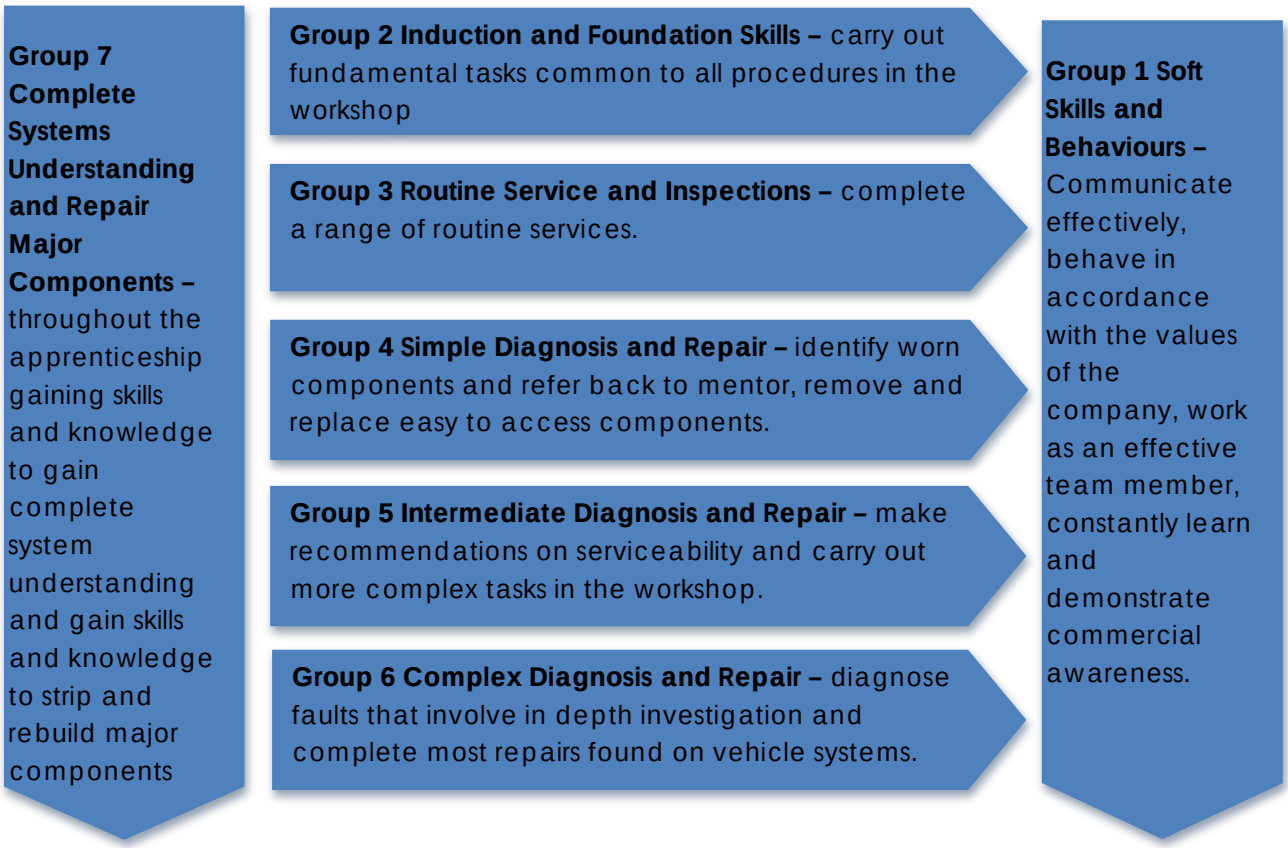
Automotive Retail Motor Vehicle Service and Maintenance Technician (Light Vehicle) Training Specification

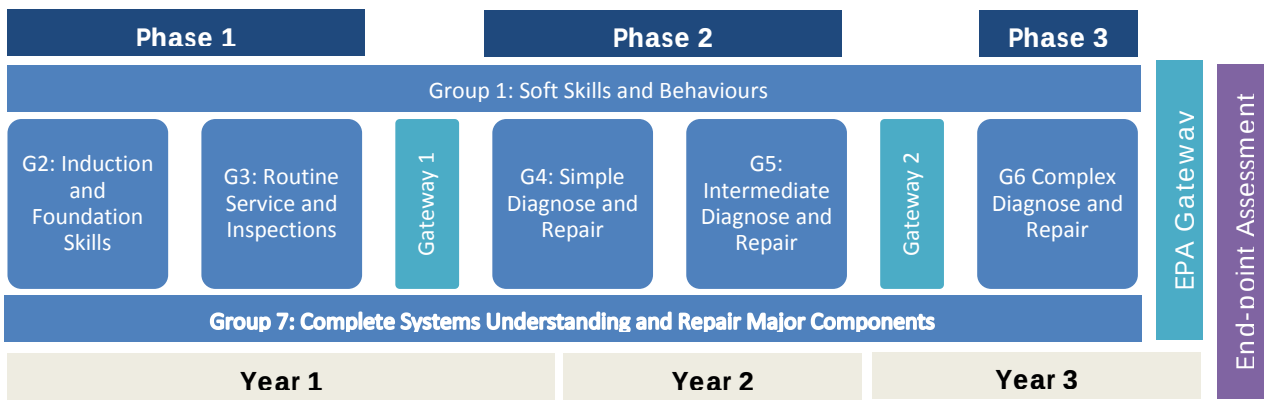
Competence is achieved by continually applying skills and knowledge taught. This is best achieved if the knowledge and skills are applied immediately after they are taught. The Assessment Strategy is designed to assess knowledge, competence and behaviours that mirror the natural progression within the workplace.

