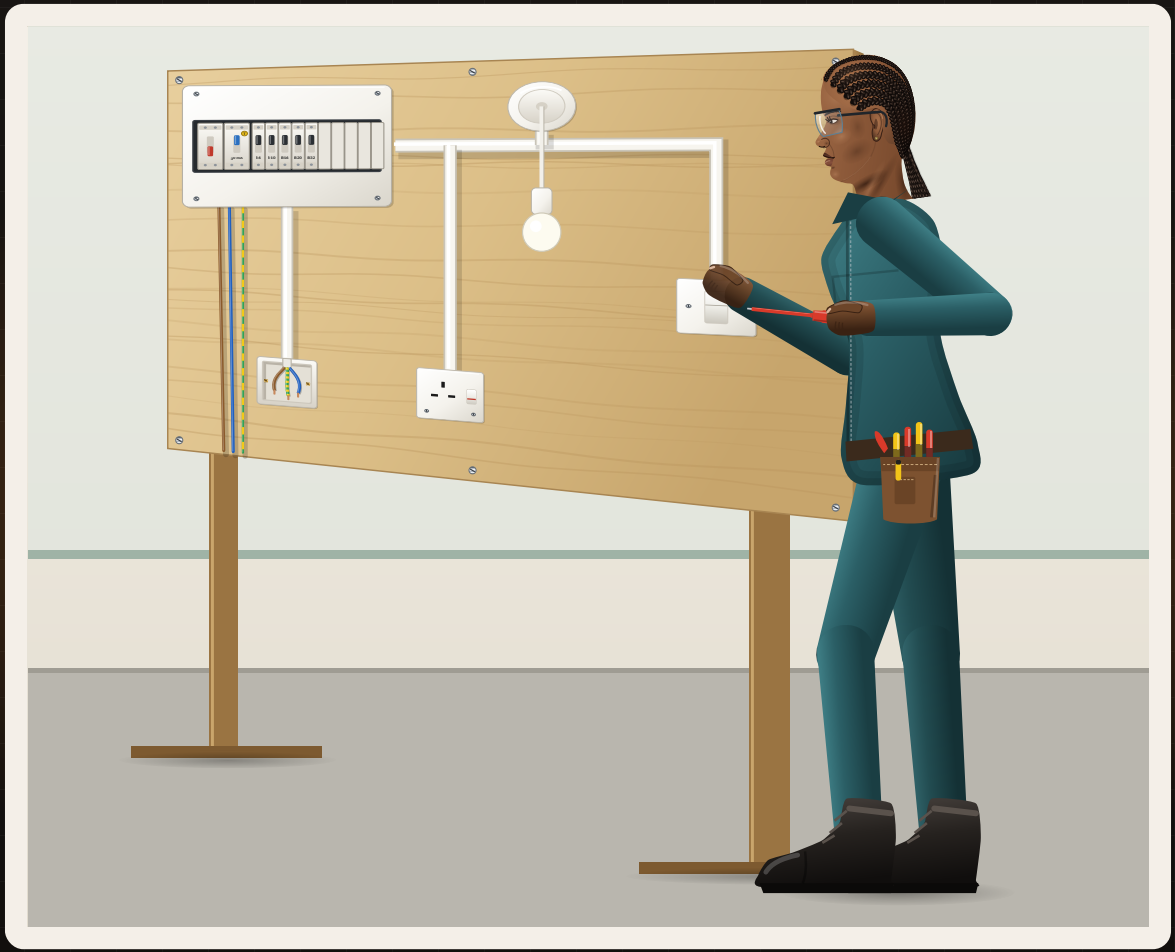
KNQF LEVEL 3 · TVET CDACC CYCLE 3

Electrical Installation

Technology Level 3

A Practical Study Guide for Kenyan Trainees

PVC sheathed cable systems · Trunking · Conduit · Testing



Realistic pictures **Wiring diagrams** **Mock assessments**

For trainees, RPL candidates, trainers and wiring fundis

Alphonce Kimutai Kirui

Aligned to the TVET CDACC Competency-Based Modular Curriculum, Electrical Installation Technology KNQF Level 3

Electrical Installation Technology Level 3

A Practical Study Guide for Kenyan Trainees

PVC Sheathed Cable Systems · Trunking Systems · Conduit Systems
Kenya National Qualifications Framework (KNQF) Level 3

Alphonce Kimutai Kirui

Electrical Installation Technology Level 3: A Practical Study Guide for Kenyan Trainees
First edition, October 2026

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Published by the author. Website: alphoncekirui.com

About the curriculum

This book is an independent study guide. It follows the topics and units of the TVET CDACC Competency-Based Modular Curriculum and Occupational Standard for Electrical Installation Technology, KNQF Level 3 (Cycle 3, greened edition, programme code 0713 254B, unit codes ENG/CU/EI/CR/01–03/3/MB), and the assessment documents for Electrical Wireman Level 3. Unit titles and codes are used for reference only. The book is not published, endorsed or approved by TVET CDACC, TVETA or the Ministry of Education. Always follow the current official curriculum and your trainer's guidance.

Safety and accuracy notice

Electricity can kill. Electric shock, burns, fire and falls from ladders are real hazards in electrical installation work. The methods in this book are for training under the supervision of a qualified trainer. Never work on a live installation: always isolate, lock off and prove dead first. Only a person licensed by the Energy and Petroleum Regulatory Authority (EPRA) for that class of work may carry out and certify electrical installation work for connection to the supply. Figures given as "typical" (cable ratings, protective device sizes, test values, fixing distances and prices) are general guidance only. Always follow the current Kenyan regulations, the wiring regulations your trainer uses, the manufacturer's instructions, workplace rules and the Occupational Safety and Health Act 2007. Prices are approximate (2026) and vary by town.

Names of people, businesses, email addresses, websites and phone numbers used in examples are made up for teaching.

Illustrations and photographs

The illustrations in this book were drawn for it. They are realistic teaching illustrations and are not to scale unless dimensions are given. Photographs come from Wikimedia Commons under free licences (public domain, CC0, CC BY or CC BY-SA). Each photograph is credited under the picture, and the full list of credits is at the back of the book.

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Reference

Glossary .....
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How to use this book

This book follows the Electrical Installation Technology Level 3 course from start to finish. It covers the three core units and the industry training, in the same order as your training. You can read it cover to cover, or study one unit at a time if you are taking a part qualification. Topics that all three units share, such as safety, cables, the intake point, lighting and power circuits and testing, are taught once in full and the later chapters refer back to them.

The course at a glance

Part	What it covers	Training time
1. Getting started	The job and the course, assessment, electrical safety and first aid, electrical principles, tools and instruments	Used throughout
2. PVC sheathed cable system	Unit 1: PVC Sheathed Cable System Installation (ENG/CU/EI/CR/01/3/MB)	100 hours
3. Trunking system	Unit 2: Trunking System Installation (ENG/CU/EI/CR/02/3/MB)	100 hours
4. Conduit system	Unit 3: Conduit System Installation (ENG/CU/EI/CR/03/3/MB)	100 hours
5. Testing, attachment and assessment	Inspection and testing, industry training, starting a wiring business and getting ready to be assessed	Testing in every unit; 240 hours of industry training

What is in each chapter

- **What you will learn:** the chapter's goals, with the unit, learning outcome and training hours it belongs to.
- **Key words:** the trade words you need, explained simply. More are in the Glossary at the back.
- **Explanations and drawings:** each topic explained step by step, with realistic labelled illustrations, circuit and wiring diagrams and photographs.
- **Worked examples:** currents, cable and fitting quantities, energy costs, test readings and job prices worked through with real numbers.
- **Practical tasks:** real installation jobs with the tools, materials, steps and safety points. Do them with your trainer.
- **Check your competence:** a checklist of what an assessor will expect you to show. Tick each item when you can do it without help.
- **Practice questions:** answers are at the back of the book.

Look out for these boxes

> **SAFETY FIRST**
>
> Hazards and how to stay safe. Never skip these.

GREEN TIP

Ways to save energy and materials, choose eco-friendly cables and fittings, and handle off-cuts and waste correctly.

TRAINER'S TIP

Advice from experienced trainers and electricians to help you work faster and better.

COMMON MISTAKES

Errors trainees often make, and how to avoid them.

ON A KENYAN SITE

How the topic looks on real Kenyan building sites, in homes, rental flats, shops and county VTC workshops.

WORKED EXAMPLE

A calculation worked step by step with real numbers.

About the pictures and diagrams

This book uses realistic illustrations of real tools, cables, accessories and installations, circuit and wiring diagrams, and photographs. Labels and thin leader lines point to the parts that matter. In wiring diagrams the conductors are drawn in their insulation colours: brown for line, blue for neutral and green-and-yellow stripes for the protective (earth) conductor. Blue arrows show movement or direction. Red marks a danger or mistake; green marks the correct way. Some photographs show real places where people are not following every safety rule; the captions point this out. Always follow the safe isolation procedure in Chapter 2.

PART 1

Getting Started

What a Level 3 electrical installer does, how you will be trained and assessed, electrical safety and first aid, the electrical principles behind every circuit, and the tools and instruments you will use in all three units.

Chapter 1: Becoming an Electrical Installer in Kenya
Chapter 2: Electrical Safety, PPE and First Aid
Chapter 3: Electrical Principles for the Installer
Chapter 4: Tools, Instruments and Workshop Practice

CHAPTER 1

Becoming an Electrical Installer in Kenya

WHAT YOU WILL LEARN

- Describe the work of a Level 3 electrical installer (wireman) and where installers find jobs in Kenya.
- Name the three wiring systems in this course and say where each one is used.
- Explain how the law, EPRA licences and the completion certificate control who may wire a building.
- Plan your next steps on the training and licence ladder.
- Explain how this competency-based course is organised, assessed and certified.
- Behave like a professional with house owners, employers and fellow workers.

Unit: All units · Course overview, assessment and industry training

Every house, duka, school and clinic in Kenya needs safe wiring before Kenya Power can switch on the supply. The people who fix the cables, switches, sockets and consumer units are electrical installers. This chapter explains the job, the rules that protect the public, and how this course trains and assesses you.

Key words

Electrical installer (wireman)
A worker who installs and tests the fixed wiring of a building.

Competency
Being able to do a task to the standard required at work, safely and every time.

Unit of competency
A block of the course that leads to its own certificate, such as Conduit System Installation.

Element
One main task inside a unit, such as "mount conduit work pieces".

Performance criteria
The checks an assessor uses to decide whether you did an element correctly.

Formative assessment
Assessment during training. It counts for 60% of your unit score.

Summative assessment
The final assessment at the end of a unit. It counts for 40%.

Portfolio of evidence
Your file of proof: assessed tasks, photos, videos, drawings and test results.

EPRA
Energy and Petroleum Regulatory Authority. It licenses electrical workers and contractors.

Completion certificate
The signed form that says an installation is finished and tested and is safe to connect.

1.1 What Does an Electrical Installer Do?

An electrical installer puts the wiring into a building and makes it safe to use. Some people call this worker a **wireman**; on many Kenyan sites he or she is simply "the fundi". The CDACC assessment papers use the title Electrical Wireman Level 3.

A Level 3 installer works on single-phase installations (one line conductor and a neutral, 240 V). The main tasks are:

- reading a layout drawing, listing materials and marking out routes;
- fixing cables, trunking or conduit and drawing cables into them;
- connecting switches, lamp holders, ceiling roses, sockets, cooker units and water-heater switches;
- fixing and wiring the intake point: main switch and consumer unit with MCBs and RCD;
- making safe joints and terminations;
- inspecting and testing before anyone switches on, then cleaning up and keeping records.

At this level you do this work **under the direction of a licensed electrician**. Section 1.4 explains why.



Figure 1.1 First-fix work: pulling single-core cables from a flush box in a new building, before any supply is connected.

Photo: Amuzujoe, CC BY-SA 4.0, via Wikimedia Commons

1.2 Where Installers Work

Wiring is needed wherever people build, in towns and in rural areas. Common employers are:

- **House wiring fundis and small contractors** who wire homes, rental flats and bedsitters, often paid "per point" (each switch, lamp or socket is one point).
- **Electrical contractors** on construction sites: estates, flats, schools, churches, hospitals and offices.
- **Maintenance departments** in factories, hotels, hospitals and county offices.
- **Contractors who work for Kenya Power** on new connections. Work on poles and overhead lines needs further training and authorisation.
- **Self-employment**, after gaining experience and the right licence (see Chapter 17).
- **Related fields** after more training, such as solar PV, which has its own EPRA licences.

