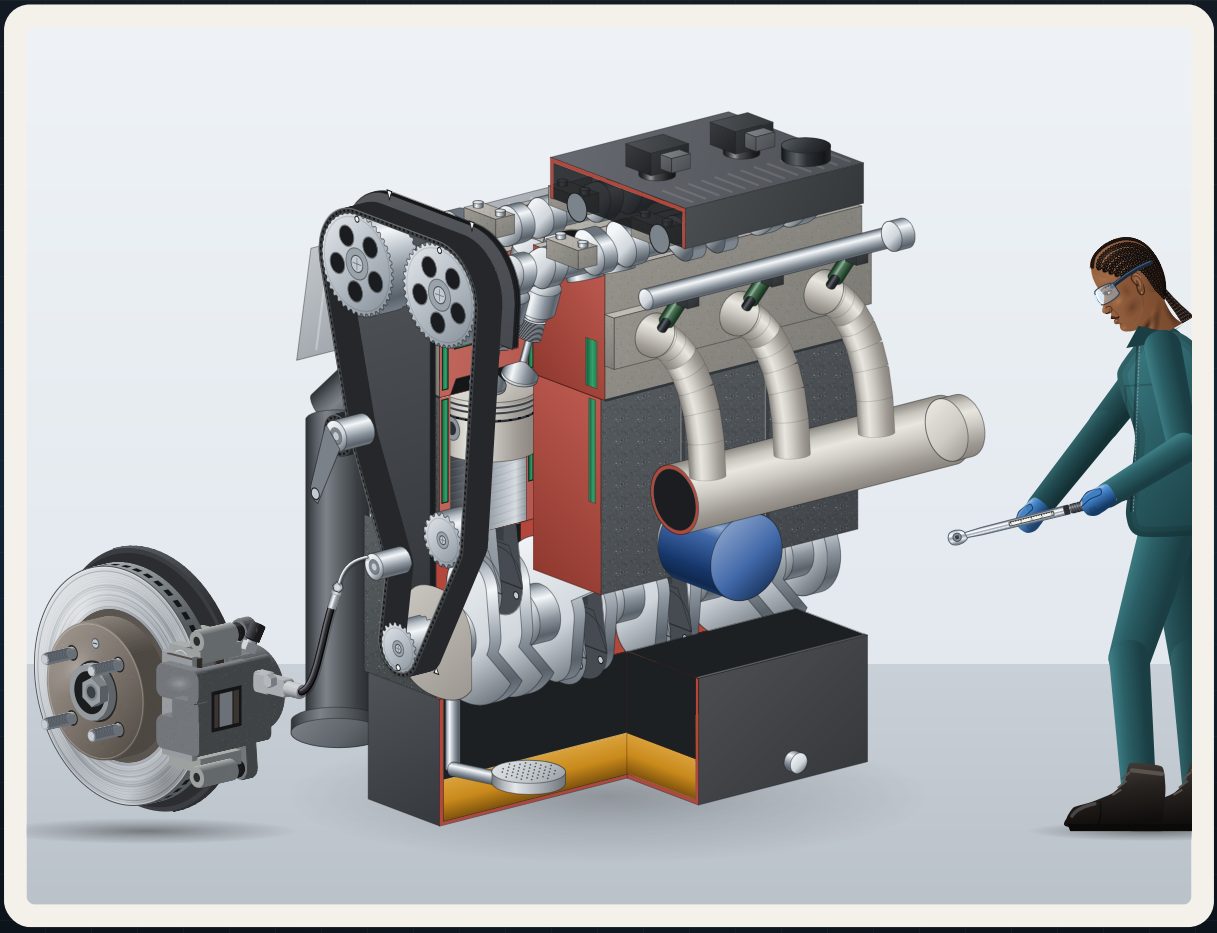
KNQF LEVEL 3 · TVET CDACC CYCLE 3

Motor Vehicle Mechanics Level 3

A Practical Study Guide for Kenyan Trainees

Petrol engine service and overhaul · Lubrication · Fuel injection · Brakes and ABS



Realistic pictures **Step-by-step tasks** **Mock assessments**

For trainees, RPL candidates, trainers and jua kali mechanics

Alphonce Kimutai Kirui

Aligned to the TVET CDACC Competency-Based Modular Curriculum, Motor Vehicle Mechanics KNQF Level 3

Motor Vehicle Mechanics Level 3

A Practical Study Guide for Kenyan Trainees

Vehicle Petrol Engine Maintenance · Vehicle Braking System Maintenance
Kenya National Qualifications Framework (KNQF) Level 3

Alphonce Kimutai Kirui

Motor Vehicle Mechanics 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 Motor Vehicle Mechanics, KNQF Level 3 (Cycle 3, programme code 0716254A, unit codes ENG/CU/AUT/CR/01–02/3/MA), and the assessment documents for Motor Vehicle Mechanic Level 3. Unit titles and codes are used for reference only. The book is not published, endorsed or approved by TVET CDACC, TVETA, NITA, NTSA or the Ministry of Education. Always follow the current official curriculum and your trainer's guidance.

Safety and accuracy notice

Garage work is dangerous. Vehicles falling from jacks, petrol fires, carbon monoxide from exhaust gas, hot coolant, brake dust and moving engine parts can kill or injure. The methods in this book are for training under the supervision of a qualified trainer. Never work under a vehicle held only by a jack. Brakes are a safety-critical system: a brake job must be checked by a competent person before the vehicle goes back on the road. Values given as "typical" or "example" (clearances, pressures, torque settings, service intervals and prices) are general guidance only and differ from engine to engine. Always follow the vehicle manufacturer's workshop manual, the current Kenyan laws and rules, workplace procedures 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. Vehicle and engine names are used only to describe common Kenyan vehicles; they are trademarks of their owners.

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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How to use this book

This book follows the Motor Vehicle Mechanics Level 3 course from start to finish. It covers the two core units and the industrial attachment, 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 both units share, such as workshop safety, housekeeping, tools and measuring instruments, are taught once in full in Part 1 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, workshop safety, first aid and housekeeping, tools and measuring instruments, engine science	Used throughout
2. Petrol engine	Unit 1: Vehicle Petrol Engine Maintenance (ENG/CU/AUT/CR/01/3/MA)	200 hours
3. Brakes	Unit 2: Vehicle Braking System Maintenance (ENG/CU/AUT/CR/02/3/MA)	100 hours
4. Attachment, work and assessment	Industrial attachment, garage jobs from job card to invoice, and getting ready to be assessed	240 hours of industrial attachment

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, cross-sections, flow diagrams and photographs.
- **Worked examples:** measurements, engine capacity, clearances, pressures, fuel and parts costs and job prices worked through with real numbers.
- **Practical tasks:** real workshop 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 fuel and materials, cut emissions, and handle used oil, fluids, filters and scrap correctly.

TRAINER'S TIP

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

COMMON MISTAKES

Errors trainees often make, and how to avoid them.

IN A KENYAN GARAGE

How the topic looks in real Kenyan workshops: jua kali garages, dealer workshops, matatu saccos, county and school fleets, and VTC workshops.

WORKED EXAMPLE

A calculation worked step by step with real numbers.

About the values and pictures

Every engine and every vehicle is different. Clearances, pressures, torque settings, capacities and service intervals in this book are **typical examples** to help you learn. On the job, always look up the correct value in the manufacturer's workshop manual or service data for that vehicle. The illustrations show realistic parts, tools and vehicles; cross-sections and flow diagrams use the same colours throughout: amber for engine oil, green for coolant, pale yellow for petrol, honey-brown for brake fluid, light blue for air and grey for exhaust. Blue arrows show movement or flow. Red marks a danger or a mistake; green marks the correct way. Some photographs show real places where people are not following every safety rule; the captions point this out.

PART 1

Getting Started

What a Level 3 motor vehicle mechanic does, how you will be trained and assessed, workshop safety, first aid and housekeeping, the tools and measuring instruments of the trade, and the engine science behind every job.

Chapter 1: Becoming a Motor Vehicle Mechanic in Kenya
Chapter 2: Workshop Safety, First Aid and Housekeeping
Chapter 3: Tools, Measuring Instruments and Workshop Equipment
Chapter 4: Engine Science for Mechanics

CHAPTER 1

Becoming a Motor Vehicle Mechanic in Kenya

WHAT YOU WILL LEARN

- What a Level 3 motor vehicle mechanic does and where mechanics work in Kenya.
- The main systems of a vehicle, and which of them this course covers.
- How competency-based training works: units, elements, performance criteria and certificates.
- How you will be assessed and where the marks are.
- Your career ladder after Level 3, including NITA trade tests and further levels.
- How to behave like a professional: customer care, job cards, honest parts, warranty and insurance basics.

Course introduction · Covers both units: ENG/CU/AUT/CR/01/3/MA and ENG/CU/AUT/CR/02/3/MA · Read before you start

Every day, thousands of Kenyan vehicles need a service, a brake job or an engine repair. Matatus run from dawn to late night, and Probox delivery cars cover hundreds of kilometres on murram roads. Behind every one of them is a mechanic. This chapter shows you what the job is, how this course will train and test you, and how to work like a professional.

Key words

Motor vehicle mechanic
A skilled worker who services, inspects and repairs vehicles.

CBET
Competency-based education and training: you learn and are assessed by doing real tasks to a set standard.

Unit of competency
One complete area of work, for example maintaining a vehicle braking system.

Element
One main task inside a unit, for example servicing the braking system.

Performance criteria
The points an assessor checks to decide if you did a task correctly.

Formative assessment
Tests done during training to check progress. They carry 60% of your unit score.

Summative assessment
The final assessment at the end of a unit. It carries 40% of your unit score.

Portfolio of evidence
A file of proof of your work: job cards, photos, measurement sheets and reports.

RPL
Recognition of prior learning: assessing skills a person already has from work, such as a jua kali fundi.

Job card
The written record of a job: customer, vehicle, request, findings, parts, labour and signatures.

Genuine part
A part sold by the vehicle maker. An OEM part is made by the company that supplies the maker.

Warranty
The maker's or seller's promise to repair faults free for a set time or distance, if the rules are followed.

1.1 What a Level 3 Mechanic Does

A Level 3 motor vehicle mechanic services and maintains vehicles, and repairs common faults **under supervision**. Under supervision means a more experienced mechanic or supervisor gives you the job, checks your work and signs it off. You are trusted with real vehicles, but you do not work alone on safety-critical jobs until you are experienced.