The training specification is designed to give a clear indication of what the Light Vehicle apprentice needs to be taught and trained at each stage of development. It covers the knowledge, skills, competence and behaviours that the apprentice will be assessed on during and at the end of their apprenticeship. There are 7 groups:



Groups 1 and 7 run alongside groups 2 to 6; as the apprentice gains the competences required to gain complete understanding they will develop effective behaviours to be a valued team member. Groups 2 to 6 would normally be completed in the order presented.

Employers are recommending that on-programme assessment commences with an initial assessment prior to entry on to the programme and is then followed by two gateways that are positioned at key transition points in the programme. The gateways will provide structure to a robust process of on programme assessment that will be agreed between the employer and their training provider.



The apprentice should pass each Gateway before progressing to the next phase of the programme.

At the start of the apprenticeship the training provider should identify a suitable workplace mentor who is in a position to make a judgement on the apprentice's progress. The mentor should be briefed on their responsibilities.

Phase 1

The mentor should complete a Logbook that confirms that the apprentice can:

- Contribute to the maintenance of a safe and efficient workshop and adheres to business processes.
- Carry out fundamental tasks associated with removal and replacement procedures on a vehicle.
- Use ICT to create emails and word-processed documents; copy and paste across documents; save and print documents.
- Use ICT to carry out web based searches.
- Obtain inspection schedules, data and recall information.
- Use equipment normally found in the workplace relating to servicing and inspections.
- Reset service indicator.
- Complete a range of services and inspect and prepare a vehicle to the required quality standard for handover to the customer.
- Identify common faults found during routine service and inspections.
- Report faults using company procedures.
- Complete documentation following workplace procedures.
- Test the function of a wide range of fitted accessories.

Gateway 1

1. The Mentor will review the Logbook and confirm that the apprentice has achieved all of the requirements in Phase 1.

2. The Employer and Training Provider will score the apprentice against the Soft Skills and Behaviour framework. Two points will be awarded if the apprentice has achieved the Quality and three points if they have achieved a Distinction in the particular Quality.
   There is no requirement to achieve every quality. The apprentice should score a minimum of 50% in Working Together & Building Trust and consider the areas where they have scored zero and use this to drive improvement.

3. The apprentice carries out a multi choice online knowledge test that covers knowledge taught in Training Groups 2 & 3.
   - The test will have 50% of the questions covering module 2 and 50% covering module 3.
   - The test should last 1 hour and have 40-50 questions.
   - The candidate should achieve 60% in each section

4. The apprentice attends a skills assessment conducted by the Training Organisation. The assessment should be timed, during which the apprentice should:
   - Carry out a Vehicle Inspection.
     i. Tick sheets are to be provided
     ii. 10 faults are to be set up on the vehicle.
   - Carry out task(s) that include:
     i. Extracting seized and broken bolts.
     ii. Drilling, cutting, filing, tapping, riveting, joining metals and plastics.

5. The Mentor, supported by the Training Provider, should review the results from the Behaviour Assessment, Knowledge Test and Skills Test and decide on:
   - Pass – Apprentice is on target and can continue to the next stage
   - Referred – Apprentice is not on target but with support can get back on track. Apprentice moves on to the next stage but is reassessed in the areas they have failed on.
   - Fail – If the apprentice continues they will not be able to reach the standard required for the end test so will need to retake the training again.

Phase 2

The apprentice should <u>fully document</u> in a Logbook four repairs, from different systems, that involve two phase removal and replacement or removal of other components to access the repair.