ON A KENYAN SITE

On a typical new house, the electrician cuts chases in the stone or block walls and lays PVC conduit and boxes before plastering. After roofing, cables are drawn in and accessories fixed. Finally, the licensed contractor tests the work and sends the completion certificate so Kenya Power can connect the token meter. Keep in touch with the site foreman so each stage happens on time.

1.3 The Three Wiring Systems in This Course

The course has three core units, each teaching one wiring system (Figure 1.2). All three use the same circuits and the same testing; what changes is how the cables are supported and protected.

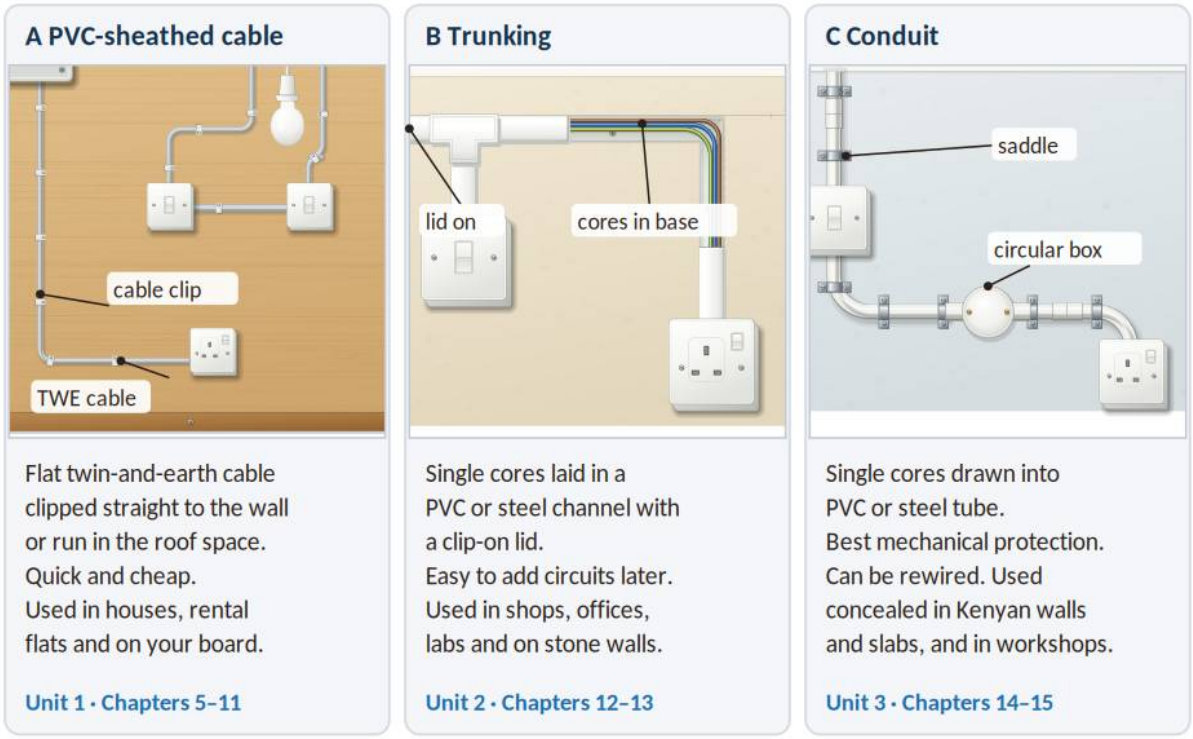


Figure 1.2 The three wiring systems: A, twin-and-earth cable clipped to a surface; B, PVC mini-trunking (lid removed at the corner to show the cores); C, surface PVC conduit with saddles and a circular box.

- **PVC-sheathed cable** (Unit 1): the cable has its own outer sheath, so flat twin-and-earth (TWE) cable is clipped straight onto a surface.
- **Trunking** (Unit 2): single-core cables laid in a square channel with a clip-on lid.
- **Conduit** (Unit 3): single-core cables pulled with a draw wire into a round PVC or steel tube. In Kenya, PVC conduit is usually buried in wall chases and slabs before plastering.

Table 1.1 The three wiring systems compared

Feature	PVC-sheathed cable	Trunking	Conduit
Cable used	Twin-and-earth or other sheathed cable	Single-core cables	Single-core cables
Protection from knocks	Low	Medium	High (steel conduit highest)
Materials cost	Lowest	Medium	Highest
Speed of installation	Fast	Medium	Slow (bending, threading, drawing in)
Adding circuits later	New cable needed	Easy: open the lid	Possible if the conduit has space
Typical places	Homes, roof spaces, rental rooms	Shops, offices, labs, rewiring stone walls	Concealed in new houses; workshops, plant rooms

WORKED EXAMPLE 1.1: MATERIALS COST OF A 10 M RUN IN EACH SYSTEM

A house owner asks why conduit costs more. Compare the materials for a 10 m lighting run (1.5 mm² cables) at book prices (approximate, 2026). Fixings are rough allowances.

PVC-sheathed: TWE 1.5 mm² costs KSh 6,000 for 90 m, so 10 m costs 10 × 6,000 ÷ 90 = KSh 667. Allow 4 clips per metre: 40 clips × KSh 2.50 (box of 100 for KSh 250) = KSh 100. Total ≈ **KSh 767**.

Trunking (16 × 16 mm): 10 m ÷ 3 m = 3.3, so buy 4 lengths × KSh 120 = KSh 480. Three single cores (brown, blue, green-and-yellow), each 10 m at KSh 4,500 ÷ 90 = KSh 50 per metre: 3 × 10 × 50 = KSh 1,500. Twenty screws and plugs at KSh 3 each = KSh 60. Total = **KSh 2,040**.

Conduit (20 mm PVC): 10 m ÷ 2.9 m = 3.4, so buy 4 lengths × KSh 170 = KSh 680. About 1 saddle per metre: 10 × KSh 50 = KSh 500. Three couplers × KSh 50 = KSh 150. Single cores as above, KSh 1,500. Total = **KSh 2,830**.

Conduit costs almost four times as much as clipped TWE here, but protects the cables far better and allows rewiring.

1.4 The Law, EPRA Licences and Certificates

Bad wiring kills people and burns buildings, so Kenyan law controls who may do installation work.

1.4.1 The laws and the regulator

The parent law is the **Energy Act, 2019**. The regulator is **EPRA**, the Energy and Petroleum Regulatory Authority. The detailed rules for wiring work are the **Electric Power (Electrical Installation Work) Rules, 2006**. These Rules remain in force under the Energy Act, 2019. EPRA has published **draft** Energy (Electricity Supply and Installation Work) Regulations, 2024 to replace them; until they are gazetted, follow the 2006 Rules and watch EPRA's website.

The 2006 Rules refer to the IEE (now IET) Wiring Regulations. Kenyan contractors therefore work to BS 7671, the IET Wiring Regulations, which are based on the international standard IEC 60364. Trainers often call them "the IEE/IET regulations".

1.4.2 Licence classes

EPRA licenses electricians (electrical workers) and electrical contractors in classes (Table 1.2).

Table 1.2 EPRA licence classes for electrical workers (Electric Power (Electrical Installation Work) Rules, 2006)

Class	Work allowed
C-2	Single-phase low-voltage installations in homes and commercial buildings of up to two storeys. Not factories or places of public entertainment. This is the domestic class.
C-1	All C-2 work plus three-phase low-voltage work, in buildings of up to four storeys (same exclusions).
B	All C-1 work with no storey limit, including factories and places of entertainment, and supplies metered at up to medium voltage.
A-1	All kinds of electrical installation work.
A-2	Specialised installation work, such as generators, lifts and escalators.

Contractor licences use the same classes. A registered contractor must be, or must employ, a licensed electrician of the right class, and that electrician must direct the work. EPRA also requires contractors to own an earth loop impedance tester, an earth resistance tester, an insulation resistance tester, a multimeter, a clamp meter and a drilling machine (see Chapters 4 and 16).

1.4.3 Why a licence matters before you sign

Before work starts, the licensed contractor sends a **commencement notice** (Form 3 in the 2006 Rules) to Kenya Power. When the work is finished and tested, the same contractor signs a **completion and test certificate** (Form 4). These certificates are now submitted electronically through a portal shared by Kenya Power and EPRA. Kenya Power will not connect a new building without them. Figure 1.3 shows the whole path.

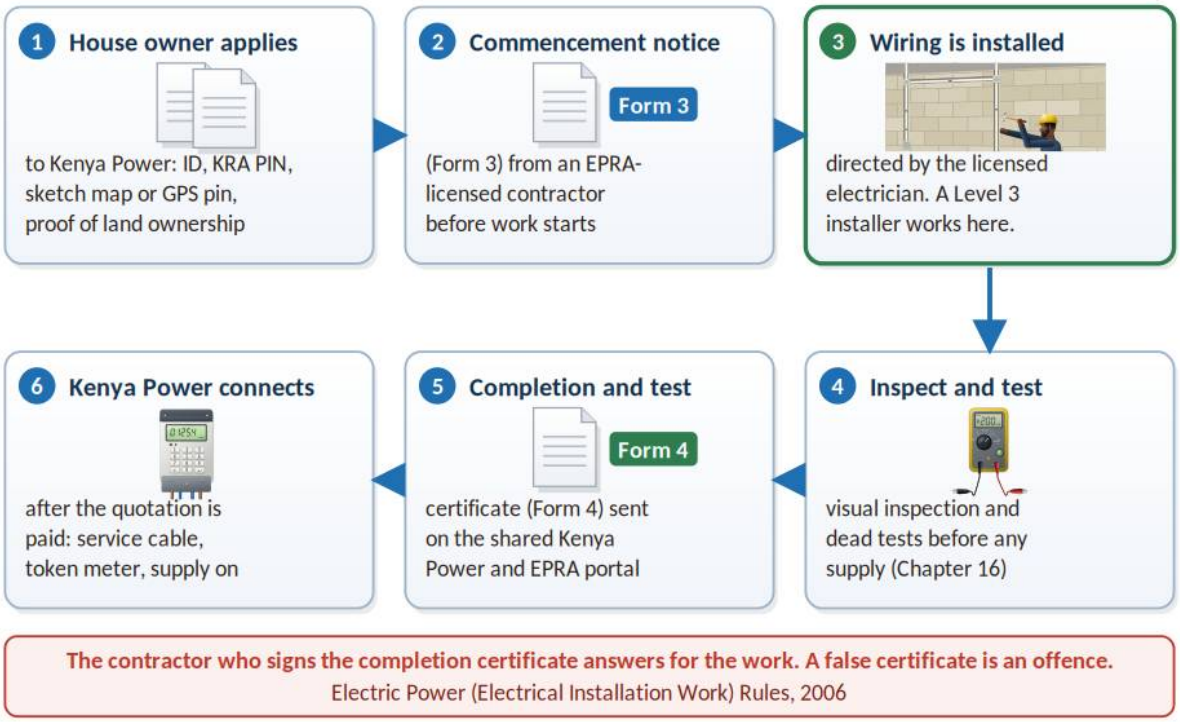


Figure 1.3 From application to connection. The licensed contractor signs both the commencement notice (Form 3) and the completion and test certificate (Form 4); Kenya Power connects only after Form 4.

The person who signs the completion certificate is saying, "I checked this work, and it is safe." If a fire or a shock happens later, investigators look at that signature first. Giving a false completion certificate is an offence under the 2006 Rules, which provide for penalties of up to KSh 30,000, up to three months' imprisonment, or both. So a Level 3 graduate must never sign a certificate or "lend" work to someone else's licence.

> **SAFETY FIRST**
>
> Illegal connections, "direct" wiring that bypasses the meter, and hooking cables onto overhead lines are criminal and deadly. Kenya Power reported 132 electrocution deaths in the year to June 2026 (Business Daily, October 2026), and an earlier Business Daily report blamed illegal connections and building under power lines. Never take part in such work, whatever the customer offers to pay. Report it to Kenya Power (97771).

