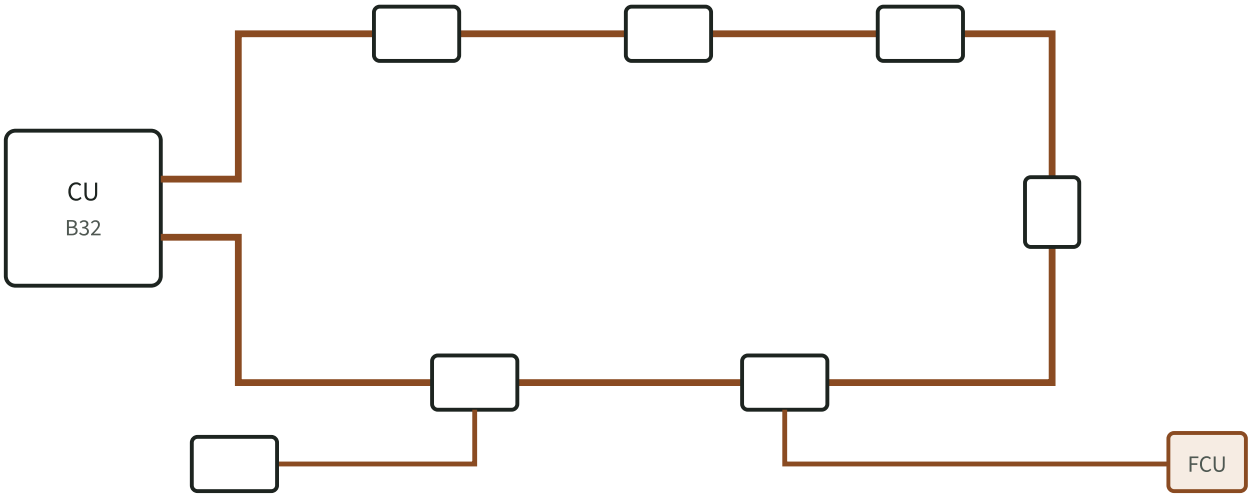
03 Ring final circuits and loading

A ring final circuit (on a **32 A** device, **2.5 mm²** T&E, up to **100 m²**) is really **two legs** of cable from the same breaker. That lets the load **spread across both legs**, which is why you shouldn't plug a kettle and a toaster into one double socket.

- At the consumer unit, **both line conductors** go in the **same terminal** of the one breaker (or RCBO), **both neutrals** in the **same neutral terminal**, and **both CPCs** in the **same earth terminal**.
- The same happens at every socket. It's still **parallel** wiring: every socket gets 230 V.
- With 2 lines out and 2 neutrals back there are **4 paths**, which is why ring volt drop divides by **4000** instead of 1000.
- A **radial** has one leg and ends at the last point. Many kitchens now use a **32 A radial in 4 mm²** instead of a ring.

Ring: 2.5 mm² T&E, both legs back to the same terminals



Unfused spur
one per socket on the ring

Fused spur via FCU
unlimited · 13 A max · smaller cable after

A **spur** is a branch off the ring. The ring itself can also be run in any shape. This is just a simple loop.

On-Site Guide · Appendix H · Table H2.1 socket-outlet circuits · **p.218** new · p.210 old

BS 7671 · Appendix 15 · Figure 15A ring final circuit arrangements (and the radial figure on the next page) · **p.583** new · p.555 old

"A REALLY GOOD DRAWING": RING, JUNCTION BOX, FCU SPURS, FIXED EQUIPMENT

Electrician's Guide to the Building Regs · radial circuit figure · **p.79** new

THE NEW EDITION SHOWS ONLY THE RADIAL, AND THE OLD ONE ONLY THE RING

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04 Spurs: fused and unfused

Fused spur

A branch taken from the ring through a **fused connection unit (FCU)**.

- The **number of fused spurs is unlimited**.
- The FCU fuse is **13 A maximum** (it can be 3 A or 5 A), so the cable **after** it can be smaller, e.g. **1.5 mm²** to a light or a shed.
- It can feed fixed equipment such as a hand dryer, a towel rail or an unswitched appliance socket.

Unfused spur

A branch taken straight from a socket (or a junction box) with **no fuse**.

- The cable must be the **same size as the ring** (2.5 mm²).
- The number of unfused spurs must **not exceed the number of socket-outlets** on the ring.
- Only **one** spur from each socket, and you **can't spur off a spur**.