Gateway 2

1. The Mentor will review the online Logbook and confirm that the apprentice can consistently:
    - Complete repairs that involve two phase removal and replacement or removal of other components to access the repair.
    - Identify causes of common faults associated with two phase removal and replacement and recommend suitable further actions.
2. The Employer and Training Provider will score the apprentice against the Soft Skills and Behaviour framework. Two points will be awarded if the apprentice has achieved the Quality and three points if they have achieved a Distinction.
   There is no requirement to achieve every quality. The apprentice should score a minimum of 50% in Working Together & Building Trust and 33% in the other three sections. They should also consider the areas where they have scored zero and use this to drive improvement.
3. The apprentice carries out a multi choice online knowledge test that covers knowledge taught in Training Groups 4 & 5.
    - The knowledge test should have 35% of the questions covering module 4 and 65% covering module 5.
    - The test should last between 1 – 1½ hours and have 50 – 60 questions.
    - The candidate should achieve 60% in each section
4. The apprentice attends a skills assessment conducted by the Training Organisation. The assessment should be completed within 110% of manufacturers recommended time and consist of:
    - Skills task(s) that have a total manufacturer's repair time of a minimum of 3 hours and involve diagnosing simple faults and two phase removal and replacement or removal of other components to access the repair.
    - Professional discussion about one of the four tasks from Phase 2
5. Mentor, supported by the Training Provider, should review the results from the Behaviour Assessment, Knowledge Test and Skills Test and decide on:
    - Pass – Apprentice is on target and can continue to the next stage
    - Referred – Apprentice is not on target but with support can get back on track. Apprentice moves on to the next stage but is reassessed in the areas they have failed on.
    - Fail – If the apprentice continues they will not be able to reach the standard required for the end test so will need to retake the training again.

During Phase 3

The apprentice should build a separate Logbook that showcases work they have carried out and behaviours achieved:

- A service or inspection where faults have been found;
- Four repairs, from different systems, that involve complex (procedure involves a range of skills that need to be carried out in a specific methodical order) diagnosis and repair;
- How the apprentice has achieved each of the Criteria listed in the Behaviours (see Assessment Plan Annex B – Grading Criteria: Assessment Method 3: Professional Discussion Part 1).

The evidence can be of any form the apprentice chooses, including:

- Job Cards;
- Technicians Reports;
- Written accounts;
- Witness testimonies;
- Images;
- Short clips of voice recordings or videos (the apprentice will be responsible for supply this in a suitable format previously agreed with the Assessment Organisation);
- Repair manuals/specifications.

The Logbook shall be submitted to the EPA Organisation at the End-Point Assessment Gateway. The logbook should contain evidence of:

The evidence will be used as a basis of the Professional Discussion and must be sufficient to show how each of the criteria have been met in the Assessment Plan Annex B – Grading Criteria: Assessment Method 3 Parts 1 and 2.

Groups

Group 1 Soft Skills and Behaviours

Competence Required

The apprentice will:

- Unit 1.1 Working Together & Building Trust
    - Routinely collaborate with others to achieve targets.
    - Maintain positive working relationships even though the other person may be very different.
    - Accept the tasks given, quickly recognise whether they have the ability to complete them and seek help appropriately.
    - Demonstrate honesty when working as part of a team.
    - Carry out tasks with consideration for others.
    - Seek support & help from colleagues when appropriate.
    - Flag up difficulties in sufficient time to take remedial action.
    - Provide feedback to others at the appropriate moment and support it with relevant evidence.
    - Actively contribute to team goals.
- Unit 1.2 Customer Experience & Communication
    - Use a clear voice and polite tone. Speak confidently and use different types of questions appropriately.
    - Complete internal documentation as required using legible, grammatically correct written communication for internal e-mails/repair order completion.
    - Exhibits appropriate body language and attitude when dealing with colleagues and customers.
    - Be trusted and deal with customers with honestly and with fairness.
    - Able to converse with others regarding technical issues explaining technical terminology when asked.
    - Approach colleagues and customers with respect and follow the appropriate procedures when dealing with a problem. Quickly refer difficult issues to others.
    - Wear appropriate clothes at all times and present a clean appearance especially when meeting customers.
- Unit 1.3 Making it Happen & Commercial Awareness
    - Contribute ideas, think them through in detail and their implications and present them clearly.
    - Take a systematic approach to problem solving. Know their limitations and when best to escalate issues.
    - Know what they need to do and the roles of people close to them. Use confidently systems and processes relevant to the role. Comply with legislation.
    - Complete documentation with a clear understanding of its purpose.
    - Understand the business side of managing a workshop and take steps to improve its overall efficiency.
    - Be punctual and routinely meet deadlines. Think about the tasks ahead and how they should be prioritised. React well to the unexpected.
    - Confidently break down complex tasks and allocate time and resources appropriately
    - Understand the environmental impact of the materials they use and take steps to minimise waste.
    - Understands the importance of PPE. Good housekeeping in the workshop. Routinely operate safely without the need for reminders.