1.5 Your Career Ladder

This course is your first step. Figure 1.4 shows how you can climb, both in training and in licensing. The course titles below are typical examples only; titles and entry rules vary, so check the current CDACC and TVETA lists before you enrol.

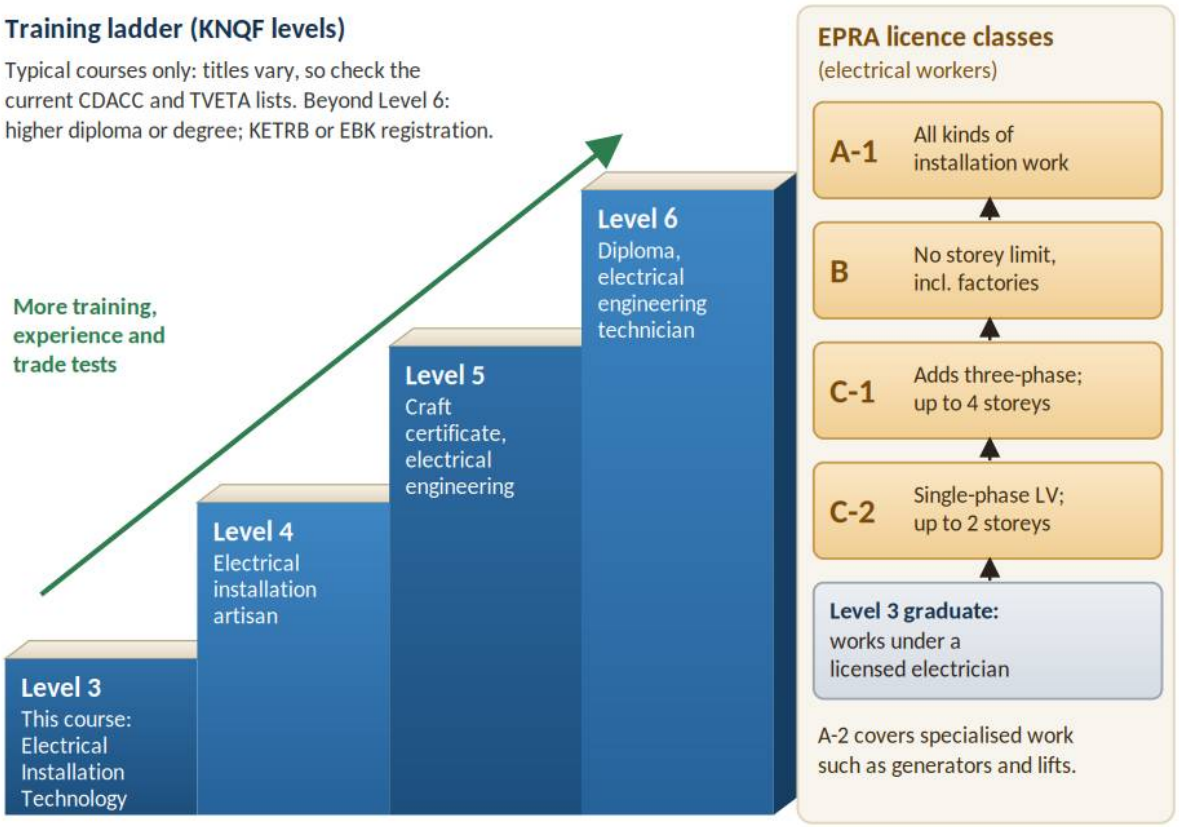


Figure 1.4 Two ladders to climb: training levels on the left and EPRA licence classes on the right. Course titles are typical examples; check CDACC/TVETA lists and EPRA's current requirements.

- **Level 3** (this course): you install wiring systems under supervision.
- **Level 4**: usually an electrical installation artisan course. Some institutions accept a Level 3 certificate for entry.
- **Level 5**: usually a craft certificate in electrical engineering (also the minimum level for a trainer of this course).
- **Level 6**: usually a diploma in electrical engineering, for technicians who design, supervise and test larger installations.

1.5.1 Getting your own licence

A Level 3 certificate is not a licence. EPRA's published requirements link licence classes to qualifications. For example, an applicant with KCSE and an Electrician or Wireman Grade II certificate (or equivalent) starts at C-2 and can rise to C-1. Many installers take NITA Government Trade Tests (Grades III, II and I) while working for this reason. Applicants also sit EPRA's written and oral interview, which covers the topics of this book. EPRA does not say how KNQF Level 3 compares with Grade II, so check EPRA's current requirements before you apply.

Table 1.3 Bodies you will deal with

Body	What it does for you
TVET CDACC	Curriculum, assessment and certificates
TVETA	Registers institutions and trainers
EPRA	Licenses electricians and contractors
Kenya Power (KPLC)	Supply, meters and connections
NITA	Government Trade Tests; industrial training
KEBS	Product standards: buy KEBS-marked goods
DOSHS, NEMA	Workplace safety (OSHA 2007); waste and e-waste
EBK, KETRB	Register engineers, technologists and technicians

1.6 How This Course Is Organised

The course follows the TVET CDACC Competency-Based Modular Curriculum for Electrical Installation Technology, KNQF Level 3. It is **competency-based education and training (CBET)**: you are judged by what you can **do**, safely and to standard, not by how much you can write.

1.6.1 Units, elements and performance criteria

Each **unit of competency** is split into **elements** (the main tasks). Each element has **performance criteria**: the things an assessor watches for. For example, mounting conduit work pieces is an element of the conduit unit; its criteria include marking mounting points and forming neat bends. The curriculum calls the matching training blocks **learning outcomes**, each with its hours.

The three core units are independent. You can take them in any order, and you can stop after one unit with a certificate for it. Figure 1.5 maps the whole course.

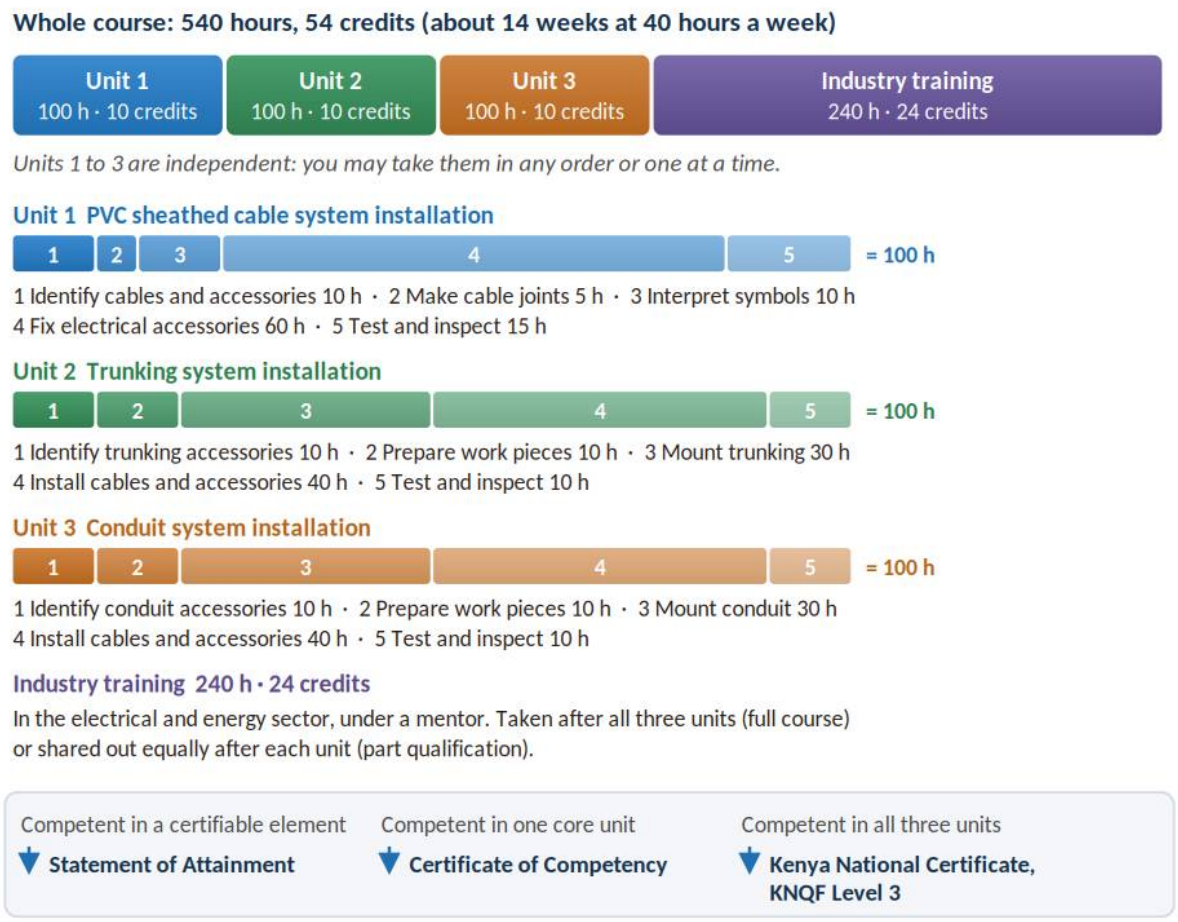


Figure 1.5 Course map: three independent 100-hour units plus 240 hours of industry training. Bar numbers are learning outcomes; bar length shows their hours.

The unit codes are ENG/CU/EI/CR/01/3/MB (PVC sheathed cable), ENG/CU/EI/CR/02/3/MB (trunking) and ENG/CU/EI/CR/03/3/MB (conduit): "EI" means electrical installation, "CR" core unit and "3" the level. The ISCED unit codes are 0713 251 01B–03B (as printed in the summary table). This greened edition (programme code 0713 254B) adds green skills; look for the Green tip in every chapter.

1.6.2 Entry, trainers and industry training

To enter the course you need KCPE or an equivalent qualification accepted by TVETA. Your trainer must hold at least an Electrical Engineering KNQF Level 5 qualification (or equivalent), be registered by TVETA, and be licensed by EBK or KETRB.

In the workshop each trainee works at an **installation booth** with a wooden board (about 1.2 m × 1 m) where circuits are fixed, wired, tested and stripped out for the next task (Figure 1.6).

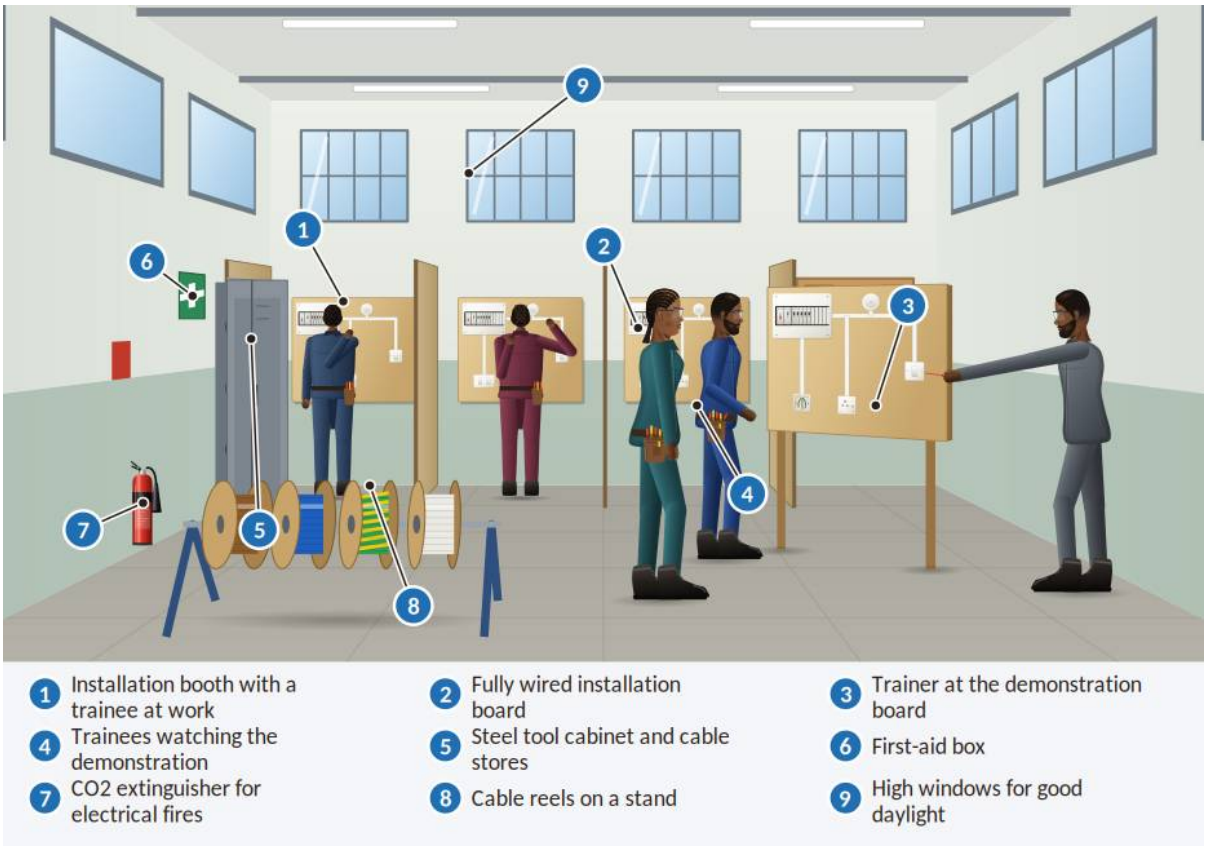


Figure 1.6 A county VTC electrical installation workshop: trainee booths, a demonstration board, stores and safety equipment.