This course trains you for two big areas of work:

- **The petrol engine.** Routine service and inspection, overhaul (taking the engine apart, measuring, repairing and rebuilding it), the lubrication system and the fuel injection system.
- **The braking system.** Inspecting, servicing and repairing drum and disc brakes, bleeding the hydraulic system and finding brake and ABS faults.

A typical day includes oil and filter changes, new air filters and spark plugs, checking belts, hoses and the battery, fitting brake pads and shoes, bleeding brakes, measuring engine parts, filling in job cards, reporting to your supervisor and cleaning up (Figures 1.1 and 1.2).

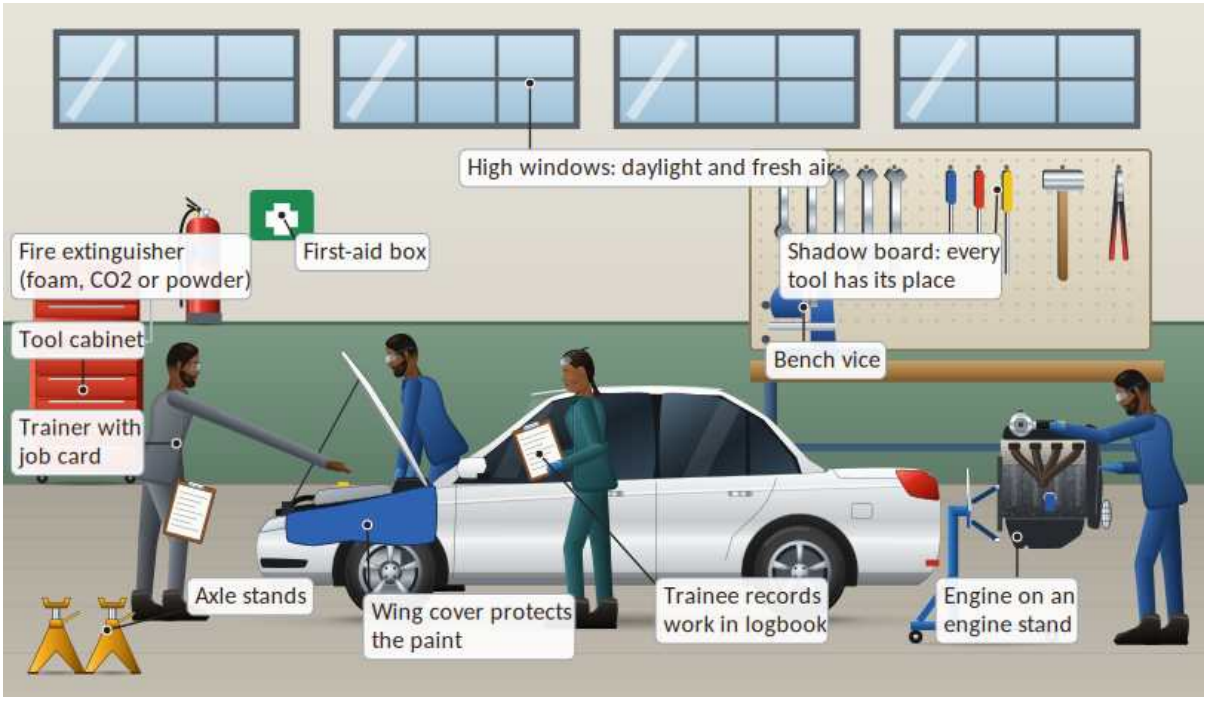


Figure 1.1 A VTC motor vehicle workshop. The trainer guides trainees at a car protected with a wing cover, while another trainee works on an engine mounted on a stand. Notice the safety equipment and the organised tools.



Figure 1.2 A mechanic at work in the engine bay of a small car. Notice the dust on every part: on murram roads dust gets into air filters, brakes and electrical connectors. For service work, nitrile gloves protect your skin from oil and fuel (Chapter 2).

Photo: Bembety, CC0, via Wikimedia Commons

1.2 Where Mechanics Work in Kenya

Kenya has many kinds of garage. Each one teaches you something different. During your industrial attachment (Chapter 15) you may work in one or more of these (Figure 1.3 shows a matatu, the workhorse of many sacco garages):

- **Jua kali and roadside garages.** Found in every town, from Kariakor and Gikomba in Nairobi to Kibuye in Kisumu. You learn speed and problem solving; keep your safety standards high even when others do not.
- **Dealer and franchise workshops.** The maker's manuals, special tools, scanners and strict procedures: good for learning modern vehicles.
- **Fleet garages.** County governments, schools, hospitals, NGOs and transport companies. Work is planned around service schedules and records.
- **Matatu sacco garages.** Matatus run long hours with heavy loads, so they need short service intervals and frequent brake work.
- **Quick-service centres.** Oil, filter, tyre and battery changes, often at fuel stations.
- **Spare-parts shops.** Mechanics with good parts knowledge make good sales staff and advisers.
- **Self-employment.** Your own garage or a mobile service. You need skills, tools, a good name and business sense (Chapter 15).

The work is growing. In 2024, 93,646 new road motor vehicles were registered in Kenya, and 72,868 of them were motorcycles, autocycles and three-wheelers (KNBS Economic Survey 2025). Most cars on our roads are imported used Japanese vehicles. Under the KEBS 8-year rule (Kenya Standard KS 1515), from 1 January 2026

only used vehicles first registered on or after 1 January 2019 can be imported. Newer imports have more electronics, timing chains, fuel injection and ABS. That is why this course teaches diagnosis with scanners and meters as well as spanners.



Figure 1.3 A matatu in Nairobi. Public service vehicles work hard all day with full loads, so their engines and brakes need frequent service. PSVs must also pass the NTSA inspection every year.

Photo: AEira-WMF, CC BY 4.0, via Wikimedia Commons

> **IN A KENYAN GARAGE**
>
> Ask any experienced fundi what he wishes he had learned early, and many will say "measuring and reading the manual". Guessing a clearance or a torque may work on an old engine, but it can destroy a modern engine within days. A mechanic who measures, records and explains is the one customers trust and fleets employ.

1.3 The Vehicle as a Set of Systems

A vehicle is easier to understand if you think of it as a group of **systems**. A system is a set of parts that work together to do one job. For example, the cooling system (radiator, water pump, thermostat, hoses and coolant) keeps the engine at the right temperature. When you diagnose a fault, you first decide which system it belongs to, then you test that system. Figure 1.4 and Table 1.1 show the main systems.

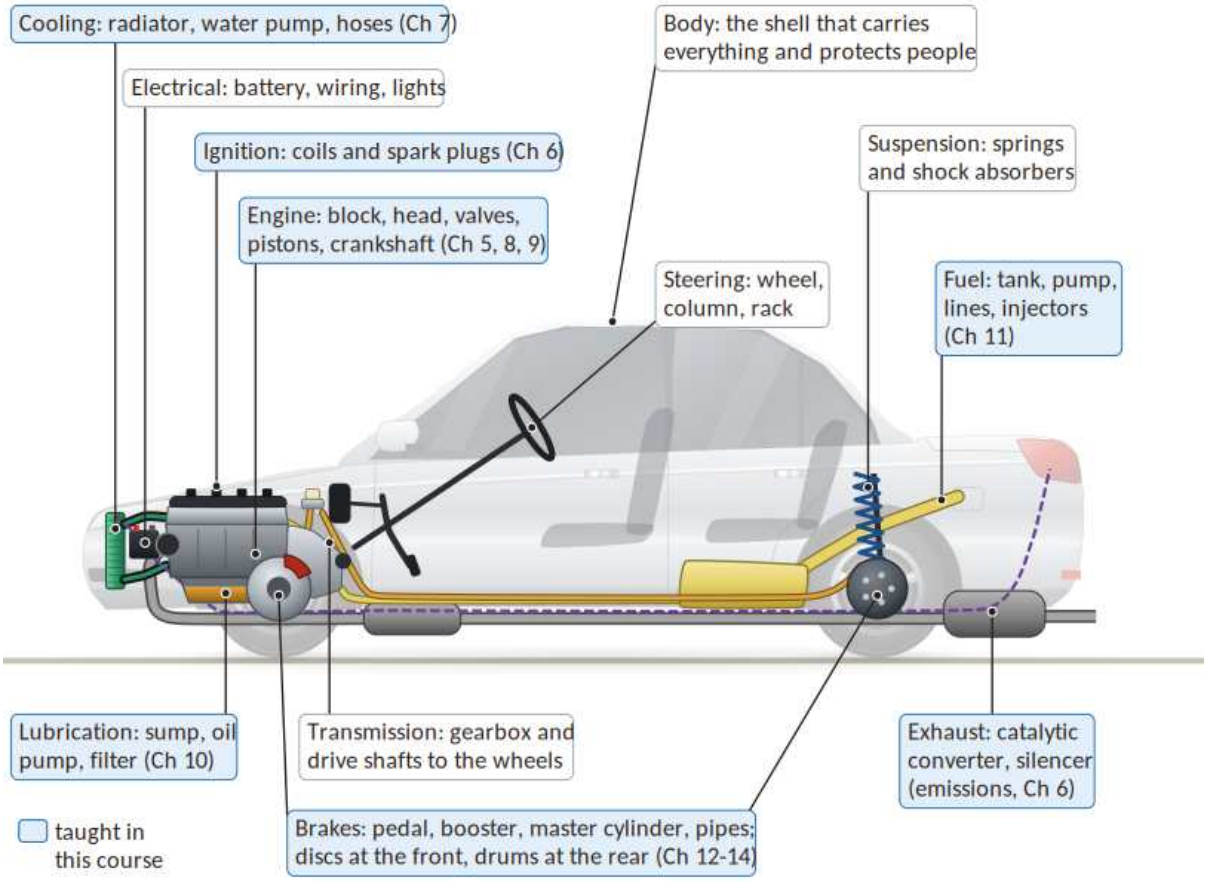


Figure 1.4 The main systems of a typical front-engine, front-wheel-drive small car (phantom view). Systems taught in this course are shown in blue boxes. Engine oil is amber, coolant green, petrol yellow and brake fluid honey-brown throughout this book.