On-Site Guide · Appendix H · H2.4 Spurs (fused unlimited, unfused ≤ number of sockets) · **p.219** new · p.211 old

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05 Kitchens and accessory heights

- Keep sockets **at least 300 mm** (edge to edge, horizontally) from a **sink**.
- The tutor said the **cooker switch** (or cooker switch with socket) shouldn't be within **100 mm** of the edge of the **hob**, and shouldn't be above it. Check the exact figure in your book.
- **Appliance sockets** under the worktop (fridge, washing machine, dishwasher) are often **unswitched** and controlled by a **switched FCU above the worktop**, so they can be isolated without pulling out the appliance.
- Read the **notes under figures**. The tutor said exam questions often come from them.
- **Approved Document M** heights are 450–1200 mm above finished floor level. These are the minimum and maximum, for accessibility.

Electrician's Guide to the Building Regs · kitchen installation figure (sink 300 mm, cooker switch, FCUs) · **p.85** new · p.79 old

Electrician's Guide to the Building Regs · Section 10 · Part M switch and socket heights · **p.186** new

06 Cables in hot areas

Cables feeding equipment that gets hot, such as **water boilers, immersion heaters, fires and central heating**, must withstand **at least 90 °C**. Ordinary PVC twin and earth is only rated **70 °C**, so it isn't suitable for the hot final connection.

- **Typical method:** run T&E as the fixed wiring to an **FCU**, then use **90 °C heat-resistant flex** from the FCU to the immersion heater or boiler. Look for markings like **H07** or **XLPE** (cross-linked polyethylene) insulation.
- Heat-resistant flex is **not fireproof**. It's heat resistant and flame retardant.
- **FP200** (usually red) is for **fire alarms**. **MICC** works too but is very expensive, around £570–£690 per 100 m for 1.5 mm^2 2-core.
- Plastic accessories and back boxes are generally made for **70 °C** only, so a hot fault can still melt the accessory even if the cable survives.
- A **drip loop** in a flex lets moisture drip off before it reaches the equipment.

07 Old and new cable colours

The UK **harmonised** its colours with the rest of Europe (not because of Brexit). New colours could be used from **1 April 2004**, and from **1 April 2006** only new-colour cable should be installed.

FUNCTION	OLD (PRE-2004)	NEW (HARMONISED)
Line 1 / single-phase line	Red	Brown
Line 2	Yellow	Black
Line 3	Blue	Grey
Neutral	Black	Blue
Protective conductor	Green/yellow (unchanged)	

Why it matters on three-phase
Old **black was neutral**, but new **black is a line (L2)**. Old **blue was L3**, but new **blue is neutral**. Mixing them up on an alteration can put a line in a neutral terminal. That causes wrong polarity, and a motor can run backwards and be damaged. Always check what each conductor actually is before connecting.

Where old and new colours meet in one installation, a **caution label** has traditionally been fitted at the consumer unit: *"This installation has wiring colours to two versions of BS 7671…"*. The tutor believed this may no longer be required under the latest amendment. **Check Reg 514.14** in your copy before relying on that.

Colour-blind electricians aren't excluded. Apps can identify cable colours. Some rail and aviation roles do require a colour test.

> **Electrician's Guide to the Building Regs** · Chapter 11 · old and new conductor colours table · **p.191** new · p.194 old

> **On-Site Guide** · Appendix K · identification of conductors (old and new)

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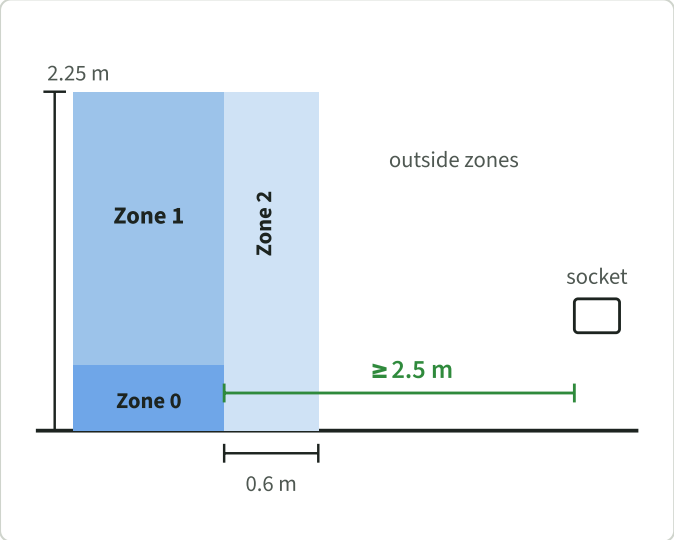
08 Bathrooms and special locations

A room containing a **bath or shower** is a special location. That includes a **bedroom with a shower enclosure in it**. An en-suite is its own room, but it's still a special location. We define zones because **the closer you are to water, the higher the shock risk**.