You must also complete at least **240 hours of industry training** in the electrical and energy sector, either after all three units or shared out after each unit. A workplace mentor records your progress in the CDACC mentoring tool (see Chapter 17).

1.7 How You Are Assessed and Certified

Assessment checks the performance criteria, so it is mostly practical:

- **Theory to practical is 10 : 90** in every unit. Theory is not a separate paper. The assessor asks you questions orally while you work.
- **Formative assessments** happen during training. Each unit has at least as many formative assessments as it has elements.
- The **summative assessment** is the final practical task for the unit.
- Your unit score is **60% formative + 40% summative**.
- Marks follow the performance-criteria weighting, so the heavy tasks carry the most marks (see Figure 1.7).

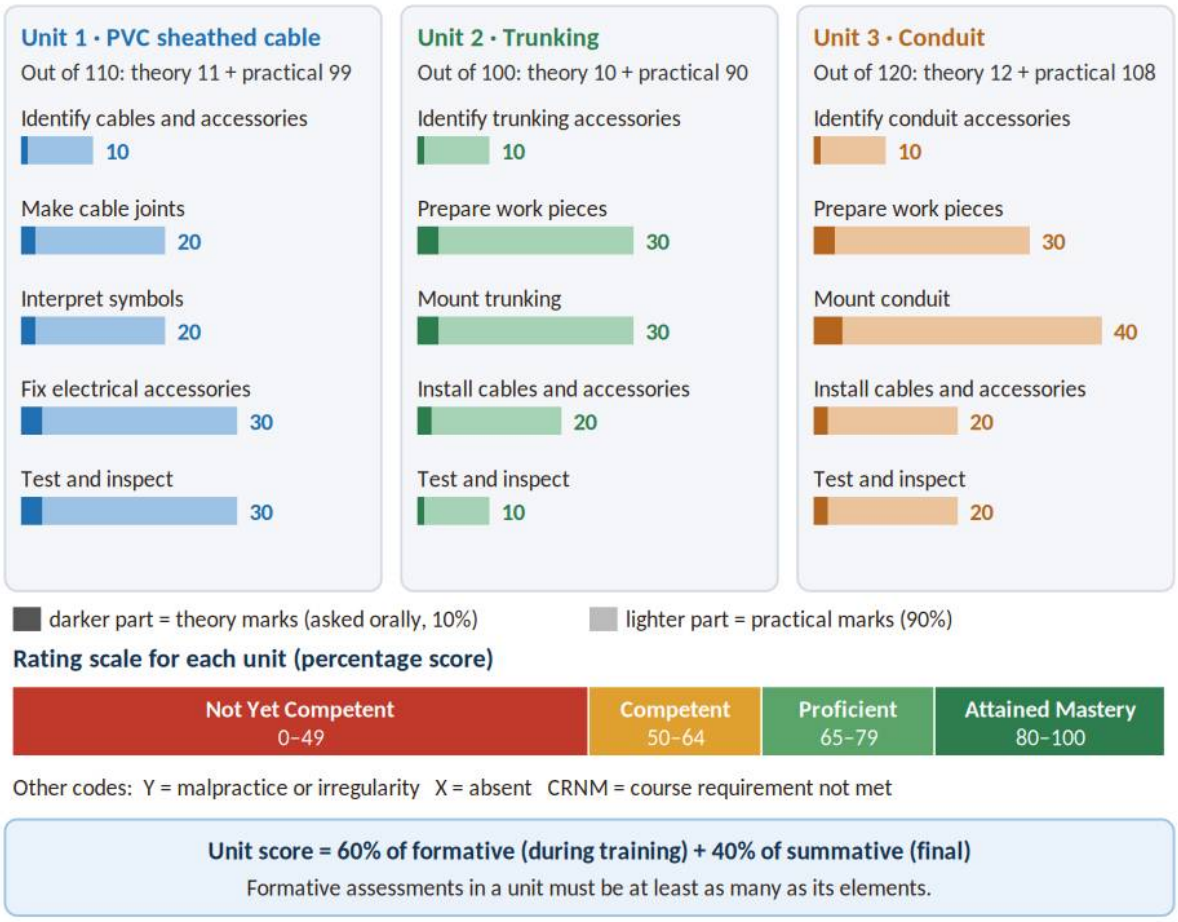


Figure 1.7 Where the marks are: element subtotals as printed in the CDACC performance-criteria weighting (theory plus practical), and the rating scale.

In Unit 1 the heaviest single criteria are performing the testing methods, installing final circuits and installing the intake point. In Unit 2, mounting the trunking and taking measurements carry the most marks; in Unit 3, mounting the conduit and marking out the mounting points. Accurate measuring and neat fixing pay.

WORKED EXAMPLE 1.2: WORKING OUT A UNIT RATING

Achieng takes the Unit 1 summative assessment. She scores 9 out of 11 in the oral questions and 78 out of 99 in the practical. Her formative assessments averaged 70%. Find her overall unit score and rating.

Step 1 Summative total: 9 + 78 = 87 out of 110.

Step 2 Summative percentage: 87 ÷ 110 × 100 = 79.1%.

Step 3 Overall: (0.6 × 70) + (0.4 × 79.1) = 42.0 + 31.6 = 73.6%.

Step 4 Rating: 73.6% lies in the 65–79 band, so Achieng is rated **Proficient**.

1.7.1 Ratings and codes

A unit score of 80–100 is **Attained Mastery**, 65–79 is **Proficient**, 50–64 is **Competent** and 49 or below is **Not Yet Competent**. Three codes are used instead of a mark: **Y** for assessment malpractice or irregularity, **X** for absent and **CRNM** for course requirement not met. "Not Yet Competent" is not the end: you get more training and are assessed again. A "Y" for cheating is serious.

1.7.2 Certificates, RPL and your portfolio

- A **Statement of Attainment** can be given when you are competent in one element that can be certified on its own.
- A **Certificate of Competency** is issued for each core unit you pass.
- The **Kenya National Certificate in Electrical Installation Technology, KNQF Level 3** is awarded when you are competent in all the units in the qualification.

TVET CDACC issues all of them. If you already wire houses but have no certificate, **Recognition of Prior Learning (RPL)** lets you be assessed on what you can already do. RPL may lead to part or full qualification. Your assessors are TVETA-licensed trainers registered by CDACC as assessors and registered with EBK and KETRB.

Start your **portfolio of evidence** now: assessed task sheets, drawings, test results, logbook pages and dated photos or videos of your work.

1.8 Professional Behaviour and Customer Care

House owners trust you with their family's safety. Your behaviour decides whether they call you again.

- **Be on time and keep your word.** If you will be late, call before the agreed time.
- **Be honest about money and materials.** Give a written quotation and account for unused materials.
- **Never cut corners on safety.** Refuse to fit undersized cable, remove an RCD or bypass a meter, even if the customer asks.
- **Respect the home.** Protect floors and furniture and sweep up chasing dust.
- **Explain the work.** Show the owner the main switch and RCD, how to press the RCD test button, and which MCB feeds which circuit.
- **Work as a team and keep records.** Agree timing with the mason and plumber, and keep test results and photos of concealed work.

GREEN TIP

Measure twice and cut once, reuse conduit and trunking off-cuts for short drops, and sell copper off-cuts only to licensed scrap dealers. Take old fluorescent tubes and CFLs (they contain mercury) to NEMA-licensed e-waste handlers. Recommend LED lamps, timers and smart switches: they cut the customer's bill every month. Phone photos of concealed conduit routes help the next electrician avoid drilling into cables.

COMMON MISTAKES

- Believing a Level 3 certificate is a licence to sign completion certificates. It is not; work under a licensed electrician.
- Buying very cheap cable that is undersized or counterfeit. Cables are among the most counterfeited goods in Kenya. Buy genuine, KEBS-marked products from reliable dealers.
- Treating the oral questions as unimportant. They are 10% of every unit, and they show the assessor that you understand why you do each step.
- Agreeing to "quick" illegal jobs to please a customer.

1.9 Your First Days in the Workshop

Chapter 2 covers safety in depth. Until then, follow these rules from day one.

SAFETY FIRST

- Never work on a live circuit. Before touching any conductor, isolate the supply, lock it off and tag it, prove your voltage tester on a known live source, test between all conductors, then prove the tester again.
- Wear your overall and safety boots. Wear eye protection when drilling, cutting or chasing.
- Use VDE (1000 V) insulated tools. Keep your hands and the floor dry.
- Know where the main isolator, the CO2 or dry-powder extinguisher and the first-aid box are. Never use water on an electrical fire.
- If someone gets a shock, switch off at the source or push them clear with dry non-conducting material, then call 999 or 112.
- Ask your trainer to check your work before any circuit is energised.

Practical task 1.1: Workshop induction and booth check

Tools and equipment

- Your installation booth and board
- Personal tool kit and checklist
- Logbook and pen
- Phone or camera (with permission)

Materials

- Workshop layout sketch (from the trainer)
- Tool register or booking sheet

Steps

1. Walk round the workshop with your trainer. Mark on the layout sketch the main isolator, the exits, the fire extinguishers (note their types) and the first-aid box.
2. At your booth, check that the board is firm and free of old cables, screws and sharp ends. Report any damage.
3. Check each tool for cracked insulation, loose hammer heads and blunt blades. Record and hand in faulty tools.
4. Sign the tool register for the tools you keep.
5. Sweep your booth and sort waste into bins for copper, PVC and general waste.
6. Write a logbook entry (date, checks, faults) and add a photo of your clean booth to your portfolio.

Safety

- Do not switch on any supply or open any accessory or consumer unit.
- Wear your overall and safety boots during the walk-round.
- Report damaged tools; never use them "just once".

Chapter summary

- A Level 3 electrical installer fixes, connects and tests single-phase wiring under the direction of a licensed electrician.
- The course teaches three systems: PVC-sheathed cable (Unit 1), trunking (Unit 2) and conduit (Unit 3), each 100 hours and 10 credits.
- The Energy Act, 2019 and the Electric Power (Electrical Installation Work) Rules, 2006 control installation work; EPRA licenses workers in classes C-2, C-1, B, A-1 and A-2.
- Kenya Power connects a building only after the licensed contractor's commencement notice and the completion and test certificate.
- Assessment is competency-based: theory 10 : practical 90, and the unit score is 60% formative plus 40% summative.
- Ratings are Attained Mastery, Proficient, Competent and Not Yet Competent, plus the codes Y, X and CRNM.
- Honesty, safety and care for the environment build a good name.

Check your competence

- [ ] I can describe the main tasks of a Level 3 electrical installer.
- [ ] I can compare PVC-sheathed cable, trunking and conduit systems.
- [ ] I can state the EPRA licence class for single-phase domestic work and its limits.
- [ ] I can explain the commencement notice and the completion and test certificate.
- [ ] I can explain units, elements, performance criteria and the 10 : 90 and 60/40 rules.
- [ ] I can work out a unit score and rating from my marks.
- [ ] I can list the certificates this course leads to, and explain RPL.
- [ ] I can follow the basic workshop safety rules.