Table 1.1 Vehicle systems and where this book teaches them

System	What it does	In this course?
Engine	Burns petrol and air to make power that turns the wheels.	Yes: Chapters 4, 5, 6, 8, 9
Cooling	Removes extra heat and keeps the engine at working temperature.	Yes: Chapter 7
Lubrication	Pumps oil between moving parts to reduce friction and wear.	Yes: Chapter 10
Fuel and emissions	Stores and delivers petrol, mixes it with air; cleans the exhaust gas.	Yes: Chapters 6 and 11
Ignition	Makes the spark that lights the mixture at the right moment.	Service and checks: Chapter 6
Brakes	Slow and stop the vehicle and hold it when parked.	Yes: Chapters 12, 13, 14
Transmission	Clutch or automatic gearbox, drive shafts: carries power to the wheels.	No (later levels)
Steering and suspension	Steer the vehicle; carry its weight and give a smooth, safe ride.	No (later levels)
Electrical	Battery, charging, starting, lights and wiring.	Battery checks only: Chapter 6
Body	The shell that carries all parts and protects the people inside.	No (body trades)

1.4 How This Course Trains You

1.4.1 Competency-based training

This course follows the TVET CDACC Competency-Based Modular Curriculum for Motor Vehicle Mechanics, KNQF Level 3 (Cycle 3, 2025). It is based on an **occupational standard**: a description, agreed with industry, of what a Level 3 mechanic must be able to do at work. In competency-based education and training (CBET) you are judged on whether you can **do** a job, safely and correctly, to the standard.

The standard is built in layers:

- A **unit of competency** is a whole area of work, such as "Maintain Vehicle Petrol Engine".
- Each unit has several **elements**: the main tasks, such as servicing the lubrication system.
- Each element has **performance criteria**: what the assessor will look for, such as the correct tools selected, the job done to the manual and the work area cleaned.

1.4.2 The course map

The full course has three parts. Unit 1, **Vehicle Petrol Engine Maintenance** (ENG/CU/AUT/CR/01/3/MA), takes 200 hours and is worth 20 credits. Unit 2, **Vehicle Braking System Maintenance** (ENG/CU/AUT/CR/02/3/MA), takes 100 hours and 10 credits. **Industrial attachment** (ENG/CI/AUT/CR/03/3/MA) is at least 240 hours in a real automotive workplace, worth 24 credits. In the curriculum the two units also carry ISCED codes 0716 251 01A and 0716 251 02A; the programme code is 0716254A.

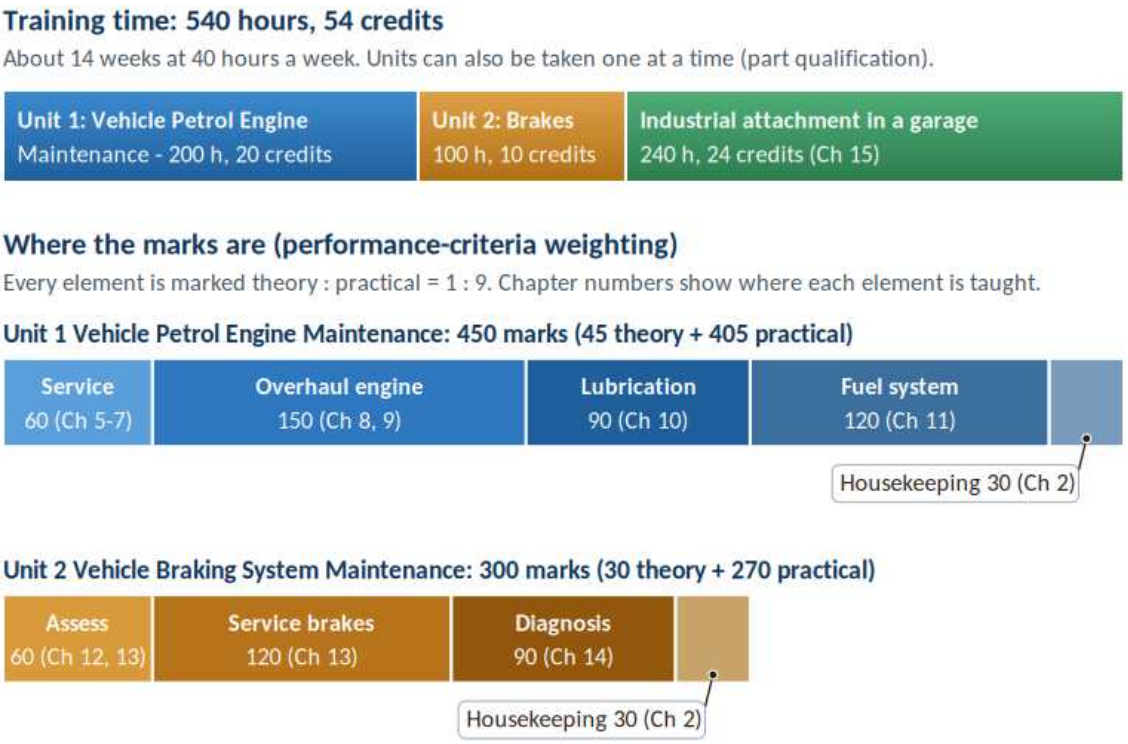


Figure 1.5 The course map. Top: how the 540 training hours are shared. Bottom: how the assessment marks are shared between the elements of each unit, and which chapters teach them.

You can take the whole qualification, or one unit at a time as a **part qualification**. To join, you need the Kenya Certificate of Primary Education or another qualification accepted by TVETA. Your trainer must hold at least a Level 5 automotive qualification, be licensed by TVETA, and be registered by EBK or KETRB.

1.4.3 Certificates you can earn

- **Certificate of Competency**: for each core unit you are found competent in.
- **Statement of Attainment**: for a single element that can be certified on its own.
- **Kenya National TVET Certificate in Motor Vehicle Mechanics Level 3**: when you are competent in all the units of the qualification.

TVET CDACC issues these certificates. **Recognition of prior learning (RPL)** lets an experienced fundi who learned on the job be assessed and earn part or all of the qualification without sitting through every lesson.

> **TRAINER'S TIP**
>
> From your first week, keep a portfolio of evidence: a file or folder with a copy of every job card you work on, your measurement sheets, short notes of what you did and what you learned, and photos taken with your phone (with your supervisor's permission, and never showing a customer's number plate or personal details). Assessors use this evidence, and so will employers when you look for work.

1.5 How You Will Be Assessed

Assessment in this course is mostly practical. These rules come from the curriculum:

- **Theory : practical = 10 : 90** for each unit. Theory is not a separate written paper. It is **integrated** into the practical and asked **orally**: while you work, the assessor asks why you do each step.
- **Formative 60%, summative 40%.** Assessments during training carry 60% of the unit score; the final assessment carries 40%.
- There will be **at least one formative assessment for every element** of a unit.
- Assessment may happen in a real workplace or in a VTC workshop set up like one. Evidence can include practical observation, projects, your portfolio of evidence, third-party reports (for example from your attachment supervisor) and written or oral questions.

Table 1.2 Competence ratings for each unit

Score or code	Rating	What it means for you
80-100	Attained Mastery	Excellent: you do the work well without help.
65-79	Proficient	Very good: you do the work correctly and confidently.
50-64	Competent	You meet the standard.
49 and below	Not Yet Competent	More practice is needed before you are assessed again.
Y	Malpractice or irregularity	Cheating or breaking assessment rules.
X	Absent	You did not attend the assessment.
CRNM	Course requirement not met	Something required, such as attendance or attachment, is missing.

Marks are shared between the elements by a **performance-criteria weighting** (Figure 1.5). Unit 1 carries 450 marks (45 theory and 405 practical) and Unit 2 carries 300 marks (30 theory and 270 practical). Engine overhaul (150) and brake servicing (120) carry the most marks. Housekeeping is marked in both units: a clean, safe, organised work area earns marks every time.

> **WORKED EXAMPLE 1.1: WORKING OUT A UNIT SCORE**
>
> Wanjiru's formative assessments in Unit 2 average 72%. In the summative assessment she scores 61%. What is her unit score and rating?
>
> 1. Formative share: 60% of 72 = 0.60 × 72 = 43.2
> 2. Summative share: 40% of 61 = 0.40 × 61 = 24.4
> 3. Unit score = 43.2 + 24.4 = **67.6**
> 4. 67.6 is between 65 and 79, so her rating is **Proficient**.
>
> Every formative assessment counts.

WORKED EXAMPLE 1.2: THEORY AND PRACTICAL MARKS IN ONE ELEMENT

The engine overhaul element carries 150 marks, shared theory : practical = 1 : 9. Otieno scores 11 in the oral questions and 108 in the practical. What are the theory and practical marks available, and what percentage did he score?

1. Theory marks = 150 × 1/10 = 15. Practical marks = 150 × 9/10 = 135.
2. Otieno's total = 11 + 108 = 119 out of 150.
3. Percentage = 119 ÷ 150 × 100 = **79.3%**

The practical carries nine times more marks than the oral questions.

1.6 Your Career Ladder

Level 3 is the first step. Each step up needs more training, experience and assessment (Figure 1.6):

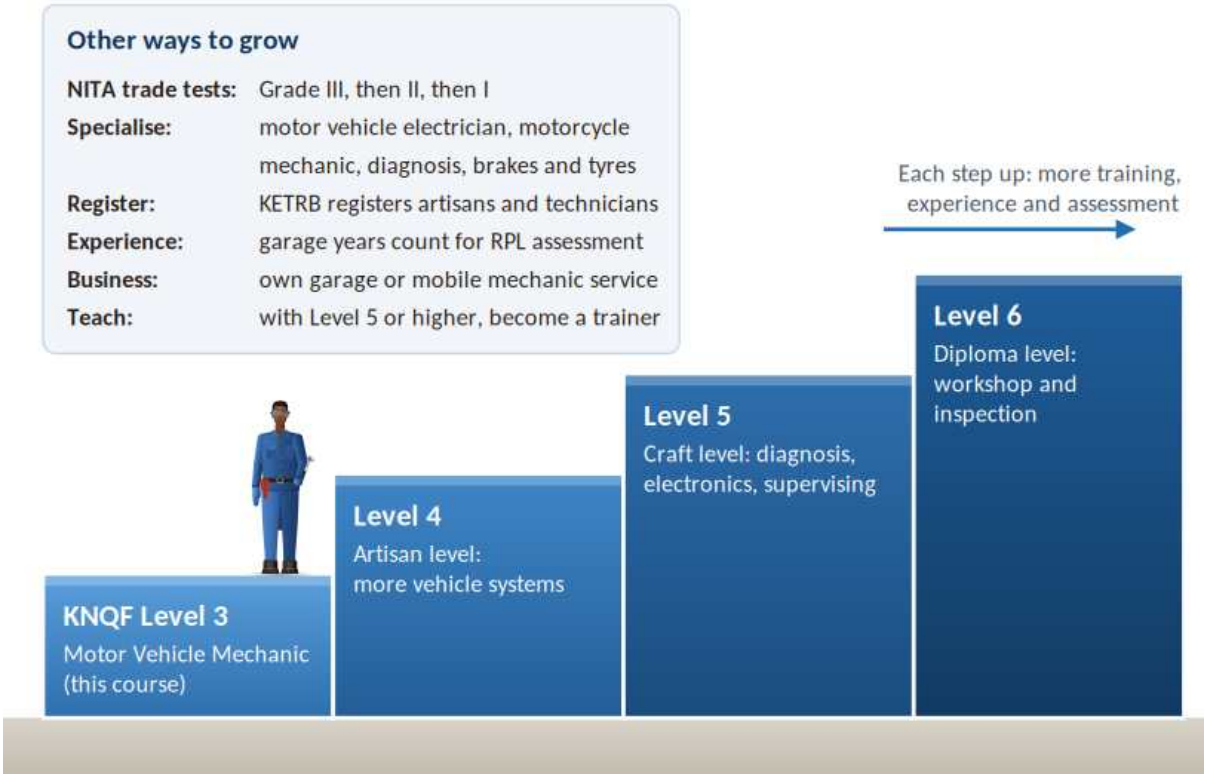


Figure 1.6 The career ladder for motor vehicle mechanics on the Kenya National Qualifications Framework (KNQF), with other ways to grow. Check the current CDACC list of qualifications with your trainer, because titles and levels are reviewed from time to time.