- **Zone 0**: inside the bath or shower tray.
- **Zone 1**: above the bath or tray up to **2.25 m** from the floor (or to the shower head if higher).
- **Zone 2**: **0.6 m** out from the edge of zone 1.
- **Walk-in / wet room** with no tray: zone 1 only, extending **1.2 m** from the fixed water outlet. There's no zone 2.
- **All circuits** in the location need **30 mA RCD** protection (RCD or RCBO).
- **Sockets** (other than shaver units) are allowed only **at least 2.5 m** from the edge of zone 1.

- **Equipment you'll see:** a pull-cord switch (on the ceiling above 2.25 m, so the cord can hang into a zone), ceiling lights, a shaver socket, extractor fans, and an electric shower.
- **Where does the shower go?** On the wall in **zone 1**, never in zone 0. Fixed equipment in zone 1 needs at least **IPX4**, or **IPX5 if it will be cleaned with water jets**. Allowed fixed equipment in zone 1 includes whirlpool units, electric showers and shower pumps, ventilation, towel rails, luminaires and water heaters.
- **Shaver socket:** it has a **safety isolating transformer** inside, with a laminated core to reduce eddy-current losses. Because the output is isolated from earth, touching one conductor won't give an earth-path shock.

CORRECTION TO THE SESSION

The tutor said the shaver transformer steps down to **12 V**. A standard shaver supply unit (BS EN 61558-2-5) actually gives an **isolated 115 V / 230 V** output. It's safe because it's **isolated**, not because it's low voltage. The 240 V marked on the one she showed is just the old nominal voltage.

- **Electrician's Guide to the Building Regs** · Section 5 · locations containing a bath or shower · **p.91** new · p.85 old
- **Electrician's Guide to the Building Regs** · walk-in shower / wet room figure · **p.89** new
- **Electrician's Guide to the Building Regs** · table: minimum IP rating and equipment allowed per zone · **p.87** new
- **On-Site Guide** · Section 8 · zone requirements table (IPX4, IPX5 where water jets used for cleaning) · **p.118** new · p.104 old
- **BS 7671** · Section 701 locations containing a bath or shower

09 IP codes

IP = International Protection (often called "ingress protection"). There are two numbers:

- The **1st number** is protection against **solid objects**: fingers, tools and dust.
- The **2nd number** is protection against **water**.
- **X** means "not tested / not relevant" for that part.

1ST	SOLIDS
0	Not protected
1	Objects ≥ 50 mm (back of hand)
2	Objects ≥ 12.5 mm (**finger**)
3	Objects ≥ 2.5 mm (tools)
4	Objects ≥ 1.0 mm (wire)
5	Dust protected
6	**Dust tight**

2ND	WATER
0	Not protected
1	Vertically dripping
2	Dripping, tilted up to 15°
3	Spraying
4	**Splashing** from any direction
5	**Water jets**
6	**Powerful jets**
7	Temporary immersion
8	Continuous immersion

- **IPX4** = splash-proof (the bathroom zone 1 minimum). **IP2X** = you can't poke a finger in. **IP4X** = you can't poke a 1 mm wire in. Consumer units use IP2X and IP4X in places, which is covered in the 18th Edition.
- **IP66** = dust tight and protected against powerful jets. That's typical for an **outdoor socket** enclosure, which costs about £10 compared with about £2 for an indoor socket, so you only fit one where it's needed.
- An extra letter can follow, e.g. **IPXXB** (a finger can't reach live parts) or **IPXXD** (a 1 mm wire 100 mm long can't reach them).

On-Site Guide · Appendix L · IP codes (only about a page)

Code of Practice for In-service Inspection & Testing · Appendix 2 · IP codes table · **p.95**

THE TUTOR'S FAVOURITE IP TABLE, BUT YOU CAN'T TAKE THAT BOOK INTO THE BUILDING REGS EXAM

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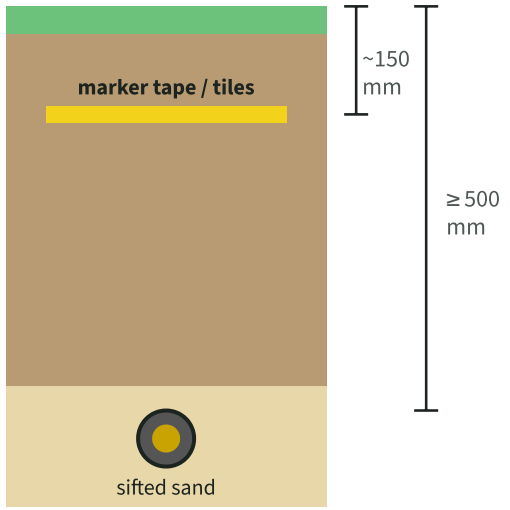
10 Gardens and outbuildings