- Unit 1.4 Learn to Learn & Striving for Excellence
    - Independently and regularly reflect on progress and set goals and priorities for future development.
    - Share their knowledge and skills when requested.
    - Demonstrate an interest in learning and actively use the opportunities to extend their knowledge and skills that are put in front of them.
    - Provide reports on my progress when asked.

Group 2 Induction and Foundation Skills

Group Overview

This is the initial stage of the apprenticeship; it is designed to get the apprentice to the point where they can assist others to complete simple, process driven tasks in the workshop, gaining experience and learning while contributing to the productivity of others.

Competence Required

The apprentice will have developed the competence to:

- Contribute to the maintenance of a safe and efficient workshop and adheres to business processes.
- Carry out fundamental tasks associated with removal and replacement procedures on a vehicle:
    - Using common tools, torque wrench and measuring instruments.
    - Removing and replace bolts, setscrews, studs, hoses, electrical connectors, trim, clips, drive belts, gaskets.
    - Extracting seized and broken bolts.
    - Handling fluids.
    - Drilling, cutting, filing, tapping, riveting, joining metals and plastics.
    - Carrying out basic procedures with the diagnostic machine.
    - Jacking and lifting a vehicle.

Knowledge and Understanding Required

The apprentice will understand:

- Unit 2.1 Soft Skills and Behaviours
    - Health and safety: legislation; policy, hazards; risks, signs; location and use of safety equipment; prohibited areas and equipment; reporting procedures; implications of not following procedures.
    - The structure of the organisation: lines of communication.
    - Employment law: own rights and responsibilities; responsibilities of the employer; support available as an employee.
    - The importance of vehicle protection.
    - How to ensure workplace security.
    - Environmental procedures and the implications of not following them.
    - Equal opportunities & diversity legislation and benefits of following E&D procedures.
    - How to communicate effectively: body language; rapport; barriers to communication; confirming understanding.
    - Core values and the impact of positive and negative traits.
    - Standards of behaviour defined by own workplace.
    - The purpose of improving own performance, ways of improving own performance and identifying opportunities that are available.

- Unit 2.2 Tools
    - Maintenance procedure and understand why they are carried out.

The apprentice will have knowledge of:

- Unit 2.3 Vehicle
    - The location and function of main components of a vehicle.

Group 3 Routine Services and Inspections

Group Overview

On completion of this group the apprentice should be able to complete a good range of routine services. They will not be expected to do some of the more complex tasks found on large services such as timing belt change. They should be able to identify the difference between good and possible faulty components but, at this stage, they will not be expected to make any decisions on whether a component is serviceable or if any future action is to be taken.

Competence Required

The apprentice will have developed the competence to:

- Use ICT to create emails and word-processed documents; copy and paste across documents; save and print documents.
- Use ICT to carry out web based searches.
- Obtain inspection schedules, data and recall information.
- Use equipment normally found in the workplace relating to servicing and inspections.
- Reset service indicator.
- Consistently complete a range of services and inspect and prepare a vehicle to the required quality standard for handover to the customer.
- Identify common faults found during routine service and inspections.
- Report faults using company procedures.
- Complete documentation following workplace procedures.
- Test the function of a wide range of fitted accessories.

Knowledge and Understanding Required

The apprentice will understand:

- Unit 3.1 Soft Skills and Behaviours:
    - How the business works from an operational perspective: organisational structure and interrelationship.
    - Industry structure: manufacturers; large dealer groups; non-franchised; Vehicle Inspectorate; professional bodies and organisations.
    - How to develop positive working relationships: importance of; listening to the views of others; honouring commitments.
    - Commercial awareness: importance of promoting products and services to customers; factors that influence customers.
    - Self-evaluation: when, how and why to carry out; opportunities in the Automotive Industry; career development.
- Unit 3.2 Electrical Systems:
    - Requirements for an electrical circuit: voltage; current; resistance; Ohms law; Watts law direction of current flow; continuity; switches.
    - Connection between volts, amps & resistance; volt drop.

    - Series and parallel circuits: current flow; voltage of components.
    - Electrical calculations.
- Unit 3.3 Servicing:
    - Where to obtain inspection schedules, data and recall information.
    - The need to use the correct lubricants for the vehicle.
    - Why and how to carry out checks usually carried out at routine services and inspections.
    - Importance of following procedures when reporting faults.
    - Legal requirements for tyres, brakes, steering, suspension and lighting.
    - Which components should be checked during a road test.
- Unit 3.4 Accessories:
    - The implications and legal requirements of fitting accessories and carrying out modifications.