Practice questions

1. List five tasks that a Level 3 electrical installer carries out on a house wiring job.
2. Name four types of employer or workplace where a trained installer can find work in Kenya.
3. Which EPRA licence class covers single-phase wiring of a two-storey house? State two limits of that class.
4. (Oral) Explain why a newly qualified Level 3 installer must not sign a completion certificate.
5. Name the three wiring systems in this course. For each, give one type of building where it is often used.
6. The whole course is 540 hours. (a) How many hours are in the three units together, and how many in industry training? (b) How many weeks is the course at 40 hours per week?
7. A trainee scores 90 out of 120 in the Unit 3 summative assessment. Her formative average is 80%. Calculate (a) her summative percentage, (b) her overall unit score, and (c) her rating.
8. What do the codes Y, X and CRNM mean on a CDACC result?

9. A shop owner wants a 15 m run of 25 × 16 mm mini-trunking with three 1.5 mm² single cores. Trunking costs KSh 120 per 3 m length and single-core cable KSh 4,500 per 90 m roll. Calculate the cost of the trunking and the cable (ignore fixings).
10. (Practical) In your workshop, show your trainer the main isolator, the correct extinguisher for an electrical fire and the first-aid box. Then explain three customer-care rules you will follow on your first site job.

PART 2

PVC Sheathed Cable System

Unit 1: PVC Sheathed Cable System Installation. Cables, colour codes and accessories, cable joints, symbols and wiring diagrams, the single-phase intake point and earthing, lighting and power circuits, and installing a complete PVC-sheathed cable system.

Chapter 5: Cables, Colour Codes and Accessories
Chapter 6: Cable Joints and Terminations
Chapter 7: Electrical Symbols, Wiring Diagrams and Drawings
Chapter 8: The Single-Phase Intake Point and Earthing
Chapter 9: Lighting Circuits
Chapter 10: Power Circuits: Socket Outlets, Cookers and Water Heaters
Chapter 11: Installing a PVC-Sheathed Cable System

CHAPTER 9

Lighting Circuits

WHAT YOU WILL LEARN

- Name the parts of a lighting circuit and choose the right cable, MCB and number of points.
- Wire one-way, two-way and intermediate switching, with the switch always in the line conductor.
- Loop in at a 3-plate ceiling rose, at a joint box and at the switch, and identify every switch wire.
- Choose lamp holders and LED lamps using lumens and colour temperature, not watts.
- Fit energy-saving controls: dimmers, timers, PIR and day/night sensors and smart switches.

Unit: PVC Sheathed Cable System Installation · ENG/CU/EI/CR/01/3/MB · Learning outcome 4 (lighting final circuits; the outcome totals 60 hours) · About 20 hours

Lighting is the first circuit most house owners ask about and the one they use every evening. A fundi who wires lights neatly and correctly earns trust quickly. This chapter teaches every lighting arrangement in the curriculum, from a single switch in a bedsitter to a long corridor with three switches. Units 2 and 3 use exactly the same circuits in trunking and conduit, so learn them well here.

Key words

Lighting point
A place where a light is connected.

Permanent line
The line conductor that is live whenever the MCB is on.

Switch wire
The conductor from the switch to the lamp; live only when the switch is on.

Loop-in
Taking the supply into a point and on to the next point.

Ceiling rose
The ceiling fitting where cables are connected and the pendant flex hangs.

Joint box
An enclosed box with screw terminals for joining cables (junction box).

Common (COM)
The two-way switch terminal that connects to either L1 or L2.

Strappers
The two conductors joining the L1 and L2 terminals of two-way switches.

Intermediate switch
A switch between two two-way switches that swaps the strappers over.

Lumen (lm)
The unit of light output.

Colour temperature
How warm or cool white light looks, in kelvin (K).

9.1 Parts of a lighting circuit

A lighting circuit is a **final circuit**: it starts at one MCB in the consumer unit and ends at the last light. Its parts are a 6 A Type B MCB (usually also behind the 30 mA RCD, Chapter 8), 1.5 mm² cable (twin and earth, or single cores in conduit or trunking), switches, lighting points (ceiling roses, batten lamp holders or light fittings), joint boxes where cables are joined, and the lamps, today almost always LED.

Every lighting point must have a **circuit protective conductor (CPC)**, even when the fitting is plastic. The house owner may later fit a metal fitting or switch plate, and it must be earthed.

Table 9.1 A domestic lighting circuit at a glance (book standard values; check the drawing and the current regulations)

Item	Usual choice	Notes
Cable	1.5 mm² TWE or 1.5 mm² single-core	Brown line, blue neutral, green-and-yellow CPC
MCB	6 A Type B	Never more than 10 A on a 1.5 mm² lighting circuit
Points per circuit	About 10 or fewer	Split a house into at least two lighting circuits
Switch position	In the line conductor only	Never in the neutral
Lamps	9 W LED (about 800 lm)	Replaces a 60 W incandescent lamp

Split a house into at least two lighting circuits, so that if one MCB trips at night the other still gives light.

> **WORKED EXAMPLE 9.1: LOAD ON A LIGHTING CIRCUIT**
>
> A lighting circuit has 10 points, each with a 9 W LED lamp. The supply is 240 V. Find the current and check the 6 A MCB. Then compare with 60 W incandescent lamps.
>
> Total power with LEDs: P = 10 × 9 W = 90 W.
> Current: I = P ÷ V = 90 ÷ 240 = **0.375 A**.
> With 60 W lamps: P = 10 × 60 = 600 W, so I = 600 ÷ 240 = **2.5 A**.
> The largest load a 6 A MCB can carry is 6 × 240 = 1,440 W. Both loads are well inside this. Good practice (about 10 points), not the LED current, limits the circuit.

9.2 One-way switching

One-way switching controls one or more lamps from **one** position: bedrooms, kitchens, stores and dukas. The rule never changes: **the switch goes in the line conductor; the neutral goes straight to the lamp.** A switch in the neutral still turns the lamp off, but leaves the lamp holder live. That is dangerous and fails inspection.

A one-way switch has two terminals, usually marked **COM** and **L1**. Connect the permanent line to COM and the switch wire to L1. (Many switches on sale are two-way types; for one-way use, connect COM and L1 and leave L2 empty.)

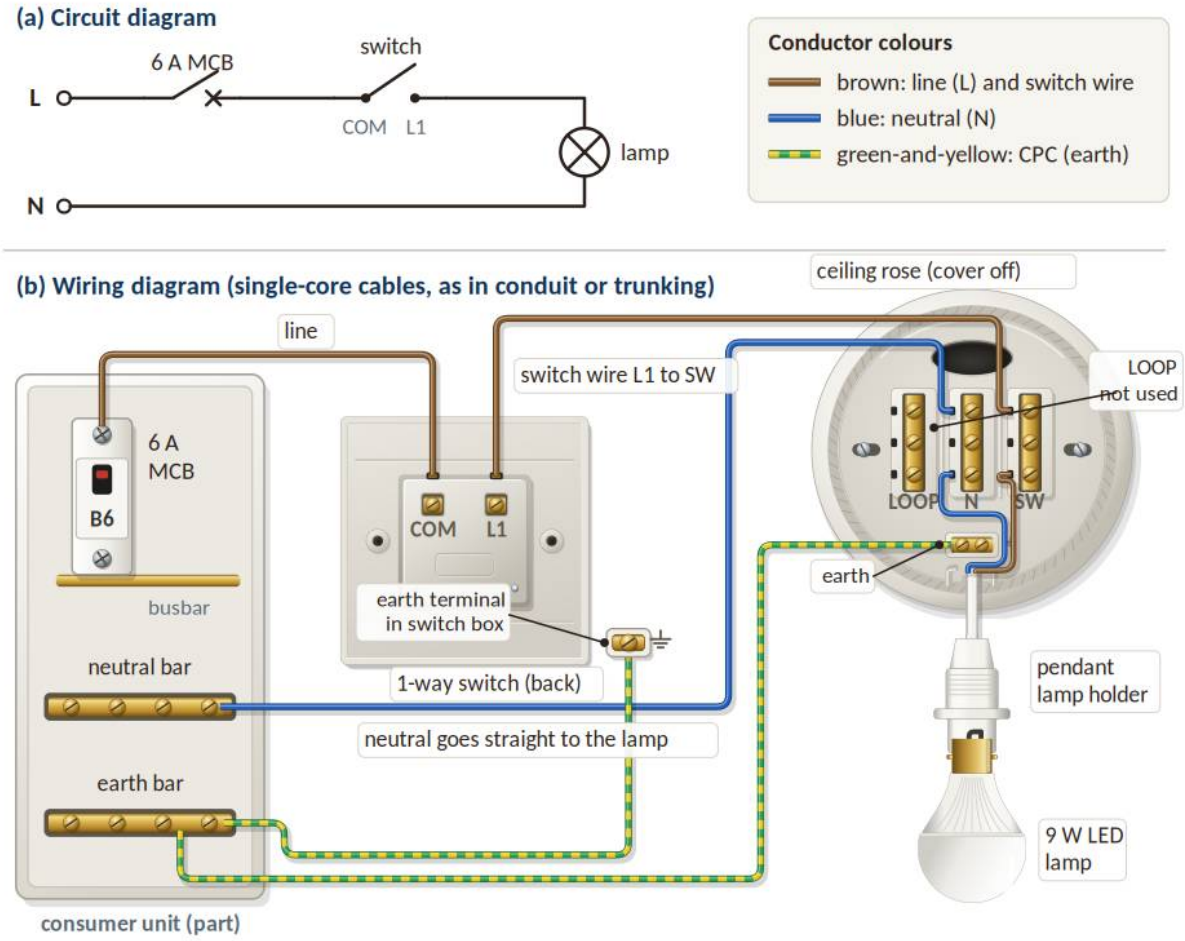


Figure 9.1 One-way switching. (a) Circuit diagram: MCB and switch in the line, neutral straight to the lamp. (b) Wiring diagram with single-core cables: line to COM, switch wire from L1 to SW, neutral to N, and a CPC to the rose and the switch box. LOOP is not needed here.

Connect the lamp flex brown to SW and blue to N, and hook the flex over the anchor hooks so the terminals do not carry the weight of the lamp. With twin and earth cable the connections are the same, but the cable is looped in at the rose (section 9.5).

> **SAFETY FIRST**
>
> Before you open any switch or ceiling rose on an existing installation, carry out **safe isolation**: switch off the lighting MCB, lock it off and tag it, prove your voltage indicator on a proving unit, test between all conductors (L–N, L–E, N–E) at the point, then prove the indicator again (Chapter 2). Switching off the light switch is **not** isolation. The permanent line and the LOOP terminal stay live, and on a two-way circuit a strapper may be live. Use VDE insulated tools and a sound stepladder.

9.3 Two-way switching

Two-way switching controls one light from **two** positions. Typical places are staircases, corridors, a bedroom with switches at the door and the bed, and halls with two doors.

A two-way switch has three terminals: **COM** (common), **L1** and **L2**. Each press moves COM from L1 to L2 or back. The **permanent line** goes to COM of switch A, two **strappers** join L1 to L1 and L2 to L2, and COM of switch B is the **switch wire** to the lamp. The lamp lights when both switches select the **same** strapper (Table 9.2), so either switch always changes it.

Table 9.2 How two-way switching works (switch A's COM is fed by the line; switch B's COM feeds the lamp)

Switch A: COM to	Switch B: COM to	Path from line to lamp?	Lamp
L1	L1	Yes, through strapper L1	ON
L1	L2	No	OFF
L2	L1	No	OFF
L2	L2	Yes, through strapper L2	ON

9.3.1 Two-way wiring with twin and earth and 3-core and earth

The usual method runs twin and earth from the rose to switch A and **3-core and earth** (brown, black, grey and a bare CPC) between the switches (Figure 9.2):

1. **At the rose:** the brown of the twin and earth goes to LOOP (permanent line). The blue, sleeved brown, goes to SW (it will bring back the switched line).
2. **At switch A:** the brown from the rose goes to COM. The black core of the 3-core goes to L1 and the grey to L2. The brown core of the 3-core and the blue (sleeved brown) from the rose are joined in a connector in the back box. Both CPCs go to the box earth terminal.
3. **At switch B:** black to L1, grey to L2, brown to COM. The CPC goes to the box earth terminal.