SWA cable (armoured)

- **Bury** garden cables **at least 500 mm** deep, or **600 mm** where "double digging" is likely. The book gives at least **450 mm** to the top of the cable. The tutor usually went about 2 ft (600 mm).
- Lay **marker tape or cable tiles** about **150 mm** below the surface along the route, so a spade hits the warning first.
- Use **SWA** (armoured cable), bedded in sifted sand. Cables can also go in **ducting** (like a flexible hoover pipe). Burying is best practice, but SWA clipped along a fence or wall is also used.
- **Outbuildings** (sheds, garages) are usually fed from the house consumer unit to a small **distribution board** in the outbuilding, with its own switch and sockets.

Electrician's Guide to the Building Regs · buried cables in gardens (depth, marker tape) · **p.97** new

Electrician's Guide to the Building Regs · outbuilding supply figure

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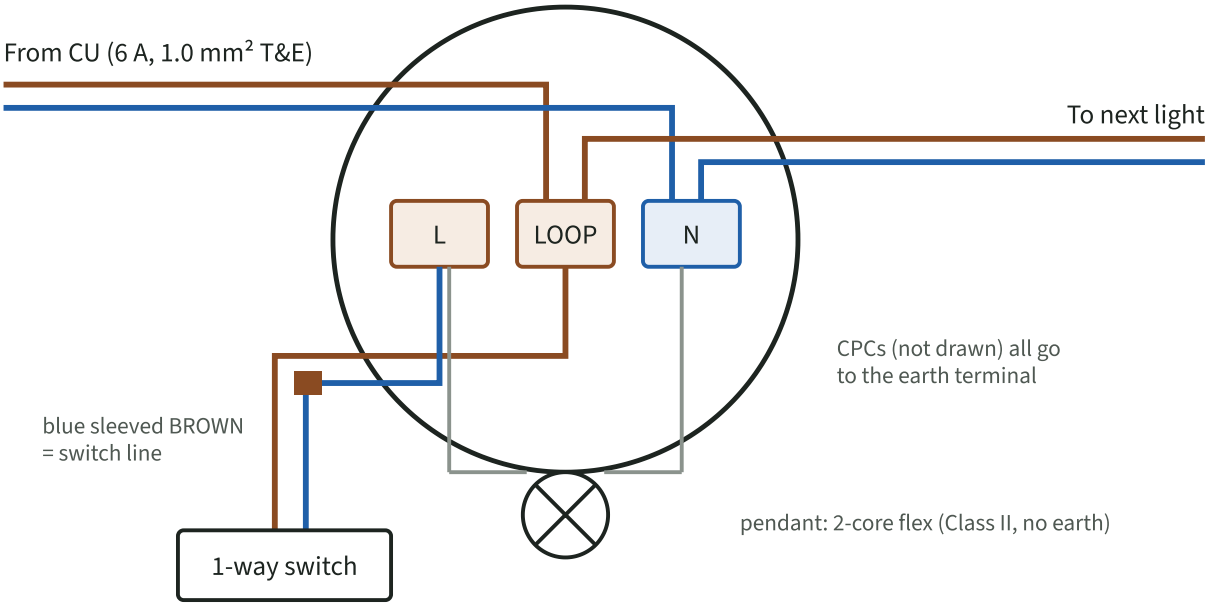
PM Lighting & three-phase

11 Lighting basics and the ceiling rose

- **Cable:** usually **1.0 mm² T&E** (carries **16 A** clipped direct, Table F6). 1.5 mm² carries 20 A. The tutor said not to over-size for "future proofing".
- **Protective device:** usually a **6 A** breaker. A 3 A is possible for very small loads.
- **Switch closed** = closed circuit = lamp on. **Switch open** = open circuit = lamp off.
- A **single-pole** switch breaks the **line** only. A **double-pole** switch breaks line **and** neutral. Never take a neutral into an ordinary light switch.
- The **pendant** is **Class II**, so it uses **2-core flex** with no earth.
- **Tip:** make a **bathroom** light the **last** point on a circuit, so fewer cables end up in a fitting exposed to condensation.