Group 4 Simple Diagnosis and Repair

Group Overview

At this stage the apprentice will be able to identify obvious broken or heavily worn components and will refer all other diagnoses to their mentor. Repair will be limited to removing and replacing components that are easy to access and require limited skill.

Competence Required

The apprentice will have developed the competence to:

- Remove and replace a range of components that involve simple procedures (components that have easy access and no special tools or procedures are needed).
- Measure components and carry out test procedures for common faults associated with simple removal and replacement procedures.

Knowledge and Understanding Required

The apprentice will understand:

- Unit 4.1 Soft Skills and Behaviours:
    - How to prioritise work; not over-promising and under delivering
    - How to take on new challenges and adapt to change.
- Unit 4.2 Electrical Systems:
    - Vehicle batteries including low maintenance and maintenance free; lead acid and nickel cadmium types; cells; separators; plates; electrolyte
- Unit 4.3 Lighting and Auxiliary Systems:
    - Simple circuit diagrams and operation of: front and tail lamps; main and dip beam headlamps; fog and spot lamps, lighting and dip switch; interior lights; directional indicators, circuit relays.
    - Statutory requirements for vehicle lighting, headlamp adjustment and beam setting.
    - Bulb types and advanced lighting technology: Xenon lighting; gas discharge lighting; ballast system; LED; intelligent front lighting; blue lights; complex reflectors; fibre optic; optical patterning.
- Unit 4.4 Wheels and Tyre Construction:
    - Tyre constructions and tyre markings: tyre & wheel size markings; speed rating; direction of rotation; profile; load rating; ply rating; tread-wear indicators.
    - Light vehicle wheels: light alloy; pressed steel and wire wheels; flat-edge and double hump rims.

- Unit 4.5 Disc Brakes Construction:
    - Construction and operation of disc brakes: disc pads; calliper; brake disc; ventilated disc; disc pad retraction; wear indicators and warning lamps.
- Unit 4.6 Steering:
    - Vehicle wheel alignment: toe in toe out.
- Unit 4.7 Engine Types and Configurations:
    - Two & four stroke cycles: petrol; diesel; naturally aspirated and turbocharged engines.
- Unit 4.8 Exhaust Systems:
    - Construction, purpose, layout and design to include brackets, silencers and safety with catalytic converters.
- Unit 4.9 Engine Cooling Systems:
    - Components, operating principles and functions of the cooling system: cooling fans and control devices; header tanks; radiators and pressure caps; hoses clips; pipes; thermostats; water pumps; coolants, cooling effect of oils.
    - Ventilation systems, layout and construction of internal heater systems: heater matrix; temperature control systems.

Group 5 Intermediate Diagnosis and Repair

Group Overview

At this stage the apprentice will be starting to carry out more complex tasks in the workshop and using logic to carry out diagnostic techniques. They will also have gained further experience to make recommendations to their mentor on serviceability of components and make recommendations based on their judgement.

Competence Required

The apprentice will have developed the competence to:

- Complete repairs that involve two stage removal and replacement and involve removal of other components to access the repair.
- Identify causes of common faults associated with two stage removal and replacement and recommend suitable further actions.

Knowledge and Understanding Required

The apprentice will understand:

- Unit 5.1 Soft Skills and Behaviours:
    - How to share ideas.
- Unit 5.2 Diagnostic Skills:
    - Common fault types, causes and effects of different types of faults, eg. whine, rumble, vibration, wander, rattle, knock, misfire, leak.
    - How to ask questions and how to avoid making wrong assumptions.
- Unit 5.3 Electrical Systems:
    - Magnetism; diodes; transistors; capacitors; construction and operation of Inductive and Hall effect sensors.
    - The effect on circuit operation of open circuit component(s); meaning of open circuit.
- Unit 5.4 Drum Brakes:
    - Construction and operation of drum brakes: brake drums; linings and shoes; leading and trailing shoes; self-servo action; automatic adjusters; backing plates; parking brake system.
- Unit 5.5 Suspension Layouts and Components:

- Advantages of light vehicle suspension systems: rigid axle; independent suspension.
- Suspension terms: rebound; bump; float; dive; pitch roll; compliance; forces acting on suspension systems during braking, driving and cornering.
- Operation of light vehicle suspension, types and components: trailing arms; wish bones; ball joints; track control arms; bump stops; Macpherson strut system; anti-roll bars; stabiliser bars; swinging arms; parallel link; swinging half-axles; transverse link and semi-swinging arms; methods of locating the road wheels against braking, driving and cornering forces; methods of controlling cornering forces by fitting anti roll torsion members; leaf spring, coil springs, torsion bar, rubber springs, hydraulic, hydro-pneumatic, hydraulic dampers; adaptive dampening; electronic systems.