Trace it: line into COM of A, along a strapper to B, out of B's COM, back on the 3-core brown to the connector in A, then up the sleeved blue to SW and the lamp. The black, grey and blue cores are all line conductors here, so each is **sleeved brown** at both ends.

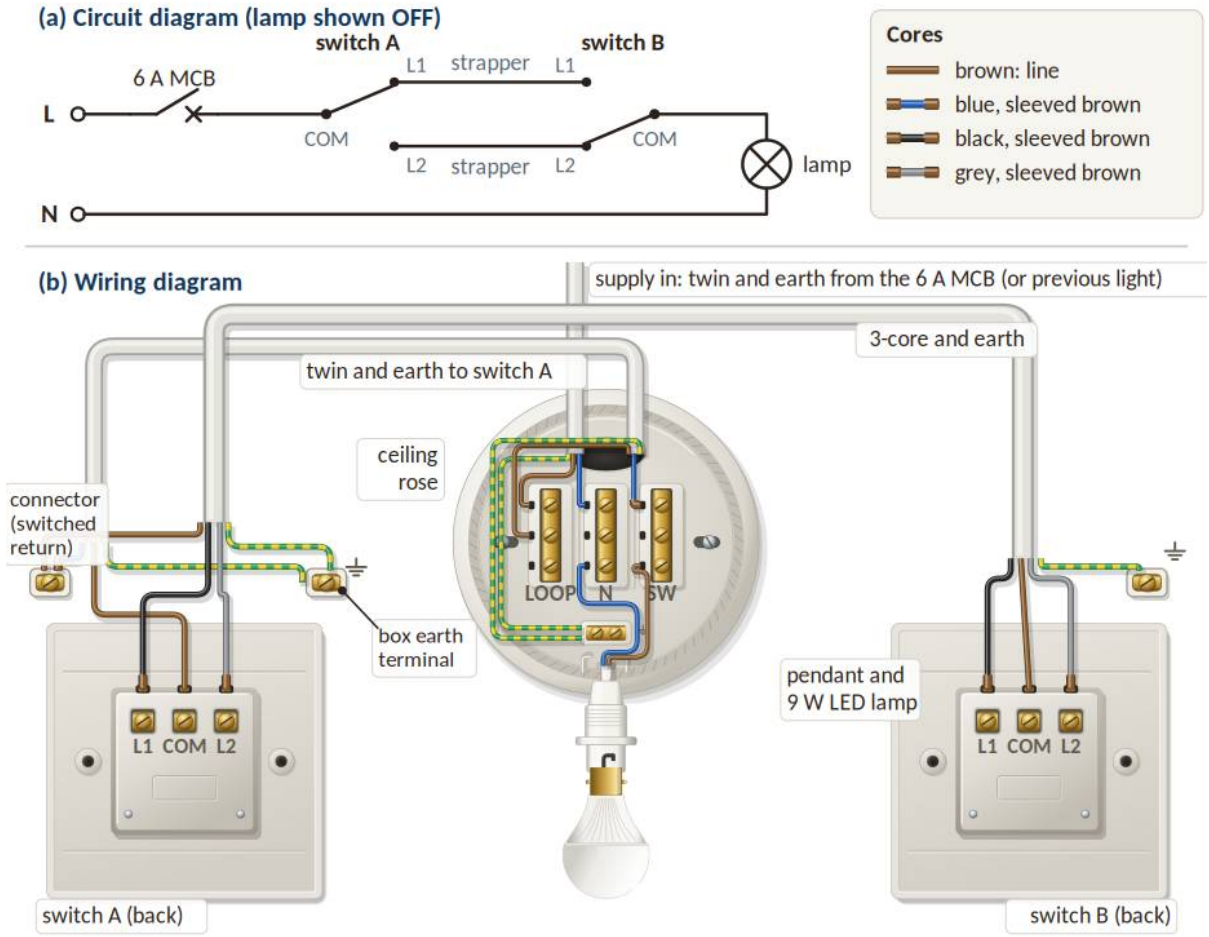


Figure 9.2 Two-way switching. (a) Line to COM of switch A, strappers L1–L1 and L2–L2, COM of switch B to the lamp. (b) Wiring for the last light on a circuit: twin and earth from the rose to switch A, 3-core and earth between the switches; the return from COM of B is joined to the sleeved blue in a connector in A's box.

> **TRAINER'S TIP**
>
> Find the COM terminal before you connect a two-way switch; it is marked COM or C. If a two-way light works from one end only, check first that the line and the lamp feed are on the COM terminals and the strappers on L1 and L2.

9.4 Intermediate switching

When a light must be controlled from **three or more** positions, add **intermediate switches** between the two two-way switches. Three positions need one intermediate; four positions need two.

An intermediate switch has two pairs of terminals, L1 and L2 at the top and L1 and L2 at the bottom. One pair takes the strappers from switch A, the other the strappers to switch C. In one position it connects them straight through; press it and it crosses them over. Crossing the strappers has the same effect as pressing a two-way switch, so every switch changes the lamp.

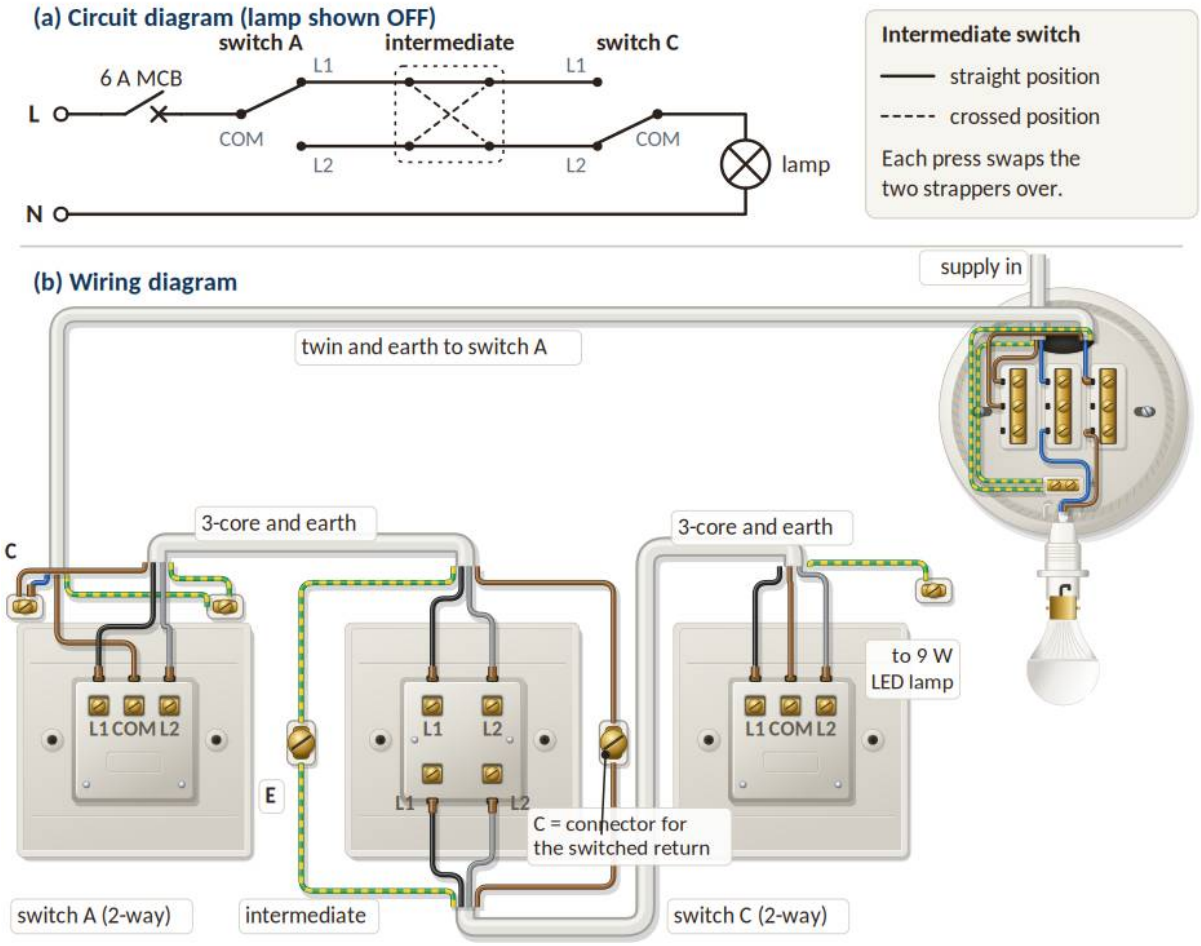


Figure 9.3 Intermediate switching. (a) The intermediate switch sits in the strappers (solid: straight position; dashed: crossed). (b) Black strappers on the L1 terminals, grey on L2; the brown cores carry the switched return from COM of switch C back through connectors (C) to the rose.

COMMON MISTAKES

- Putting the switch in the neutral. The lamp goes off but the lamp holder stays live.
- Blue, black or grey line cores without brown sleeving at both ends.
- Connecting the line or the lamp feed to L1 or L2 of a two-way switch instead of COM.
- Mixing the pairs on an intermediate switch: one strapper from switch A and one from switch C on the same pair. The light then works only in some switch positions.
- Leaving the CPC cut short or folded back in the switch box. Every CPC must be sleeved and connected to an earth terminal.
- Taking the neutral for a light from a different circuit ("borrowed neutral"). Isolating one MCB then leaves live neutrals in the box.

9.5 Looping-in methods

"Looping in" means bringing the supply into a point and taking it on to the next point from the same terminals. It can be done at the ceiling rose, at a joint box or at the switch.

9.5.1 Looping in at the ceiling rose

A **3-plate ceiling rose** has three banks of terminals and an earth terminal:

- **LOOP**: the permanent line, the browns of supply in, supply out and switch drop. **This terminal stays live when the light switch is off.**
- **N**: the blues of supply in, supply out and lamp flex.
- **SW**: the switch-drop blue (sleeved brown) and the flex brown.
- **Earth**: all the CPCs, sleeved green-and-yellow.

Only **one cable** then runs down the wall to the switch: the **switch drop**. At a one-way switch its brown goes to COM and its blue (sleeved brown) to L1. The last rose on a circuit has no supply-out cable.