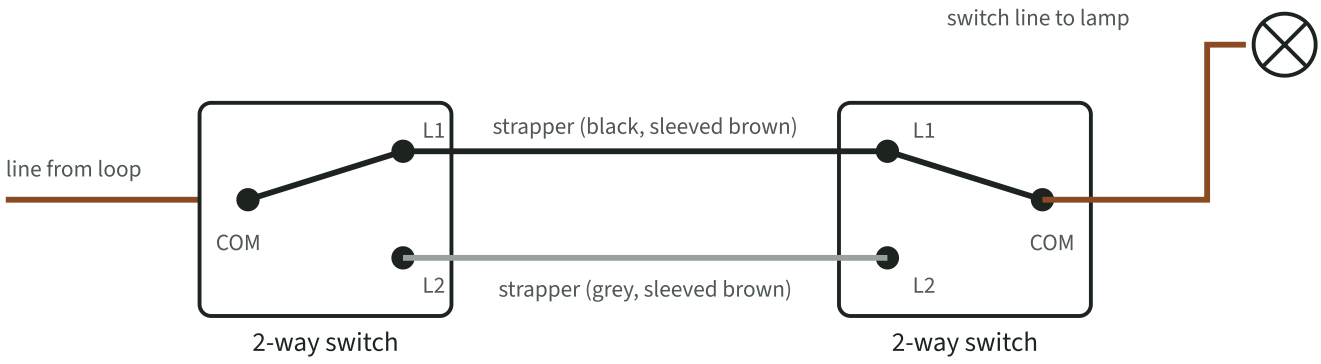


Loop-in, loop-out ("3-plate") method. The supply, the outgoing cable and the switch-cable brown share the **loop** terminal. The switch returns on the blue of the switch cable, **sleeved brown**, into the **L** (switch-line) terminal with the pendant's brown. **L** = switch line · **LOOP** = permanent line · **N** = neutrals.

> **TWO LIGHTS ON ONE SWITCH**
>
> If you want the next light to come on **with** this switch, take the next light's brown out of the **loop** terminal and put it in the **switch-line (L)** terminal, and do the same at each light (daisy-chain). If each room has its own switch, keep the browns in **loop**. The lights are still in **parallel**: each gets 230 V, and one lamp failing doesn't turn the others off.

12 Two-way switching

A two-way switch has **3 terminals**: **COM** (common), **L1** and **L2**. Pressing it doesn't turn it "on" or "off". It just **swaps** COM between L1 and L2. The two switches are linked by **3-core & earth** cable (brown, black, grey plus a bare CPC), called the **strappers**.



3-core & earth between the switches

Both switches on L1 = closed = lamp **on**. Flip either switch = open = lamp **off**. Flip the other one too and it's on again.

- **Sleeve every strapper brown** (black and grey), because they're all line conductors. You *could* buy all-brown 3-core, but then you couldn't tell which is which.
- **There's no right or wrong colour** for COM, L1 or L2. The rule is that **both switches match**: whatever colour is in COM on one goes in COM on the other, and the same for L1 and L2. If they don't match, the switches won't "talk" to each other.
- Coiling the CPC neatly in the back box is purely cosmetic. It adds length, and length means resistance.

On-Site Guide · Section 7 · Figure 7.4.4 two-way switching wiring (black in COM in that drawing) · **p.107** new · p.95 old

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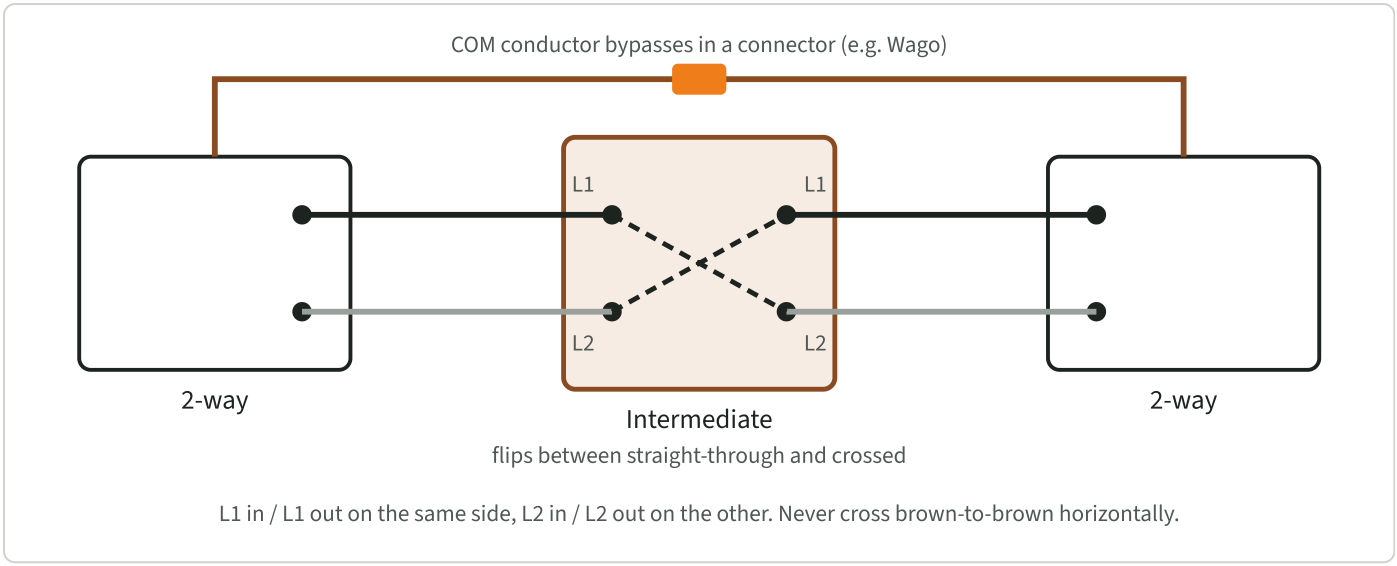
13 Intermediate switching