- Unit 5.6 Steering:
  - Geometry: castor; camber; kingpin or swivel pin inclination; negative offset; Ackerman principle; toe-out on turns; steered wheel geometry; slip angles; oversteer; understeer; slip angles; self-aligning torque; neutral steer.
  - Operation and layout of rear and four wheel steering: passive; active.
- Unit 5.7 Power assisted steering:
  - Components layout and operation: piston; power cylinders; drive belts; pumps; hydraulic valve (rotary, spool and flapper type); hydraulic fluid.
  - Principles and components of electrical and electronic steering systems: motor, torque sensor; ECU.
  - Advantages of power steering, operation and layout of rear and four wheel steering.

- Unit 5.8 Vehicle Starting and Charging System:
  - Alternator: drive systems, rotor; stator; slip ring; brush assembly; diode rectification pack; voltage regulation; cooling fan; phased winding connections; three phase output.
  - Starter: ignition/starter switch; solenoid; inertia and pre-engaged starters; ring gear and pinion; one-way clutch.
- Unit 5.9 Auxiliary electrics 1:
  - Relays; engine cooling fan.
  - Telematics and I.C.E. systems and components: radios; CD and multi play units; DVD players; MP3 players; speakers; aerial systems; amplifiers; V.D.U. screens; SAT/NAV; communication units.
  - Knowledge of radio frequencies: analogue; DAB; factors affecting performance.
- Unit 5.10 Ignition Systems:
  - Knowledge of layout of distributor ignition systems: ignition terminology; dwell angle; dwell variations; ignition timing advance and retard systems; dynamic and static ignition timing.
  - Coils: voltages; principles of a coil; safety; oscilloscope patterns; mapping; advance and retard.
  - Spark plugs: reach; heat range; electrode features and electrode polarity.
- Unit 5.11 Transmission Drivelines:
  - Layout and construction of drive shafts used in front wheel, rear wheel and four-wheel drive systems: flexible couplings; sliding joints; constant velocity joints; universal joints.
  - Stresses applied to shafts: torsional; bending; shear.
  - Wheel bearing arrangements: non-driving and driven wheel arrangements; roller; taper roller; needle; ball; plain.
  - Knowledge of fully floating, three quarter floating and semi floating axles.

Group 6 Complex Diagnosis and Repair

Group Overview

At this stage the apprentice will be able to diagnose faults that involve in depth investigation. They will be able to fully follow logical fault finding processes and make decisions based on test results narrowing down to the root cause. They will have gained experience and transferable skills to complete most repairs found on vehicle systems.

Competence Required

The apprentice will have developed the competence to:

- Complete a wide range of repairs that involve complex procedures, or in depth knowledge.
- Identify causes of common faults associated with two stage removal and replacement and recommend suitable further actions.
- Use current flow diagrams and electrical test equipment to carry out standard diagnostic and repair procedures.
- Use diagnostic, mechanical and electrical measuring equipment.
- Follow a logical diagnostic sequence; carries out tests on components based only on the information available; makes sound recommendations based on the information found.

Knowledge and Understanding Required

The apprentice will understand:

- Unit 6.1 Soft Skills and Behaviours:
    - How to communicate effectively outside their own work environment.
    - How to resolve problems within the workplace: types of problems that may occur; identifying problems; ways of dealing with problems; how and when to refer problems.
- Unit 6.2 Diagnostic Skills:
    - Fault finding strategies: how to adopt a methodical approach; dealing with the unknown; where to start; initial assessment.
    - How to work efficiently to minimize spares used in effecting a repair.
- Unit 6.3 Electrical Systems:
    - Meaning of: short circuit; bad earth; high resistance; electrical capacity.
    - Complex vehicle wiring diagrams: electrical and electronic symbols; earth and insulated return systems'
    - How to make repairs to wires and connectors.
    - Multiplex: principles; digital and fibre optic; databus types; error checking; oscilloscope patterns; ECU; electronic and electrical safety procedures.
- Unit 6.4 Auxiliary electrics 2:
    - Construction and operation of: displays; clock clusters; switch fitted to stalk and steering systems.
    - Security: central door lock locking system; door locking actuators; solenoids; dead locking actuators; luggage compartment release solenoids; anti-theft modules; audible warning units; sensing units; immobiliser units.
    - Supplementary restraint and airbag systems: clock spring; airbag assemblies; seatbelt tensioner; control units; sensors; seat belt pre-tensioners; warning systems; circuit protection; safe handling procedures and regulations.
    - Heater operation and construction; fan motors; rheostat interfaces; electro-valves modules; switches; heated seats; electrically adjusted seats.

- Convenience systems: electric windows; window motor/regulator; heated screens; mirror operation mechanisms; sun roof operation.
- Construction and operation of wiper and washer systems: motor, auto and intermittent wash wipe; relays; washer motors, wiper linkage, multifunction relays, headlamp wash/wipe.