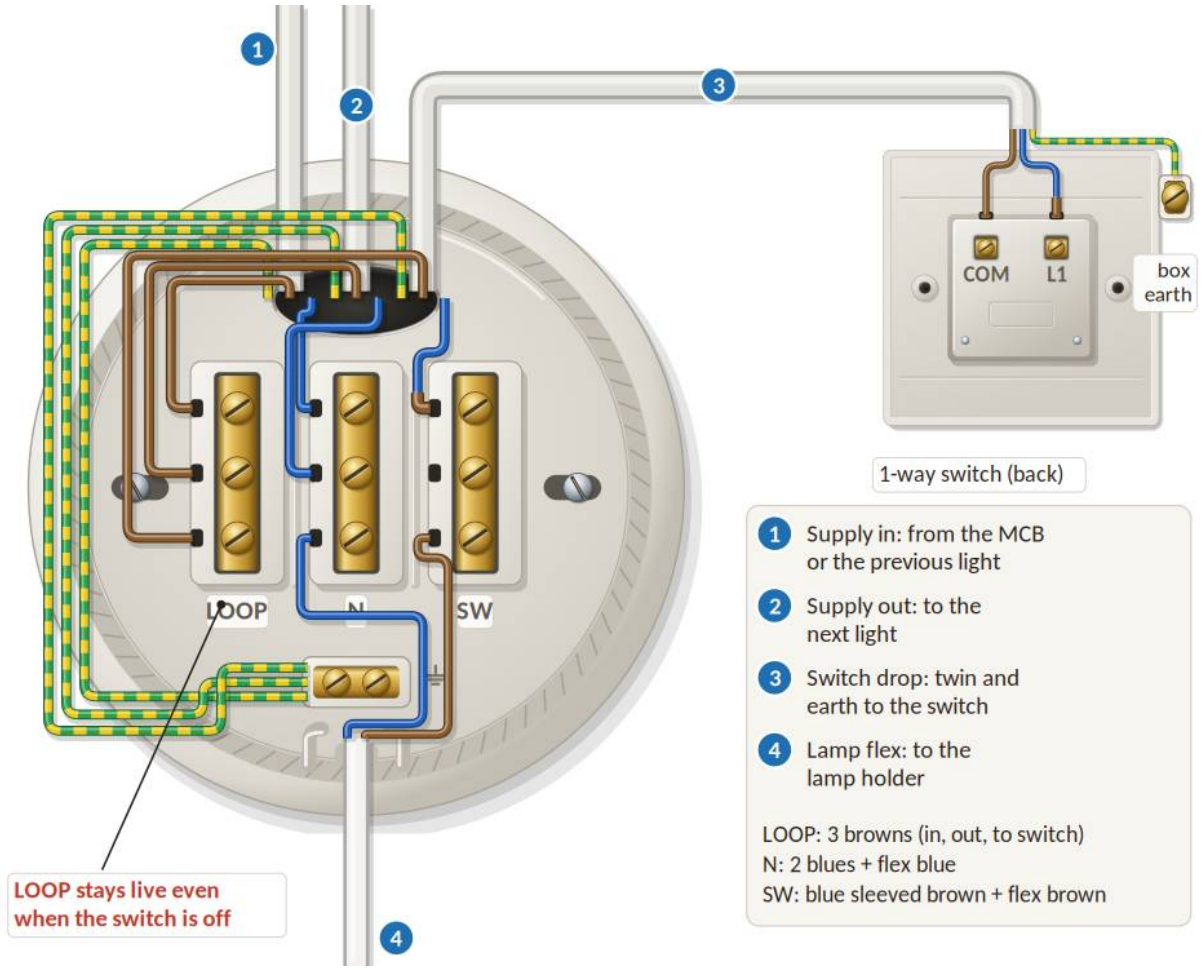


Figure 9.4 Looping in at a 3-plate ceiling rose in the middle of a circuit: (1) supply in, (2) supply out, (3) switch drop, (4) lamp flex on the anchor hooks. All CPCs, sleeved, go to the earth terminal. Conductors are spread out for clarity.

SAFETY FIRST

With the light switch off, a loop-in rose still has a live LOOP terminal and live cores going on to the next rose. Isolate the lighting MCB and prove dead before you touch a rose, pendant or lamp holder, and keep a tight cover on every rose.

9.5.2 Looping in at a joint box

When a fitting has no loop-in terminals (a batten holder, LED panel or bulkhead), the looping is done in a 30 A four-terminal **joint box** in the ceiling void. Four cables enter: supply in, supply out, the switch drop and a cable to the light. The terminals become L (three browns), SW (sleeved switch-drop blue and the brown to the light), N (three blues) and E (four CPCs), as in Figure 9.5. Label the terminals in the lid. Fix the box to a batten, not hanging on its cables, and keep it accessible for inspection.

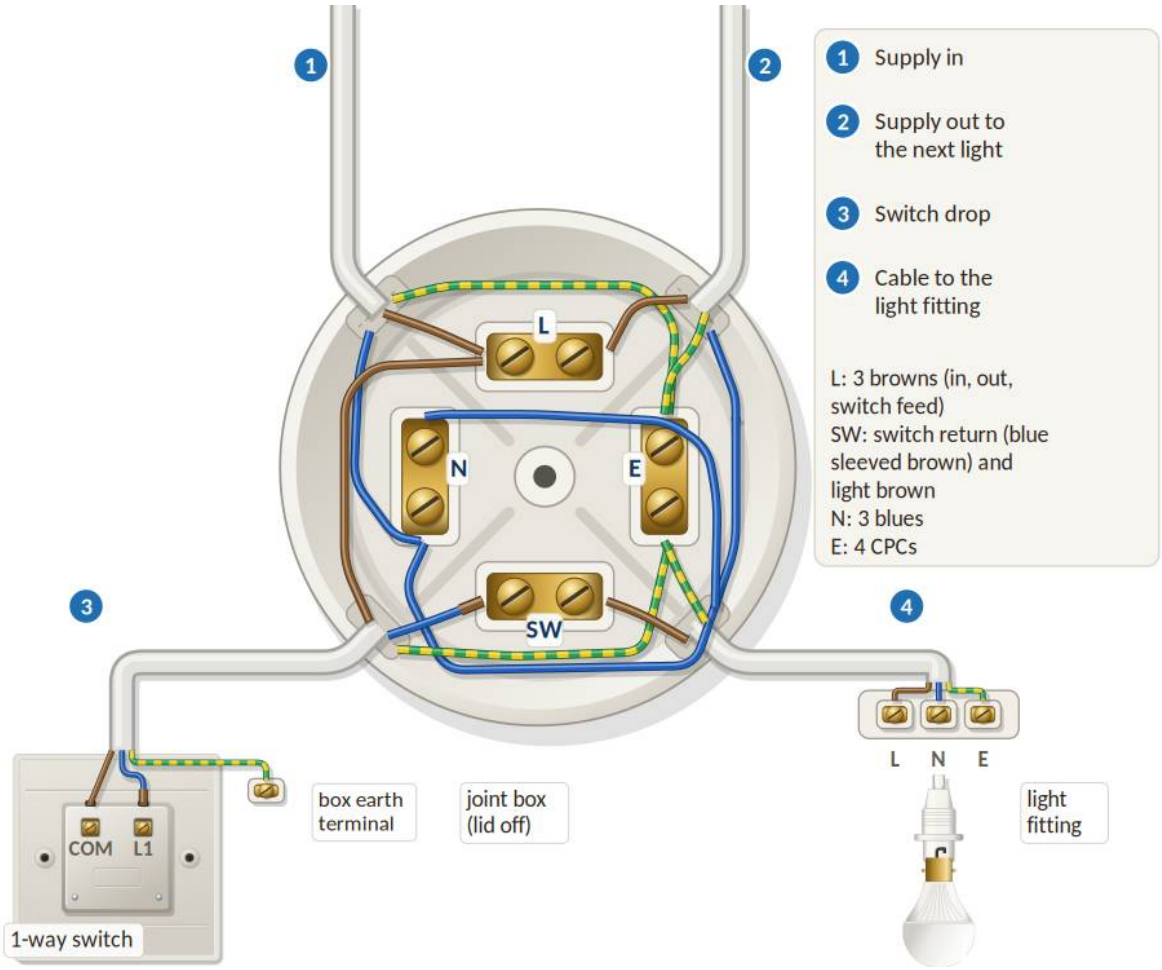


Figure 9.5 Looping in at a four-terminal joint box: L joins the permanent-line browns, SW joins the switch return to the brown going to the light, N the blues and E the CPCs.

9.5.3 Looping in at the switch

In conduit and trunking (Units 2 and 3) the cables are single cores, and there is a neat third method. The **permanent line is looped from switch to switch**: one brown runs from the MCB to the COM terminal of the first switch, and another brown runs on from that COM terminal to the COM of the next switch. The **neutral is looped from light to light**, using the N terminal of each rose or a connector at each fitting. From L1 of each switch a switch wire runs up to its own light. This saves cable where several switches are grouped at one door; it is Figure 9.1(b) extended to more lights (Chapters 13 and 15 show it in trunking and conduit). Never join a neutral at a switch terminal.

9.5.4 Identifying the switch wire

In a twin and earth switch drop the blue core is the switch wire, a **line** conductor. Mark it at **both ends** with brown sleeving or tape (in old red-and-black work, the black is sleeved red). An unsleeved blue on a switch tells the next electrician it is a neutral, and that could kill them.

> **ON A KENYAN SITE**
>
> Many town houses are wired with single cores in conduit chased into block walls, looped at the switches. Rural houses and rental plots are often wired with twin and earth on the timber trusses, looped in at the roses. You must be able to wire both. When you alter an old red-and-black installation, sleeve or tag every conductor at the interface and fix a caution notice at the consumer unit saying that two colour codes are in use (Chapter 5).

9.6 Lamp holders and lamps

9.6.1 Lamp holders

- **B22 bayonet cap:** the usual cap on Kenyan pendant and batten holders (Figure 9.6).
- **E27 Edison screw:** the lamp screws in. The **centre contact** must be connected to the switch wire (line) and the screw thread to the neutral. If you reverse them, the thread that fingers can touch while changing a lamp is live. Checking this is part of the polarity test (Chapter 16).

In bathrooms and outdoors use enclosed fittings with a suitable IP rating (Chapter 5). A metal pendant needs 3-core flex so its earth terminal can be connected to the CPC.

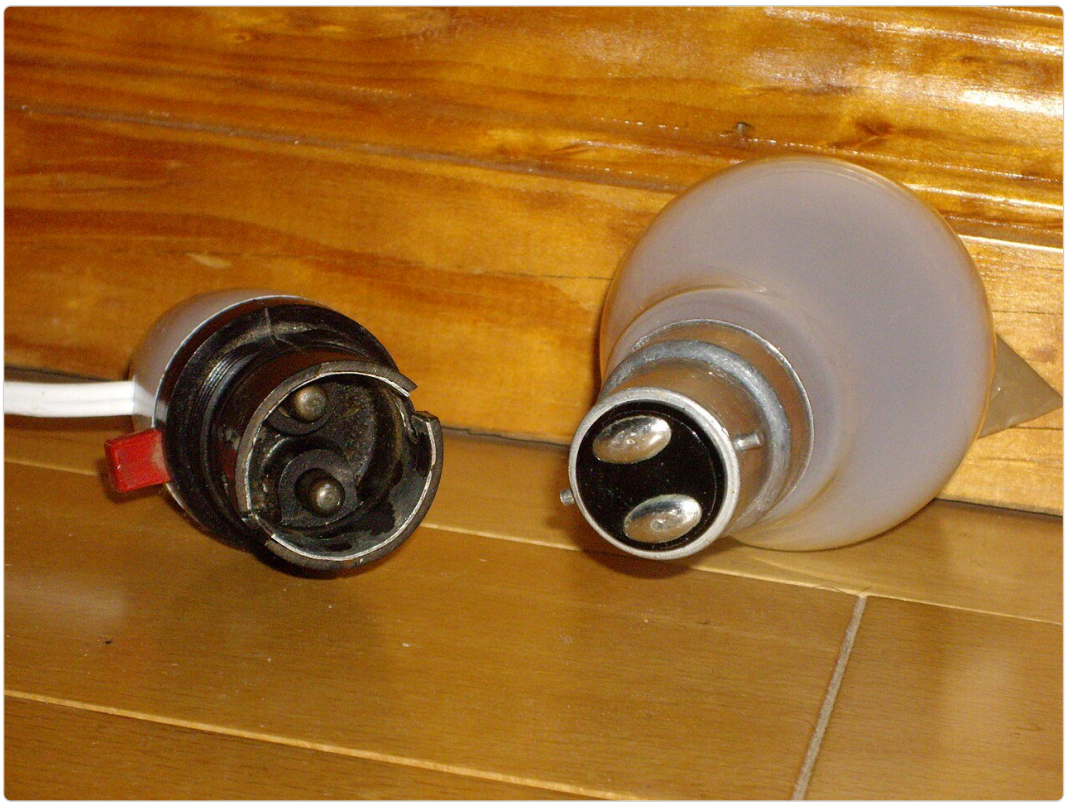


Figure 9.6 A B22 bayonet lamp holder (left) and a bayonet lamp cap (right): the side pins lock into the J-slots and the two cap contacts press on the holder plungers.

Photo: Jnestorius, CC BY-SA 3.0, via Wikimedia Commons

9.6.2 Choosing lamps: lumens, watts and colour

Watts measure the **power used**; light output is measured in **lumens (lm)**. A 60 W incandescent lamp, a 13–15 W CFL and an 8–9 W LED lamp all give about the same light, roughly 800 lm. The LED does it with about one-seventh of the power.

Incandescent lamps turn most of their energy into heat. CFLs use about a quarter of the power but contain **mercury**. LED lamps use the least power, last much longer and contain no mercury: use them for all new work.