- **Levels 4, 5 and 6.** On the KNQF, Level 4 is artisan level, Level 5 craft level and Level 6 diploma level. Each adds more vehicle systems, then diagnosis, electronics and supervising others. A diploma can lead to workshop management, inspection and training roles. Course titles at each level vary, so check the current CDACC list.
- **Specialisms** such as auto-electrics and motorcycle repair.
- **NITA government trade tests** in Grades III, II and I. The April series covers all grades, the August series Grades II and I, and the December series Grade III only.

- **Registration.** KETRB (the Kenya Engineering Technology Registration Board) registers engineering technicians and technologists, including holders of artisan and craft qualifications.

Pay starts modestly and rises with skill and trust. In 2026, a casual Level 3 mechanic in a garage earns about KSh 1,000 a day. An employed mechanic earns about KSh 27,350 a month, which is the statutory minimum wage for an Artisan Grade III in Nairobi, Mombasa and Kisumu. Mechanics who can diagnose modern vehicles earn much more.

1.7 Working Like a Professional

Customers trust you with one of the most expensive things they own, and with their lives: a badly fitted brake pad or a loose wheel nut can kill. Professional behaviour means:

- **Safety first, always.** Your own, your colleagues' and the customer's (Chapter 2).
- **Honesty.** Tell the truth about what you find, what you fitted and what it costs. Never charge for work you did not do or parts you did not fit.
- **Following the manual.** Use the maker's workshop manual for every specification: clearances, torques, fluid types and capacities. The values in this book are typical examples to help you learn.
- **Respect for the vehicle.** Use seat, floor, steering-wheel and wing covers. Leave nothing inside.
- **Good communication.** Explain faults in simple words. Report test results to your supervisor. If a job will take longer, or a part is not available, say so early so the customer can be told.
- **Time and cost.** Work to the agreed time. A job finished right first time makes a profit and keeps the customer.
- **Permission before extra work.** If you find another fault, stop, report it and get the customer's approval before doing it.

1.7.1 The job card

The **job card** is the most important document in a garage. It is opened when a vehicle arrives and closed when it leaves. It protects the customer, the garage and you. A good job card shows who brought the vehicle, what they asked for, what you found, what was approved, what parts and time were used, and who did and checked the work. It is also proof of servicing for the vehicle's history and warranty. Figure 1.7 shows a completed job card.

> **COMMON MISTAKES**
>
> - Starting work before the job card is opened, so there is no record of existing scratches, fuel level or the customer's request.
> - Doing extra work "to help" without asking, then the customer refuses to pay.
> - Writing "serviced" instead of listing exactly what was done and which parts were fitted.
> - Throwing away old parts before the customer has had the chance to see them.
> - Guessing a torque or a clearance instead of looking it up in the manual.

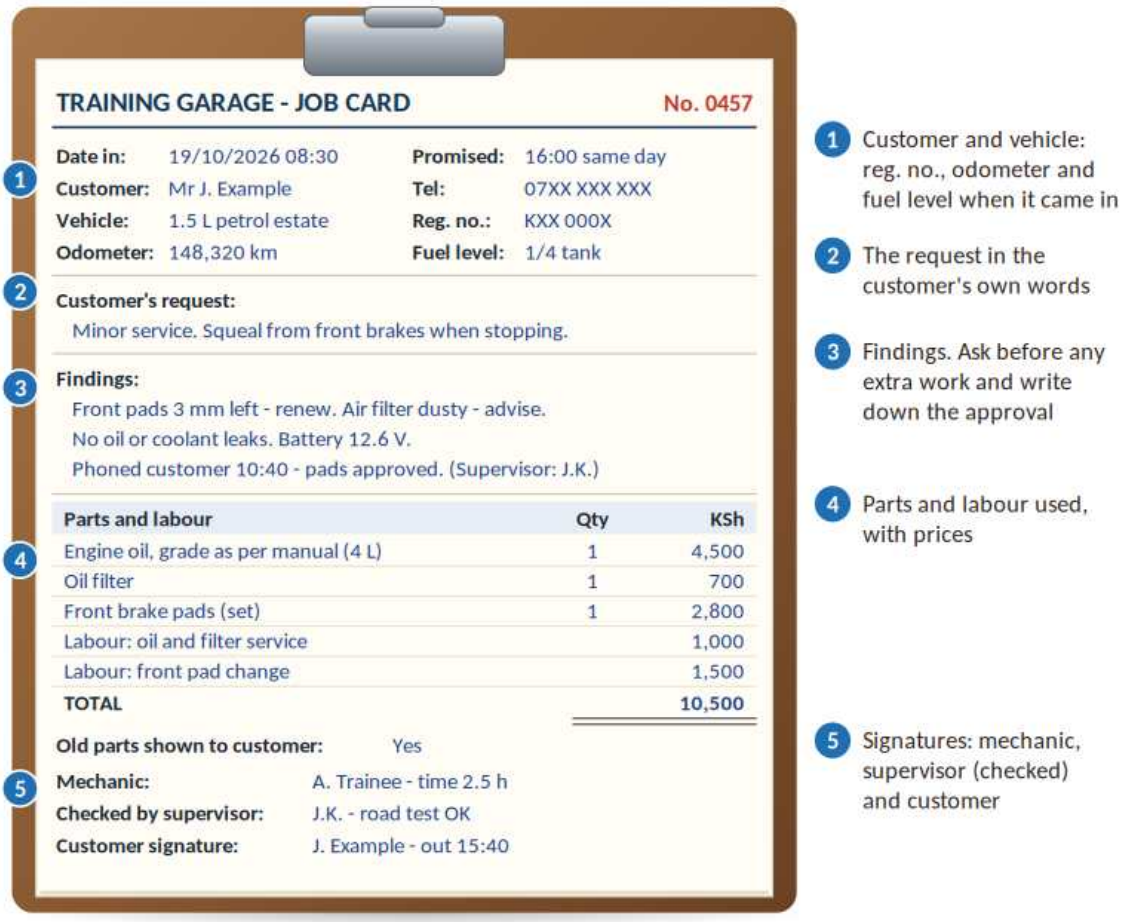


Figure 1.7 A completed job card for a minor service and front brake pads. Prices are approximate, 2026. Notice the telephone approval for the extra work and the supervisor's check before the car was released.

1.7.2 Honest parts: genuine, OEM, aftermarket, used and fake

Spare-parts shops sell several kinds of part. **Genuine** parts come from the vehicle maker. **OEM** (original equipment manufacturer) parts are made by the companies that supply the maker, often to the same standard. **Aftermarket** parts are made by other companies; good brands are fine, poor ones wear out fast. **Used or ex-Japan** parts come from dismantled vehicles; they can be good value for body parts but are risky for brake and safety parts. **Counterfeit** (fake) parts copy the look and packaging of a good brand but not its quality. A fake brake pad or oil filter can fail and cause an accident or destroy an engine.

Warning signs of a fake: a very low price, poor printing or spelling on the box, no part number, and a part lighter or rougher than the one you removed. Buy from trusted suppliers, keep receipts, and tell the customer which kind of part you fitted (Chapter 15).

1.7.3 Warranty and insurance basics

A new vehicle, and some vehicles from dealers, come with a **warranty**. The maker or seller repairs certain faults free for a set time or distance, as long as the vehicle is serviced at the intervals in the service book, with the specified oil, fluids and parts, and each service is recorded. Work not done to the maker's specification can make the warranty invalid, and the garage may be blamed. So follow the manual exactly, use the correct parts and fluids, record everything on the job card and in the service book, and keep the receipts.

Most vehicles are also covered by **motor insurance**. Accident repairs paid by an insurer are normally agreed with the insurer's assessor before work starts. While a customer's vehicle is in the garage, the garage is responsible for it: report any damage, even a small scratch, to your supervisor at once. Never drive a customer's vehicle without your supervisor's permission and a valid driving licence.

> **SAFETY FIRST**
>
> On your first day in any workshop, find the fire extinguishers, the first-aid box, the emergency exits and the emergency numbers (999 or 112; Kenya Red Cross 1199). Wear your overall and safety boots at all times. Never go under a vehicle that is held up only by a jack. Never start or move a vehicle without permission. Chapter 2 teaches workshop safety, first aid and housekeeping in full; read it before you do any practical work.

1.8 The Rules and Bodies You Will Meet

You do not need to know these laws and organisations in detail at Level 3, but you should know who they are:

Table 1.3 Bodies and laws a Kenyan mechanic should know

Body or law	Why it matters to you
TVET CDACC	Develops your curriculum, assesses you and issues your certificates.
TVETA	Registers and licenses training institutions, trainers and programmes.
NITA	Runs the government trade tests, Grades III, II and I.
KETRB	Registers engineering technicians and technologists.
NTSA and the Traffic Act (Cap. 403)	Vehicle inspection and roadworthiness. Brakes are tested on a roller brake tester at NTSA inspection.
KEBS	Kenya standards, including KS 1515 for imported used vehicles.
EPRA	Sets maximum fuel prices each month and regulates fuel quality.
NEMA and EMCA	Environmental law. Used oil is hazardous waste and must go to a NEMA-licensed handler.
OSHA 2007 and DOSHS	Workplace safety and health. Workshops must be registered with DOSHS.
Kenya Motor Repairers Association (KEMRA)	A garage owners' association that worked with KEBS on motor repair standards.