To control a light from **3 or more** places, fit **intermediate** switches **between** the two two-way switches. You can have as many as you need, e.g. a stairwell over several floors or a big room with several doors. They're mainly commercial, and rare in homes.



Wire it as before, matching colours. The **common** conductor (whatever colour you used in COM) doesn't connect to the intermediate. It just **joins through in a connector** in the back box. It isn't an earth.

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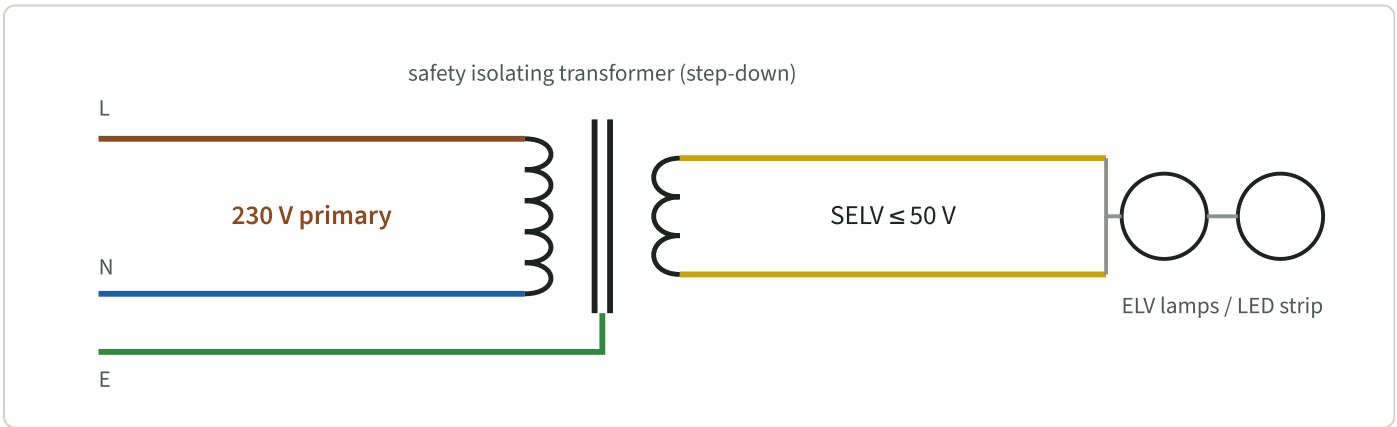
14 ELV and SELV lighting

ELV	**Extra-low voltage**: not exceeding **50 V AC** or **120 V ripple-free DC**. "Ripple-free" means a perfectly smooth DC line, not half-wave humps.
LV	**Low voltage**: above ELV, up to **1000 V AC** (1500 V DC). The 230/400 V mains is LV.
SELV	**Separated** extra-low voltage, supplied through a **safety isolating transformer**, e.g. 230 V in, 12 V (≤ 50 V) out.



- **Where you'll see it:** under-cabinet and LED strip lighting, track lighting, media walls and garden lighting.
- ELV isn't automatically safe. You still need the right protective measures and must consider the environment.
- **Why the grid steps voltage up:** for the same power, higher voltage means less current, so less voltage drop over long distances. That allows thinner cables and fewer transformers.

- Transformer types include step-up and step-down (voltage), current, power and isolating.