- Unit 6.5 Engine Inlet Systems:
  - Construction and purpose of air filtration systems:
  - Torque and power: meaning of volumetric efficiency and the effect of volumetric efficiency on engine performance.
  - Methods used to improve volumetric efficiency: turbo-charges; supercharges; waste gates. disadvantages of pressure charging induction systems.
- Unit 6.6 Engine Sensors:
  - Sensors: analogue and digital signals; MAP; air and coolant temperature; air flow; throttle potentiometer; oxygen; flywheel; camshaft.
  - Closed/open loop engine management systems.
- Unit 6.7 Fuel Systems:
  - The relative advantages and disadvantages of petrol and diesel engines.
  - Fuel pressure regulators, fuel pump relays.
  - Mechanical control and electronic control throttle units: idle speed control
  - Function and layout of petrol injection systems: single and multi-point systems; unit injectors; injection components; injection pump, pump relay.
  - Principles and requirements of compression ignition engines: combustion chambers (direct and indirect injection); function and basic operation of diesel fuel injection components; fuel pump; HP Pump; fuel filters; sedimenters; injector types (direct and indirect injection); single and multi-hole; pintle; glow plugs; cold start devices; fuel cut-off solenoid.
  - Knowledge of rotary diesel systems: governors; fuel pipes; procedures for injection pump timing; bleeding the system.
- Unit 6.8 Emissions:
  - Terms related to hydro-carbon fuels: volatility; calorific value; flash point; octane rating; cetane value.
  - Composition of hydro-carbon fuels and air: percentages hydrogen; carbon; nitrogen and oxygen and the combustion processes; stoichiometric ratio; lambda; weak and rich air/fuel ratios;
  - By-products of combustion for different engine conditions and fuel mixtures: water vapour (H_2O); nitrogen (N); carbon monoxide (CO); carbon dioxide (CO_2); carbon (C); hydrocarbon (HC); oxides of nitrogen (NOx, NO_2, NO) and particulates; MOT requirements; current European legislation and regulations.
  - Engine combustion: flame travel; pre-ignition and detonation; flash point; fire point; methods used to reduce emissions; EGR; low emission fuels; AdBlue; lean burn technology; catalytic converters.
- Unit 6.9 Clutch:
  - Construction and operation of clutch: reasons for fitting; coil spring clutches; diaphragm spring clutches; single plate clutches; multi plate clutches; mechanical and hydraulic operating mechanisms; master cylinder; slave cylinder; EGS clutch systems.
- Unit 6.10 Advanced Suspension Systems:
  - ECU, sensors and actuators, electrical inputs, voltages, oscilloscope patterns; safety procedures
  - Self-levelling suspensions: reasons for fitting; operation under different conditions.

    - Operation of driver controlled and ride controlled systems.
- Unit 6.11 Brake Hydraulics:
    - Requirements of brake fluid: properties; boiling point; potential damage to paint surfaces; hygroscopic action; manufacturer's change periods; fluid classification and rating.
    - Terms associated with mechanical and hydraulic braking systems: braking efficiency; brake fade; brake balance.
    - Components and operation of master cylinder; vacuum pumps; servo; proportioning and load sensing pressure valves.
    - The principles and components of ABS and EBS systems: ECU, Speed sensors, pump & valves.
- Unit 6.12 Stability:
    - Operation of stability and traction control systems
- Unit 6.13 Climate Control:
    - Air conditioning mechanical components and operation: compressors; condensers; receivers; dryers; connection; valves; hoses; thermostats; refrigerants; comfort control systems; internal heater system.
    - Electronic climate control: control panel, sunlight sensors, internal/external temperature sensors.

Group 7 Complete Systems Understanding and Repair Major Components

Group Overview

At this stage, in addition to being able to complete most repairs, they will have the skills and knowledge to strip and rebuild major components but may not have gained enough experience to be competent at this.

Competence Required

The apprentice will have developed the competence to:

- Apply advanced diagnostic principles and logical problem-solving techniques, supported by diagnostic tools and testing regimes, to establish electrical, mechanical and electronic faults.
- Use appropriate recommended diagnostic techniques across all systems.
- Interpret a wide range of diagnostic information and confirm system serviceability using suitable test instruments.

Skills Required

The apprentice will have the skills to:

- Differential and gearbox:
    - Carry out procedures used for inspecting, testing and rebuilding gearboxes including, leaks, gear selection, synchromesh operation, abnormal noise, electrical and hydraulic systems.
- Engine mechanical
    - Carry out restoration and repair, assessing engine mechanical components, measuring for wear and serviceability including cylinder bores, crankshaft journals.