Rules change. At the time of writing, annual NTSA inspection applies to PSVs, commercial, school and government vehicles; enforcement for private cars was suspended. Check NTSA's current requirements.

GREEN TIP

A well-serviced engine with a clean air filter, good spark plugs and the right oil uses less fuel and makes less pollution, and brakes that do not drag save fuel too. Kenya produces over 30 million litres of used engine oil a year: catch every drop and send it to a licensed collector, never into soil or drains. Vehicles are changing too: electric vehicle registrations rose from 1,378 in 2022 to 39,324 in 2025, mostly electric boda bodas. Keep learning.

Practical task 1.1: Receive a vehicle, open a job card and identify its systems

Tools and equipment

- A workshop vehicle (engine cold)
- Wheel chocks
- Seat, floor, steering-wheel and wing covers
- Torch
- Owner's manual or workshop manual

Materials

- Blank job cards and a pen
- Your logbook or portfolio file
- Clean rag

Steps

1. Put on your overall and safety boots. Collect the keys and a blank job card from your trainer.
2. Check that the vehicle is on level ground, the handbrake is on and the gear is in P (automatic) or first gear (manual). Place chocks at a rear wheel.
3. Fit the seat, floor and steering-wheel covers before you sit in the vehicle.
4. Fill in the top of the job card: date and time, customer details (use your trainer as the customer), registration number, odometer reading and fuel level. Note any warning lamps when the ignition is switched on, with your trainer present.
5. Walk around the vehicle. Record existing scratches, dents, cracked glass and tyre condition.
6. Open the bonnet and fit a wing cover. Without touching anything hot or moving, find and point out to your trainer: the engine, radiator and coolant reservoir, battery, engine oil dipstick and filler cap, air filter box, brake fluid reservoir, and the exhaust manifold.
7. With a torch, look through the wheels (do not go under the vehicle) and identify whether each wheel has a disc or a drum brake.
8. Write the "customer's" request on the job card in their own words. Let your trainer check and sign the card. Put a copy in your portfolio.

Safety

- Do not start the engine or move the vehicle unless your trainer tells you to.
- Keep fingers away from the cooling fan: on many cars the electric fan can start without warning, even with the engine stopped.
- Do not crawl under the vehicle; it is not supported on axle stands.
- Close the bonnet gently and check that it has latched.

Chapter summary

- A Level 3 mechanic services, maintains and repairs vehicles under supervision; this course covers the petrol engine and the braking system.
- Mechanics work in jua kali garages, dealer workshops, fleet and county garages, matatu saccos, quick-service centres, parts shops and their own businesses.
- The course has Unit 1 (200 h), Unit 2 (100 h) and industrial attachment (240 h): 540 hours and 54 credits.
- Assessment is 90% practical, with theory asked orally; formative counts 60% and summative 40%; 50 and above is competent.
- Unit 1 carries 450 marks and Unit 2 carries 300; overhaul and brake servicing carry the most, and housekeeping is marked in both.
- Professionals are safe, honest and careful: they open a job card, follow the manual, get approval before extra work and protect the customer's warranty.

Check your competence

- [ ] I can describe the work of a Level 3 motor vehicle mechanic.
- [ ] I can name at least five kinds of workplace for mechanics in Kenya.
- [ ] I can point out the main systems on a real vehicle and say which ones this course covers.
- [ ] I can calculate a unit score from formative and summative results and give the rating.
- [ ] I can open and complete a job card correctly.
- [ ] I can explain the difference between genuine, OEM, aftermarket, used and counterfeit parts.

Practice questions

1. List five places in Kenya where a Level 3 mechanic can work, and one thing you would learn in each.
2. Explain, with an example from the braking unit, the difference between a unit of competency, an element and a performance criterion.
3. Name the three parts of the course with their hours. How many weeks will the whole course take at 40 hours a week?
4. Kamau's formative assessments in Unit 1 average 58% and his summative score is 70%. Calculate his unit score and give his rating.
5. The brake servicing element carries 120 marks. How many marks are for theory and how many for practical?
6. What do the codes Y, X and CRNM mean on a result slip?
7. Name four vehicle systems taught in this course and three systems that are not.
8. (Oral) A customer brings a nearly new car that is still under the maker's warranty for its service. What must you do to protect the warranty?
9. A casual mechanic earns KSh 1,000 a day and works 22 days in a month. An employed mechanic earns KSh 27,350 a month. What is the difference in monthly pay?
10. (Practical) Receive a workshop vehicle and open a complete job card for it, including condition, fuel level, odometer and the customer's request.

PART 2

Vehicle Petrol Engine Maintenance

Unit 1: Vehicle Petrol Engine Maintenance. How the petrol engine works, routine service and inspection, the cooling system, dismantling, measuring and rebuilding an engine, the lubrication system and the petrol fuel injection system.

Chapter 5: How the Petrol Engine Works
Chapter 6: Routine Engine Service and Inspection
Chapter 7: The Cooling System
Chapter 8: Dismantling the Engine and Inspecting the Parts
Chapter 9: Servicing Engine Parts, Reassembly and Refitting
Chapter 10: The Lubrication System
Chapter 11: The Petrol Fuel System and Fuel Injection

CHAPTER 6

Routine Engine Service and Inspection

WHAT YOU WILL LEARN

- Explain why engines are serviced on a schedule, and when a vehicle needs the shorter "severe service" interval.
- Prepare a vehicle and work area for a service, and carry out a full under-bonnet inspection.
- Read the oil dipstick, spark plugs and exhaust smoke and say what each one tells you about the engine.
- Replace the engine oil and filter, air filter, fuel filter, spark plugs and drive belt, and top up coolant and brake fluid correctly.
- Carry out a dry and wet compression test, and interpret the results.
- Record the service, cost it and dispose of the waste correctly.

Unit: Vehicle Petrol Engine Maintenance · ENG/CU/AUT/CR/01/3/MA · Learning outcome 1 (service vehicle petrol engine; inspection and replacement of service parts) · Part of the 60 hours of this outcome

Most engine work in a Kenyan garage is not an overhaul but a service: oil and filter, a look under the bonnet, maybe plugs or an air filter. A good service keeps an engine alive for many years; a loose drain plug can destroy it in a day. This chapter teaches the routine service, the engine's warning signs and the compression test.

Key words

Service schedule
The maker's list of what to check or replace, and when, given in kilometres and months.

Severe service
Hard use (dust, short trips, heavy loads, much idling) that needs shorter service intervals.

Minor service
A routine service: oil and filter change plus the standard checks and top-ups.

Sealing washer
A soft copper, aluminium or fibre washer under the drain plug. It crushes to seal and is renewed each time.

Spark plug gap
The distance between the centre and ground electrodes of a spark plug, where the spark jumps.

V-ribbed belt
A flat drive belt with small V-shaped ribs that drives the alternator, water pump and other parts.

Compression test
A test that measures the highest pressure each cylinder makes when the engine is cranked.

Wet test
A repeat compression test with a little oil added to the cylinder, to tell ring wear from valve leakage.

6.1 Why engines need routine service

Oil breaks down with heat and fills with soot, fuel and metal particles. Filters block, plug electrodes burn away, and belts and hoses harden and crack. A **service** replaces these items before they fail and checks everything else for early trouble. The maker's **service schedule** gives each item a limit in kilometres and in months: do it at whichever comes first, because oil ages even in a car that stands.

6.1.1 Normal and severe service

Most manuals give a normal schedule (clean roads, long steady trips) and a **severe service** schedule for hard use. Most Kenyan vehicles need the severe one: murram dust blocks air filters; matatus and taxis idle all day; short town trips never warm the engine, so water and fuel collect in the oil; and hills and heavy loads work the engine hard. Table 6.1 gives typical intervals; always follow the manual.

Table 6.1 Typical routine service items and intervals (examples only - check the manual)

Item	What to do	Typical interval
Engine oil and oil filter	Replace both together	Mineral 5,000 km; semi-synthetic 7,500 km; synthetic 10,000 km; or 6 months, whichever is first
Air filter	Inspect; replace when dirty	Every service; replace sooner on murram roads
Spark plugs	Inspect or replace	Per manual; copper much sooner than iridium
Fuel filter	Replace	Per manual (in-tank filters last long)
Drive belts, hoses, battery	Inspect; replace if worn	Every service
Timing belt (belt engines only)	Replace with tensioner	About 100,000 km or per manual (chains: inspect only)
Coolant	Check level and condition	Every service; replace per manual
Brake fluid	Check level; replace	Check every service; replace every 2 years (Chapter 13)

> **IN A KENYAN GARAGE**
>
> Customers are often told to "use thick oil" such as 20W-50 in an engine built for 0W-20 or 5W-30. Explain politely that the right grade is on the filler cap or in the manual, and that thick oil flows slowly at a cold start, when most wear happens.

6.2 Preparing for the service

1. **Open a job card** (registration, odometer, complaints, approved work) and **look up the data**: oil grade and quantity, filter number, plug type and gap, torques.
2. **Position the vehicle** on firm, level ground in a ventilated area: handbrake on, park or first gear, wheels chocked. To go underneath, lift it as in Chapter 2 and use axle stands. Never work under a car held only by a jack.
3. **Protect the vehicle** with wing, seat and steering-wheel covers.
4. **Wear PPE:** overall, safety boots, nitrile gloves, and goggles under the car or with fluids.
5. **Lay out tools and materials**, including a new drain-plug washer.

> **SAFETY FIRST**
>
> Engine oil and coolant can scald you for an hour or more after a drive. Never open the radiator cap or expansion tank cap on a hot engine: the coolant is under pressure and can spray out boiling. Keep hands, hair and rags away from the fan and belts; an electric fan can start on its own with the engine off. Run engines only outside or with an exhaust extraction hose: exhaust carbon monoxide cannot be seen or smelt.

6.3 Under-bonnet inspection

Inspect before you change anything, in a fixed order, and report every fault before the car leaves. Figure 6.1 shows the inspection points in a typical small-car engine bay; Figure 6.2 shows a real one.