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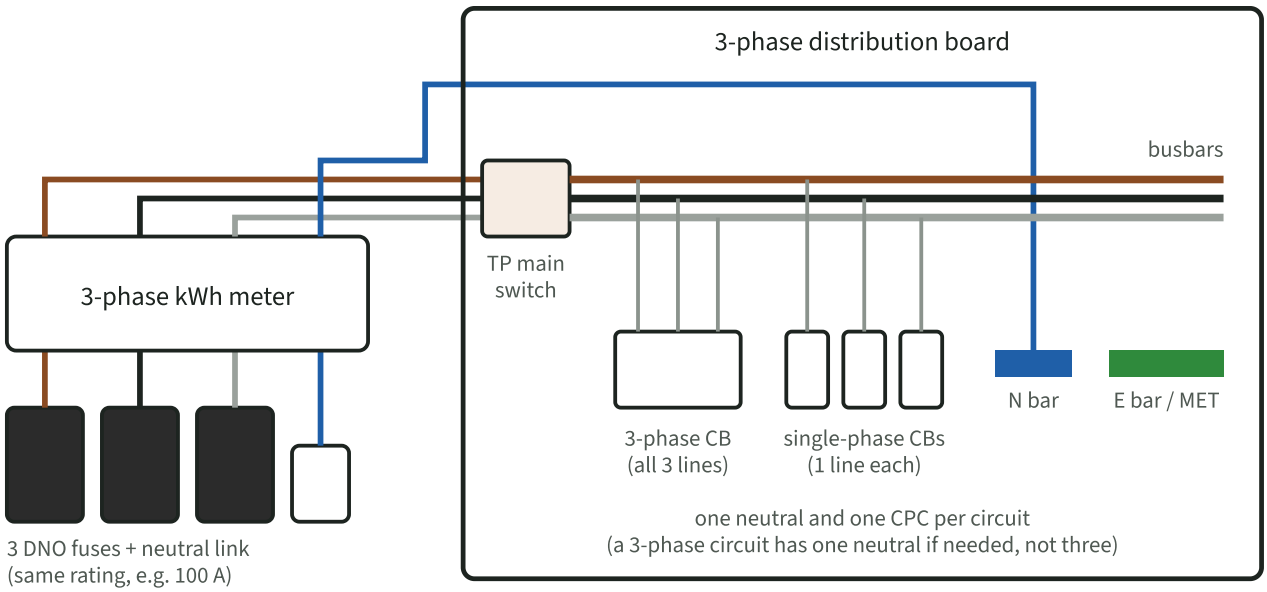
15 Three-phase supplies and boards

- A generator has **3 windings**, making 3 sine waves **120° apart**. Line to neutral is **230 V** on each phase. Line to line is **400 V**, not 460 V, because the phases never peak together.
- **Star** (the transformer secondary) is **unbalanced**, because each phase feeds different loads, so it **needs a neutral**. **Delta** (usually the primary) is **balanced**, so it **doesn't need a neutral**.
- Three-phase is mainly **commercial and industrial** (big machinery, plant, welders). Very large sites may take an 11 kV supply. One transformer can feed a street, a village or a single factory. A house normally takes **one phase**, and you usually won't know which.



- **Triple-pole (TP) main switch:** switches off **all three** phases at once, so you can't turn off just one. A **TP&N** (4-pole) switch also breaks the neutral.
- You can mix **three-phase** and **single-phase** circuits on one board. Example: 4 three-phase breakers fill 12 ways, or 2 three-phase plus 6 single-phase uses the same space for **8 circuits**.
- For a whole supply there are **3 DNO fuses** (all the same rating: 63, 80 or 100 A), a **three-phase meter** with L1, L2, L3 and N in and out, and an isolator. The **earth doesn't go through the meter**.

- **Isolation:** for a consumer unit change with no isolator, the **DNO** must pull the fuse. For work on one circuit, lock off that breaker or the main switch. Safe isolation is covered in detail later.
- **Mixed colours:** when joining old and new three-phase cables, e.g. red→brown, yellow→black, blue→grey, black→blue, fit a **caution label** and make sure **every conductor is correctly identified**.

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16 How an RCD's test button works

Inside an RCD, the line and neutral pass through a **toroid coil** (a ring-shaped core). Normally the line and neutral currents are equal, so their magnetic fields cancel. If some current leaks to earth, they don't match, and the coil detects the **imbalance** and trips the RCD.

The **test button** connects a small **resistor** that makes a deliberate imbalance, so the RCD should trip. Pressing it is the **first test** you'll do when you test an RCD later in the course. Tell an RCD apart from a CB by the **test button** and the **mA rating**.