Colour temperature is printed on the pack in kelvin. **Warm white** (about 2,700–3,000 K) suits bedrooms and sitting rooms, **cool white** (about 4,000 K) kitchens, classrooms and workshops, and **daylight** (about 6,500 K) shops and salons. Check the voltage (220–240 V), the cap, and the "dimmable" mark if a dimmer will be used.

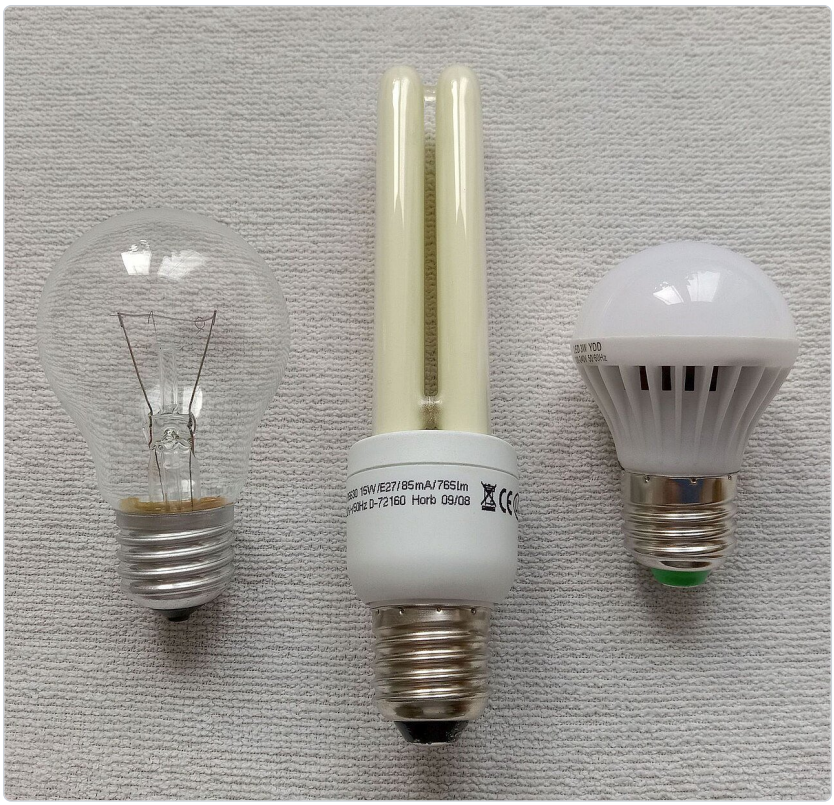


Figure 9.7 Three lamps for about the same light: incandescent (left), CFL (centre) and LED (right). These have E27 screw caps; most Kenyan pendants use the B22 bayonet cap.

Photo: Hidalgo944, CC BY-SA 4.0, via Wikimedia Commons

Table 9.3 Lamps for about 800 lm, used 5 hours a day (energy at KSh 28 per kWh; approximate, 2026)

Lamp	Power	Energy per year	Cost per year	Notes
Incandescent	60 W	109.5 kWh	KSh 3,066	Mostly heat; short life
CFL	14 W	25.6 kWh	KSh 715	Contains mercury; NEMA-licensed disposal
LED	9 W	16.4 kWh	KSh 460	About KSh 250 to buy; no mercury

WORKED EXAMPLE 9.2: SAVING MONEY WITH LED LAMPS

A house owner has 6 incandescent lamps of 60 W, each used about 5 hours a day. You replace them with 9 W LED lamps at KSh 250 each. Find the energy and money saved in a year at KSh 28 per kWh, and how long the LEDs take to pay for themselves.

Power saved per lamp: 60 − 9 = 51 W. For 6 lamps: 6 × 51 = 306 W = 0.306 kW.
Energy saved per day: 0.306 kW × 5 h = 1.53 kWh.
Energy saved per year: 1.53 × 365 = **558.45 kWh** (about 558 kWh).
Money saved per year: 558.45 × 28 = **KSh 15,636.60** (about KSh 15,600).
Cost of the LEDs: 6 × 250 = KSh 1,500. Saving per day: 1.53 × 28 = KSh 42.84. Payback: 1,500 ÷ 42.84 ≈ **35 days**.

9.7 Energy-saving lighting controls

These controls replace or work with an ordinary switch. Fit them in the line, never the neutral, and follow the maker's instructions.

- **Dimmers:** for LED lamps use an **LED-compatible (trailing-edge) dimmer** and only lamps marked "dimmable"; old dimmers make LEDs flicker. Check the dimmer's minimum load.
- **Timers** switch lights at set times, for example a security light from 6:30 p.m. to 6:00 a.m.
- **PIR (passive infrared) sensors** switch a light on when someone moves nearby and off after a set time: corridors, toilets, gates.
- **Day/night (photocell) sensors** switch outdoor lights on at dusk and off at dawn.
- **Smart switches and smart lamps** are controlled by a phone app over Wi-Fi. Many need a **neutral at the switch**, which a loop-in rose does not provide: buy a "no-neutral" type or run a cable with a neutral to the box, never from another circuit.

GREEN TIP

Fit LED lamps, put sensors or timers on outside and corridor lights, and measure runs before cutting so off-cuts are short. Sell copper off-cuts only to licensed scrap dealers. Take failed CFLs and fluorescent tubes (mercury) to a NEMA-licensed e-waste handler; never break or burn them.

9.8 Good practice when installing lighting circuits

- Plan the circuit on the drawing first (Chapter 7). Fix switches where the drawing shows (commonly about 1.2–1.4 m above the floor, on the handle side of the door; check with your trainer) and fix roses to sound timber, never only to ceiling board.
- Strip only enough insulation for the terminal: no copper outside it, no insulation under the screw. Tighten every screw and pull-test each conductor.
- Sleeve every CPC and terminate it, even at plastic switches. Never mix neutrals from different circuits.
- Inspect and test before switching on: CPC continuity, insulation resistance and **polarity** (Chapter 16). Photograph each rose and switch before closing it, for your portfolio and the job record.
- Clean up, sort waste and leave the house owner's room as you found it.

TRAINER'S TIP

Learn these faults for oral questions: lamp never lights → check the lamp, then the SW connection at the rose and L1 at the switch; lamp never goes off → the flex brown is on LOOP instead of SW, or the switch is shorted out; two-way works from one switch only → COM and a strapper swapped; MCB trips when the light is switched on → switch wire or flex touching neutral or earth. Always isolate before you look.

Practical task 9.1: One-way and two-way lighting, loop-in at the ceiling rose

Tools and equipment

- Installation board (1.2 m × 1 m) with consumer unit fitted
- VDE screwdriver set, insulated pliers, side cutters, wire stripper, knife
- Tape measure, spirit level, pencil
- Multimeter or continuity tester, voltage indicator and proving unit

Materials

- 1.5 mm² twin and earth, 1.5 mm² 3-core and earth
- 2 ceiling roses with pendant lamp holders and 9 W LED lamps
- 1 one-way switch, 2 two-way switches, pattress boxes
- Green-and-yellow and brown sleeving, connectors, cable clips, screws

Steps

1. Draw the wiring diagram for both circuits from the trainer's layout and have it checked. Mark out and fix the boxes and rose bases.
2. Run twin and earth from the 6 A MCB way to rose 1 (supply in) and on to rose 2 (supply out). Run a twin and earth switch drop from rose 1 to the one-way switch.
3. For rose 2, run twin and earth to two-way switch A and 3-core and earth from A to two-way switch B.
4. Clip the cables, sleeve all CPCs and line cores, and terminate as in Figures 9.2 and 9.4. Connect to the MCB, neutral bar and earth bar. Do not switch on.
5. Test dead (CPC continuity, each switch breaks the line; Chapter 16). The trainer then energises; operate every switch combination (Table 9.2). Photograph the work and clean up.

Safety

- Work dead at all times; the trainer energises the board.
- Prove the voltage indicator before and after testing dead.
- Keep fingers away from the knife edge; cut away from your body.

Practical task 9.2: Intermediate switching and joint-box loop-in

Tools and equipment

- Installation board and the tools from Practical task 9.1
- Continuity tester
- Phone or camera for job records

Materials

- 2 two-way switches and 1 intermediate switch with boxes
- 1 four-terminal 30 A joint box, 1 batten lamp holder and a 9 W LED lamp
- 1.5 mm² twin and earth and 3-core and earth
- Sleeving, connectors, clips, screws

Steps

1. Fix the joint box on a batten above the light position, and the batten lamp holder below it.
2. Fix two-way switch A, the intermediate switch and two-way switch C in a line, as at the bottom, landing and top of a staircase.
3. Bring the supply into the joint box. Run the switch drop (twin and earth) to switch A, 3-core and earth from A to the intermediate and from the intermediate to C, and a short twin and earth from the joint box to the lamp holder.
4. Connect the joint box as L, SW, N and E (Figure 9.5) and the strappers as in Figure 9.3; label the lid.
5. Test dead, then the trainer energises. Each switch must change the light whatever the other two are doing. Photograph and clean up.

Safety

- The joint box lid must be fitted before the circuit is energised.
- Use a sound stepladder, fully opened and locked, when working at ceiling height.

Chapter summary

- Lighting circuits use 1.5 mm² cable on a 6 A Type B MCB (10 A at most), with about 10 points or fewer.
- The switch is always in the line; the neutral goes straight to the lamp; every point has a CPC.
- Two-way: line to COM of switch A, strappers L1–L1 and L2–L2, COM of switch B to the lamp. Intermediates go in the strappers.
- At a 3-plate rose: LOOP takes the permanent-line browns (always live), N the neutrals, SW the switch wire and flex brown, earth all CPCs.
- Joint boxes loop in when a fitting has no loop terminals; in conduit and trunking the line is often looped at the switches.
- Blue, black or grey cores used as line conductors are sleeved brown at both ends.
- Choose lamps by lumens; a 9 W LED replaces a 60 W lamp, and dimmers, timers and sensors save more.

Check your competence

- [ ] I can select the cable, MCB and number of points for a lighting circuit.
- [ ] I can wire one-way switching with the switch in the line.
- [ ] I can wire two-way and intermediate switching using COM, L1 and L2.
- [ ] I can loop in at a ceiling rose, a joint box and the switch.
- [ ] I can identify and sleeve every switch wire and strapper.
- [ ] I can choose an LED lamp by lumens and calculate the saving.
- [ ] I can fit a dimmer, timer or sensor and say when a smart switch needs a neutral.

Practice questions

1. State the cable size and MCB rating normally used for a domestic lighting circuit.
2. Explain why the switch must be connected in the line conductor and not in the neutral.
3. Name the three terminal banks of a 3-plate ceiling rose and list the conductors connected to each when the rose is in the middle of a circuit.
4. Draw the circuit diagram of a two-way switching circuit and mark COM, L1 and L2 on both switches.
5. A staircase light must be controlled from the ground floor, the landing and the first floor. Name the switches needed and say where each goes.
6. Why must the blue core of a twin and earth switch drop be sleeved brown? Where is the sleeving fitted?
7. A lighting circuit has 8 LED lamps of 9 W each on a 240 V supply. Calculate the current drawn and state whether a 6 A MCB is suitable.
8. A shop replaces 8 incandescent lamps of 60 W with 9 W LED lamps. The lights are on 4 hours a day. Calculate the energy saved in 30 days and its value at KSh 28 per kWh.
9. A lighting job needs 150 m of 1.5 mm^2 twin and earth cable. Cable is sold in 90 m rolls at KSh 6,000. How many rolls must you buy and what do they cost?
10. Oral and practical: a house owner wants a smart switch fitted in place of a one-way switch on a loop-in circuit. Explain what you must check before buying it, then wire and test a one-way circuit on the board for your trainer.

Enjoyed this sample?

This free sample has the front matter, Chapter 1 and the full Chapter 9 on lighting circuits. The complete guide has **17 chapters** and **316 pages**. It covers all three units (PVC Sheathed Cable System, Trunking System and Conduit System Installation), from safety, cables, joints, symbols and the intake point to lighting and power circuits, trunking, conduit bending and drawing in, and inspection and testing.

It also includes 110+ realistic illustrations, wiring diagrams and photos, practical tasks, practice questions with answers, three mock assessments marked like the CDACC tool, a 200-term glossary, an electrical quick reference and logbook pages.

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