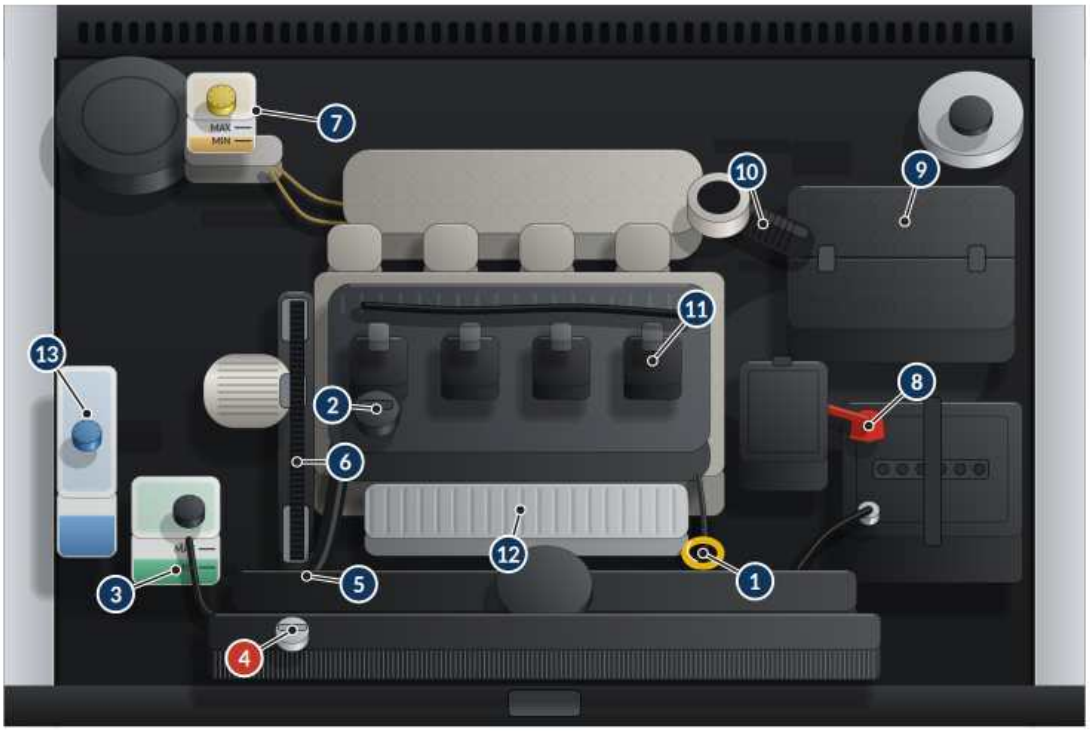


Figure 6.1 Engine bay of a right-hand-drive small car with a transverse engine, seen from the front (radiator at the bottom, driver's side on your left). Work round the numbered points in the same order every time.



Figure 6.2 A real engine bay: a four-cylinder petrol engine fitted lengthways in a pick-up. Find the oil filler cap, the yellow dipstick handle, the radiator cap, the brake fluid reservoir and the high-tension leads.

Photo: Killua.V8, CC BY-SA 3.0, via Wikimedia Commons

6.3.1 Leaks

Look on top of the engine, below it and on the ground. Wipe a suspect area clean and recheck after a run. Identify the fluid:

- **Engine oil:** amber to black, slippery; from the cam cover gasket, filter, drain plug, sump gasket or crankshaft seals.
- **Coolant:** green, red, pink or blue, sweet smell; at hose ends, radiator, water pump, expansion tank.
- **Petrol:** strong smell, evaporates fast. A fire risk: do not start the engine.
- **Brake fluid:** clear to honey, slightly oily, often under the master cylinder. A safety fault (Chapter 13).

6.3.2 Belts and hoses

Most small engines use one **V-ribbed belt** to drive the alternator, water pump and air-conditioning compressor. With the engine off, twist the belt and look at the ribs with a torch. Replace it if the ribs are cracked, glazed (shiny and hard, so it slips and squeals), frayed at the edges (check pulley alignment) or oil-soaked (fix the leak too). An **automatic tensioner** has marks that show when the belt has stretched too far; other belts are set to the deflection in the manual. A loose belt slips and stops charging; an over-tight one wears the pump and alternator bearings.

Squeeze each coolant hose with the engine cold. A good hose is firm and springy. Replace one that is spongy, hard and cracked, swollen or rubbed through.

6.3.3 Battery condition

Check the battery is clamped, the case is not cracked or swollen, and the terminals are tight and clean. Remove corrosion with a wire brush and baking soda solution (goggles and gloves). With a multimeter on DC volts, a fully charged battery reads about **12.6 V at rest** (engine off for some hours); with the engine running, the charging voltage should be about **13.8–14.7 V**. A low reading at rest means the battery needs charging and testing; a charging voltage outside the range points to the alternator.

6.3.4 Engine oil level and condition

The vehicle must be on level ground, with the engine stopped for a few minutes so the oil drains back to the sump. Pull the dipstick, wipe it, push it fully home, pull it out again and read it. The oil film should end between the MIN and MAX marks (Figure 6.3).

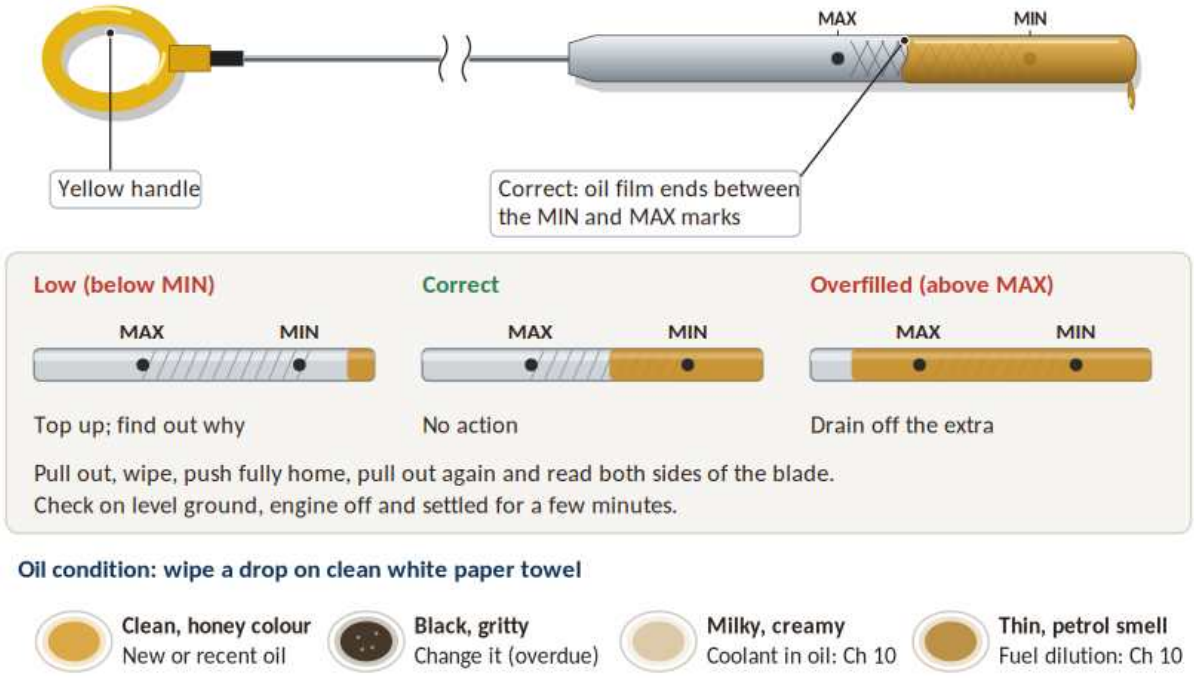


Figure 6.3 Reading the dipstick: level (top and middle) and condition (bottom).

- **Low oil** starves the bearings. Top up with the correct grade, then find out why: leak or burning.
- **Overfilled oil** is also harmful. The crankshaft whips it into foam, which the pump cannot pump properly, and oil may be pushed out through seals. Drain off the extra.
- **Condition:** black, gritty oil is overdue for a change. Milky, creamy oil means coolant is getting in, often through a failed head gasket. Thin oil that smells of petrol shows fuel dilution (Chapter 10).

6.3.5 Coolant and brake fluid levels

With the engine **cold**, coolant in the expansion tank should be between MIN and MAX and clear; rusty or oily coolant needs investigating (Chapter 7). Brake fluid falls slowly as pads wear; a sudden drop means a leak.

6.3.6 Fuel lines

Follow the fuel pipes and hoses to the fuel rail. Look for wetness, a petrol smell, cracked hose and loose clips. Any fuel leak must be repaired before the car is returned (Chapter 11).

6.3.7 Air filter and intake

Hold the element up to a light. If no light shows through, or the pleats are full of dust and insects, replace it. Never wash a paper element or blow it hard with compressed air: the paper tears. Check the intake hose for cracks and loose clips: air leaking in after the airflow sensor upsets the mixture, and dust wears the cylinders and rings.

6.3.8 Exhaust manifold and emissions

Look for cracks, broken studs and soot marks (a leaking gasket) at the exhaust manifold, and listen for ticking with the engine running. Then read the tailpipe smoke (Table 6.2).

Table 6.2 Exhaust smoke colour and what it usually means

Smoke	Usual meaning	Next check
None visible (warm engine)	Normal	-
Blue or blue-grey	Oil burning: worn rings or bores, valve stem seals or guides, blocked PCV	Oil use, plugs, compression test (Section 6.5)
Black	Rich mixture: blocked air filter, leaking injector, faulty sensor	Air filter, plugs, trouble codes (Chapter 11)
White, thin, clears when warm	Condensation on a cold morning - normal	None
White, thick, sweet smell, stays when warm	Coolant entering the cylinders: head gasket or cracked head	Coolant level, pressure test (Chapter 7), compression test

6.3.9 Spark plugs and ignition coils

Modern engines have **coil-on-plug** ignition (one coil sitting on each plug); older ones use a coil pack and high-tension (HT) leads. Check coils for cracks and "tracking" (thin black burn lines where the spark leaks to earth), connectors for a locked fit, and leads for cracked insulation. Remove the plugs (Section 6.4.4), keep them in order and compare them with Figure 6.4.



Figure 6.4 Reading spark plugs: the insulator nose and electrodes show how each cylinder is burning.

Measure each gap with a wire-type gauge. Typical gaps are **0.8 mm (copper/nickel)** and **1.1 mm (iridium)**; check the manual. On many plug codes the number after the dash is the gap ("-11" = 1.1 mm). Worn plugs have rounded electrodes and a wider gap, which needs more voltage and causes misfires.