> **On-Site Guide** · Section 11 · RCD construction and operation (toroid, test button)

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17 All book references from this day

Tab these pages. "New" = orange / green-orange editions, "old" = brown / green-brown.

BOOK	WHAT	NEW	OLD
On-Site Guide	Iz formula and some factors	183	–
On-Site Guide	Table F1 ambient temp (Ca), voltage drop formula ★	184	168
On-Site Guide	Table F3 grouping (Cg)	186	–
On-Site Guide	Table F6 flat T&E ratings and mV/A/m	193	177
On-Site Guide	Table H2.1 socket-outlet circuits ★	218	210
On-Site Guide	H2.4 Spurs (fused/unfused) ★	219	211
On-Site Guide	Figure 7.4.4 two-way switching	107	95
On-Site Guide	Section 8 bath/shower zone table (IPX4/IPX5)	118	104
On-Site Guide	Section 11 RCD operation · App K colours · App L IP codes	–	–
BS 7671	Appendix 4 symbols list (Ca, Cg, Ci, Cc 0.9, Cf 0.725) ★	452	424
BS 7671	Table 4Ab voltage drop limits ★	458	430
BS 7671	Table 4B1 ambient temperature factors	469	441
BS 7671	Table 4C1 grouping factors	471	443
BS 7671	Table 4D5 flat T&E (It and mV/A/m)	484	456
BS 7671	Appendix 15 Fig 15A ring final circuit (radial next page) ★	583	555
Electrician's Guide to the Building Regs	T&E current ratings by reference method	41	37
Electrician's Guide to the Building Regs	Radial circuit figure (new only)	79	–
Electrician's Guide to the Building Regs	Kitchen installation figure ★	85	79
Electrician's Guide to the Building Regs	Bath/shower: IP rating and allowed equipment per zone	87	–
Electrician's Guide to the Building Regs	Walk-in shower / wet room figure	89	–
Electrician's Guide to the Building Regs	Section 5 rooms containing a bath or shower	91	85
Electrician's Guide to the Building Regs	Buried cables in gardens	97	–
Electrician's Guide to the Building Regs	Part M switch and socket heights	186	–
Electrician's Guide to the Building Regs	Chapter 11 old and new cable colours ★	191	194
CoP In-service Inspection & Testing	Appendix 2 IP codes table	95	–

★ = the tutor specifically said to highlight or tab it, or went through it in detail.
Page numbers are as given in the session. Check them against your own copy.

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18 Self-test

Test yourself. Answers are under each question.

▼ **Write the formula for Iz when correction factors apply.**

`Iz = In ÷ (Ca × Cg × Ci …), using only the factors that apply`

▼ **In = 32 A, Ca = 0.94, Cg = 0.8. What is Iz?**

`32 ÷ (0.94 × 0.8) = 42.55 A`

▼ **What factor applies to a circuit protected by a BS 3036 rewireable fuse? And to a cable buried in the ground?**

`Cf = 0.725 · Cc = 0.9`

▼ **How many unfused spurs can a ring with 8 sockets have? How many fused spurs?**

`Up to 8 unfused spurs (one per socket) · fused spurs are unlimited`

▼ **Why does ring-circuit volt drop divide by 4000 instead of 1000?**

`The ring has 4 paths: 2 line legs out and 2 neutral legs back`

▼ **What is the minimum distance for a socket from the sink in a kitchen?**

`300 mm (horizontally, edge to edge)`

▼ **What temperature rating should the final flex to an immersion heater have?**

`At least 90 °C (heat-resistant flex)`

▼ **What was the old colour of the neutral, and what colour is L2 now?**

`Old neutral: black · new L2: black (old L2 was yellow)`

▼ **Minimum IP rating for fixed equipment in bathroom zone 1? What if it's cleaned with water jets?**

`IPX4 · IPX5`

▼ **What does IP66 mean?**

Dust tight (6) and protected against powerful water jets (6)

▼ **In a 3-plate ceiling rose, which terminal does the switch line go in?**

The L (switch-line) terminal, with the pendant's brown. The permanent line goes in LOOP.

▼ **What cable goes between two two-way switches, and what are its cores called?**

3-core & earth · the cores are strappers (black and grey sleeved brown)

▼ **What's the maximum voltage for ELV AC? And ripple-free DC?**

50 V AC · 120 V ripple-free DC

▼ **Why does a star-connected secondary need a neutral but a delta primary doesn't?**

Star is unbalanced (different loads per phase), so the neutral carries the out-of-balance current. Delta is balanced.