6.4 Replacing service parts

6.4.1 Engine oil and oil filter

Drain the oil warm, not hot: it flows faster and carries more dirt out. Always change the filter too (Figure 6.5).



Figure 6.5 Oil and filter change sequence.

1. Remove the oil filler cap so the oil drains freely. With the car safely supported, put the drain pan under the plug. Unscrew the last turns by hand while pushing the plug inwards, then pull it away quickly. Drain until it only drips.
2. Remove the filter with a filter wrench and check its rubber seal came off with it. An old seal left on the engine under the new one causes a sudden, large leak.
3. Wipe the mounting face, oil the new filter's seal, and screw it on by hand until the seal touches; then tighten by hand the amount printed on the filter (often about three-quarters of a turn).
4. Fit the drain plug with a **new sealing washer** and torque it to the manual value.
5. Refill with the correct grade and quantity (typically about 3.7 L with filter for a 1.3–1.5 litre Toyota engine; check the manual), pouring a little less at first.
6. Refit the cap, start the engine and check that the oil lamp goes out within a few seconds. Check the plug and filter for leaks.
7. Stop, wait a few minutes, check the dipstick and top up to just below MAX. Reset the service reminder and fix a service sticker.

GREEN TIP

Kenya produces over 30 million litres of used engine oil a year, and used oil is hazardous waste under the Environmental Management and Co-ordination (Waste Management) Regulations, 2006. Pour it into a labelled, sealed drum, never into drains or soil. Drain old filters upside down for 12–24 hours and keep them separately for the NEMA-licensed collector.

6.4.2 Air filter

Wipe out the air box with a damp cloth. Fit the new element the same way round as the old one, with its sealing edge seated evenly all round, and close every clip; a badly seated filter lets dust go round it.

6.4.3 Fuel filter

Some vehicles have an in-line fuel filter; many modern small cars have it inside the tank with the pump (Chapter 11). Before opening any fuel line on an injected engine you must **depressurise** the system, because the fuel is held at about 300–350 kPa (3–3.5 bar, about 44–51 psi):

1. Remove the fuel pump fuse or relay (see the fuse box lid or manual).
2. Start the engine and let it run until it stalls, then crank it for 2–3 seconds more.
3. Switch off and disconnect the battery negative terminal.
4. Wrap a rag round the joint before you open it to catch the last drops.

Fit the new filter with its flow arrow towards the engine, using new clips or washers where specified. Refit the fuse or relay and battery, switch the ignition on (not start) two or three times to build pressure, and check for leaks.

SAFETY FIRST: PETROL

No smoking, flames or sparks. Work in a ventilated area, catch spilt fuel, and put petrol-soaked rags in a closed metal bin. Keep a foam, CO_2 or dry powder extinguisher within reach; never use water on a petrol fire.

6.4.4 Spark plugs

Work on a **cold engine**: a hot plug can strip or seize in an aluminium head.

1. Unplug and remove the coils (pull HT leads by their boots), labelled by cylinder.
2. Blow dirt out of the plug wells (goggles on), then remove the plugs and keep them in order.
3. Check each new plug's gap. Adjust copper plugs by bending the ground electrode only; never lever against the fine centre electrode of a pre-gapped iridium plug.
4. Start each plug by hand (or with a short rubber hose on its terminal) to avoid cross-threading.
5. Tighten to the manual torque, or to the turn angle printed on the box for a new gasket-type plug.

6.4.5 Drive belts

Photograph the belt route first. Lever the automatic tensioner against its spring and slip the belt off a smooth pulley. Spin each pulley by hand: roughness or wobble means a worn bearing. Fit the new belt with every rib in its groove, release the tensioner slowly, and run the engine to check the belt runs straight and quietly. A manually adjusted belt is set to the manual's tension and rechecked after a short run.

6.4.6 Topping up coolant and brake fluid

Coolant: engine cold only. Top up the expansion tank to MAX with the same type of coolant, usually a 50/50 mix with clean water or ready-mixed. Plain water gives no corrosion protection and boils sooner; never mix coolant types.

Brake fluid: clean the cap before opening. Top up to MAX only with the type printed on the cap (usually DOT 4) from a sealed bottle, because brake fluid absorbs water from the air. Never add oil, water or DOT 5 silicone fluid to a DOT 3 or DOT 4 system. It damages paint and eyes: wear goggles. A very low level means worn pads or a leak (Chapter 13).

COMMON MISTAKES

- Reusing the drain-plug washer, or overtightening the plug and stripping the sump thread.
- Fitting a new filter over the old seal left on the engine ("double gasket").
- Using whatever oil grade is on the shelf, or not checking the dipstick after filling.
- Removing spark plugs from a hot aluminium head, or cross-threading a new plug.
- Topping up brake fluid from an old, open bottle, or with the wrong fluid.
- Forgetting to refit the oil filler cap or a coil connector.

WORKED EXAMPLE 6.1: COSTING A MINOR SERVICE

A 1.5-litre saloon needs an oil and filter change. Compare a mineral-oil service with a synthetic-oil service at a jua kali garage (book prices, approximate 2026).

Mineral oil: oil 4 L KSh 3,200 + filter KSh 700 + labour KSh 1,000 = **KSh 4,900**. Interval 5,000 km, so the cost per km = 4,900 ÷ 5,000 = **KSh 0.98 per km**.

Synthetic oil: oil 4 L KSh 7,000 + filter KSh 700 + labour KSh 1,000 = **KSh 8,700**. Interval 10,000 km, so the cost per km = 8,700 ÷ 10,000 = **KSh 0.87 per km**.

Over 20,000 km: mineral 4 × 4,900 = KSh 19,600; synthetic 2 × 8,700 = KSh 17,400. The dearer oil is cheaper per kilometre, but only if the manual allows the longer interval.

Practical task 6.1: Carry out a minor engine service

Tools and equipment

- Trolley jack, axle stands and chocks (or a pit or lift)
- Socket set, drain plug key, oil filter wrench, torque wrench
- Spark plug socket, gap gauge, multimeter, drain pan, funnel

Materials

- Correct oil, oil filter and new drain plug washer
- Air filter and spark plugs if due; coolant and DOT 4 brake fluid
- Rags, job card, covers, service sticker

Steps

1. Open the job card and prepare the vehicle and work area as in Section 6.2.
2. Inspect in the order of Figure 6.1, including battery voltage at rest; record every finding.

3. Change the oil and filter as in Section 6.4.1, with a new washer and correct torque.
4. Inspect or replace the air filter and spark plugs (Sections 6.4.2 and 6.4.4).
5. Run the engine: check the oil lamp, leaks and charging voltage; then check the dipstick.
6. Top up coolant (cold) and brake fluid if needed; fit the service sticker and report faults.
7. Segregate the waste, and clean and store the tools.

Safety

- Axle stands on firm ground, never a jack alone; open the cooling system only when cold.
- Nitrile gloves and goggles; run the engine only with ventilation or an extraction hose.

6.5 The compression test

On the compression stroke both valves are closed and the rising piston squeezes the air. If the rings, valves and head gasket seal well, the pressure is high; if one leaks, it is low. The test tells you whether an engine with low power, misfire, blue smoke or high oil use needs a simple repair or an overhaul (Chapter 8). The **compression tester** is a gauge on a hose with an adaptor that screws into the plug hole; a non-return valve holds the highest reading until you press the release button (Figure 6.6).

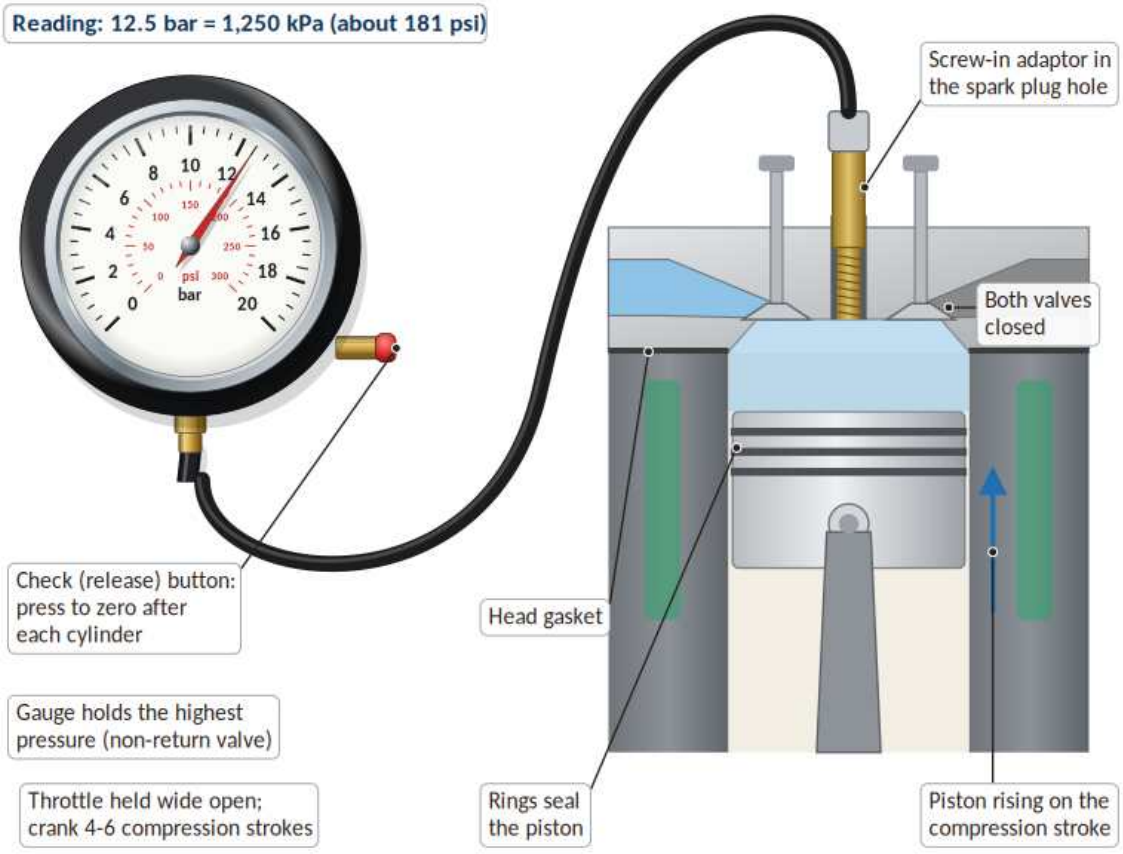


Figure 6.6 Compression test. The gauge holds the highest pressure: here 12.5 bar (1,250 kPa, about 181 psi), a good reading.

6.5.1 The dry test

The dry test is done with nothing added to the cylinders and the same conditions for each: engine warm, battery fully charged, all plugs out, throttle wide open, and the same number of compression strokes (usually 4–6; Practical task 6.2). In a good cylinder the needle jumps high on the first stroke. If it starts low and creeps up, suspect the rings; if it rises a little and stops, suspect a valve.

6.5.2 The wet test

If a cylinder reads low, squirt about 15 mL (one tablespoon) of clean engine oil through the plug hole and test it again. The oil briefly seals the rings, but it cannot seal a valve or a head gasket. So:

- if the reading **rises a lot**, the rings or bore are worn;
- if the reading **stays low**, a valve is not sealing (burnt, bent or with no clearance) or the head gasket is leaking.

Do not add more oil: oil does not compress, and too much can lock the engine (hydraulic lock) and bend a connecting rod.

6.5.3 Reading the results

A healthy petrol engine typically gives about **1,000–1,300 kPa (145–190 psi)**, depending on its compression ratio. Just as important, the lowest should be within **10%** of the highest (some makers allow 15%; check the manual). Figure 6.7 shows how to interpret the readings.

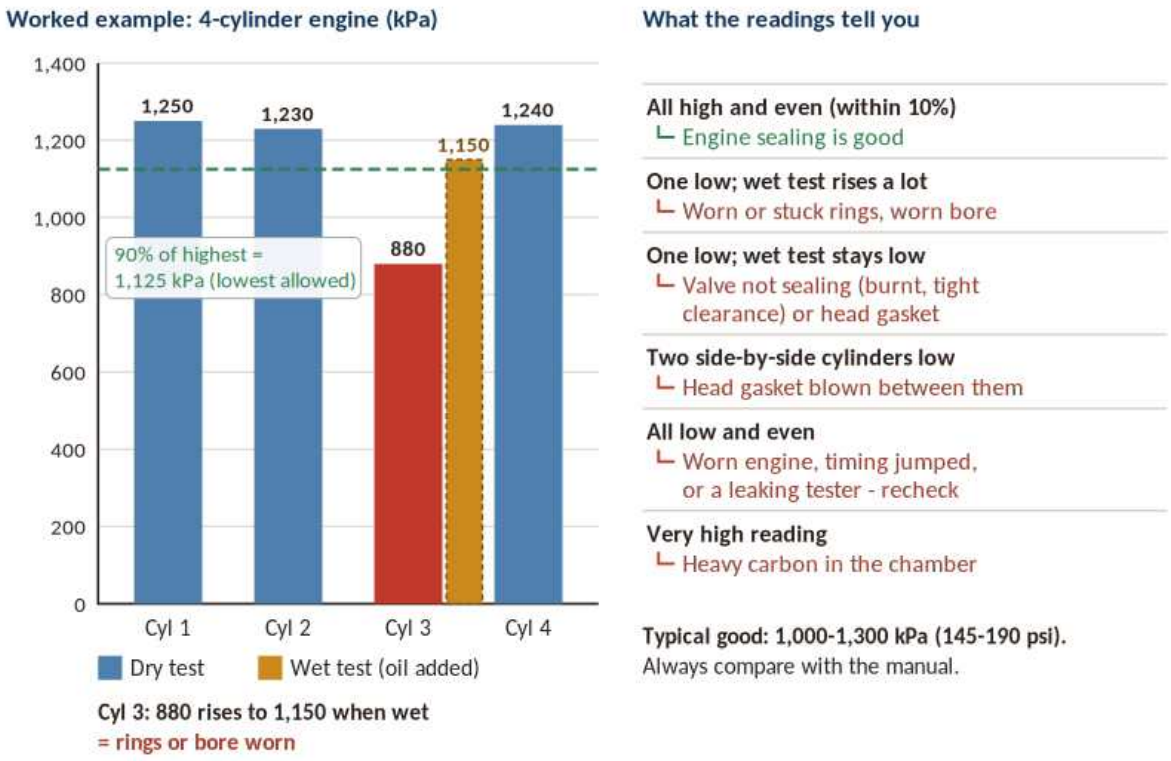


Figure 6.7 Interpreting compression readings. Left: the results of Worked example 6.2; cylinder 3 is below the 90% line and rises when oil is added, so its rings or bore are worn. Right: a guide to the common patterns.

WORKED EXAMPLE 6.2: COMPARING CYLINDER COMPRESSIONS

A Probox with blue smoke gives these dry readings: cylinder 1 1,250 kPa; cylinder 2 1,230 kPa; cylinder 3 880 kPa; cylinder 4 1,240 kPa. The manual allows a 10% difference.

Step 1: Highest reading = 1,250 kPa (cylinder 1). Lowest = 880 kPa (cylinder 3).

Step 2: Percentage difference = (highest − lowest) ÷ highest × 100 = (1,250 − 880) ÷ 1,250 × 100 = 370 ÷ 1,250 × 100 = **29.6%**. This is far more than 10%, so cylinder 3 has a fault.

Step 3: Lowest allowed = 90% of 1,250 = 0.9 × 1,250 = **1,125 kPa**. Cylinders 1, 2 and 4 are above this; cylinder 3 is not.

Step 4: Wet test on cylinder 3: 1,150 kPa. The reading rose by 1,150 − 880 = 270 kPa, so the oil sealed the leak. Diagnosis: worn or stuck rings in cylinder 3, which also explains the blue smoke.

Units: 1,250 kPa = 12.5 bar (100 kPa = 1 bar) ≈ 12.5 × 14.5 = 181 psi.

TRAINER'S TIP

Record readings cylinder by cylinder, dry and wet, with the number of strokes. Two side-by-side cylinders low: think head gasket. All four low and even on a badly running engine: think timing, such as a jumped belt or stretched chain.

Practical task 6.2: Carry out a dry and wet compression test

Tools and equipment

- Compression tester with the correct adaptor
- Spark plug socket, ratchet, torque wrench, blow gun
- Battery charger if needed; OBD-II scanner

Materials

- Clean engine oil and a measuring syringe
- Rags, job card, covers

Steps

1. Warm the engine to operating temperature and switch off. Handbrake on, park or neutral, wheels chocked.
2. Disable the fuel pump (fuse or relay) and the ignition (unplug the coil connectors). Blow dirt from the plug wells and remove all the plugs.
3. Screw the tester adaptor into cylinder 1 by hand only; its O-ring seals it. Connect the gauge.
4. Hold the accelerator fully down and crank for 4–6 compression strokes until the needle stops rising. Record the reading and number of strokes, press the release button, and repeat for each cylinder.
5. Calculate the percentage difference between the highest and lowest readings. For any low cylinder, add about 15 mL of oil, retest and record the wet reading.
6. Refit the plugs (torque), coils and fuse or relay. Clear any fault codes caused by the test, start the engine, then write your diagnosis on the job card.

Safety

- The engine is hot: gloves, and keep clear of the exhaust manifold.
- Disable ignition and fuel before cranking: a coil off its plug but still connected can give a dangerous shock and a spark near fuel vapour.
- Keep hands and the tester hose away from the fan and belt while cranking.

6.6 Finishing the job

Check your own work: caps fitted, levels correct, no leaks, no tools or rags in the engine bay, warning lamps out, covers removed. Complete the job card (parts, readings, faults), service book and sticker. Finish with housekeeping (Chapter 2): absorb spills; used oil to the drum, drained filters to their bin, coolant and brake fluid to their own sealed containers, oily rags to the lidded bin, old plugs to scrap metal.

Chapter summary

- Service by kilometres or months, whichever comes first; most Kenyan vehicles need the severe-service schedule.
- Inspect in a fixed order: leaks, belts and hoses, battery, fluids, fuel lines, air filter, exhaust, plugs and coils.
- Oil, plugs and exhaust smoke show the engine's condition: blue smoke means oil, black a rich mixture, thick white coolant.
- Change oil and filter together with a new drain-plug washer; depressurise before opening fuel lines; change plugs cold.
- Good compression is typically 1,000–1,300 kPa with all cylinders within 10%; a wet test separates ring wear from valve or gasket leaks.
- Record the work and send waste to NEMA-licensed handlers.

Check your competence

- [ ] I can explain normal and severe service with Kenyan examples.
- [ ] I can prepare a vehicle safely and carry out and record an under-bonnet inspection.
- [ ] I can read the dipstick, spark plugs and exhaust smoke.
- [ ] I can replace oil and filter, air filter, fuel filter, spark plugs and a drive belt, and top up coolant and brake fluid correctly.
- [ ] I can carry out and interpret a dry and wet compression test.
- [ ] I can cost a service and complete the job card and sticker.

Practice questions

1. Give four Kenyan driving conditions that call for severe service, and the effect of each.
2. Why check the oil on level ground, a few minutes after stopping? Give one harm of low oil and one of too much oil.
3. Describe how a carbon-fouled plug and an oil-fouled plug look, and give one likely cause of each.
4. A customer's car gives thick white smoke with a sweet smell even when the engine is warm. What is the likely cause, and which two checks would you make next?
5. Oral question: why should a drain-plug sealing washer be renewed, and why must the old filter seal be checked when the filter is removed?
6. List the steps to depressurise the fuel system of a port-injected engine before replacing an in-line fuel filter.
7. A 1.5-litre engine gives these dry readings: 1,180, 1,200, 1,150 and 960 kPa. (a) Calculate the percentage difference between the highest and lowest. (b) What is the lowest reading allowed by a 10% rule? (c) Cylinder 4 gives 970 kPa wet. What is the likely fault? (d) Convert 1,200 kPa to bar and psi.
8. A customer uses semi-synthetic oil (4 L KSh 4,500), an oil filter (KSh 700) and jua kali labour (KSh 1,000). The interval is 7,500 km and she drives 1,500 km a month. (a) What does each service cost? (b) After how many months is the next service due? (c) What is the cost per kilometre?
9. Why is a compression test done with a warm engine, a charged battery and the throttle wide open?
10. Practical: carry out Practical task 6.1 on a training vehicle and complete the job card and sticker; your trainer observes and signs.

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It also includes 100+ realistic illustrations, cross-sections and photos, 28 practical tasks, practice questions with answers, two mock assessments marked like the CDACC tool, a 219-term glossary, a quick reference of typical values, and logbook and measurement-sheet pages.

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