They will also be required to complete the F-Gas certificate.

Knowledge and Understanding Required

The apprentice will understand:

- Unit 7.1 Differential:
    - Calculate final drive gear ratios and calculate the overall gear ratio from given data.

- Construction and operation of final drive units, reasons for fitting; crown wheel & pinion; bevel; hypoid and helical gears; differential gears; sun & planet gears; lubricants; lubrication bearings and seals; limited slip differential; third differential, differential locks; traction control systems and launch control.

- Unit 7.2 Manual Gearboxes:
  - Reasons for fitting gearboxes.
  - Calculate gear ratios and driving torque for typical gearbox specifications.
  - Transverse and inline layouts: layout and construction of gears and shafts for 4, 5 and 6 speed gearbox designs; sliding mesh; constant mesh; synchromesh; reverse gear; gear selection linkages; selector forks and rods; detents and interlock mechanisms; arrangements for gearbox bearings; bushes; oil seals; gaskets; gearbox lubrication; speedometer drive; electrical and electronic components including reverse lamp switch.
  - Procedures used for inspecting, testing and rebuilding gearboxes including, leaks, gear selection, synchromesh operation, abnormal noise
- Unit 7.4 Engine Mechanical:
  - Calculate compression ratios from given data.
  - Engine components and layouts: single (OHC) and multi camshaft (DOHC) arrangements; single and multi-cylinder (2, 4, 6, 8 cylinder) types; cylinder head layout and design; combustion chamber and piston design; layout and operation of multi-valve arrangements; variable valve timing and the effect on performance.
  - Rotary engine: advantages; disadvantages; rotor; eccentric shaft; housing; seal.
  - How to restore and repair: assess engine mechanical components; measure for wear and serviceability including cylinder bores, cylinder heads, crankshaft journals, valve faces, valve guides, valve seats and camshafts.
- Unit 7.3 Engine: Lubrication:
  - Terms associated with lubrication and engine oil: full-flow; hydrodynamic; boundary; multi-grade; organic, mineral and synthetic oil; lubrication grades; viscosity index; additives; detergents; dispersants; anti-oxidants inhibitors; anti-foaming agents; anti-wear.
  - Requirements and features of engine oil: operating temperatures; pressures; splash and pressurised systems; pumps; pressure relief valve; filters full flow and by-pass; oil ways; oil coolers; wet and dry sump systems.
- Unit 7.4 Automatic Transmissions:
  - Fluid couplings, fluid flywheel, torque converter, epicyclic gearing (sun, planet, annulus and carrier) and method for achieving different gear ratios; hydraulic control systems, electronic control systems.
  - Continuously variable transmissions (CVT) and sequential manual gearbox (SMG): ECU; sensors and actuators; electrical inputs & outputs; voltages; oscilloscope patterns; interaction between the electrical/electronic system with hydraulic system and mechanical components; electronic and electrical safety procedures.
- Unit 7.5 Alternative fuels and hybrid and electric systems
  - The apprentice will have knowledge of alternative fuels and hybrid and electric systems.
  - Health and safety: industry standards and regulations, the importance of isolating high voltage systems.
  - Advantages and disadvantages of the different alternative fuels and hybrid and electric systems
  - System layouts: charging systems, regeneration brakes, battery types

Soft Skills and Behaviour Matrix

Working Together & Building Trust			
Criteria	**Distinction**	**Pass**	**Fail**
Take responsibility when required and be honest and accountable when things don't go as planned. Operate as an effective team member Behave in accordance with the values of the company and treat colleagues and customers with respect and courtesy.	Recognises when others are struggling and offer support where appropriate.	Routinely collaborates with others to achieve targets.	Ignores that they are part of a team.
	Encourages others to be involved, recognises those that are slow to contribute or are being excluded and takes steps to bring them into the team.	Maintains positive working relationships even though the other person may be very different from themselves.	Does not support colleagues when they can see they are in trouble. Fails to handle differences between themselves and others.
	Recognises the strengths and weaknesses in themselves and others and allocates tasks to those who are best able to complete them.	Accepts the tasks they are given and quickly recognises whether they have the ability to complete them and seeks help appropriately.	Refuses tasks they don't want to do.
		Demonstrates honesty when working as part of a team.	Behaves in a dishonest way.
		Carries out tasks with consideration for others.	Ignores the impact of their actions on others.
	Alerts others to the problems they may encounter when completing a task and offers solutions to ensure a team meets its agreed goals.	Seeks support & help from colleagues when appropriate Flags up difficulties in sufficient time to take remedial action.	Not seeking the support of others when they need it.
	Provides accurate, balanced constructive feedback to others using the appropriate approach and supported by relevant evidence.	Provides feedback to others at the appropriate moment and support it with relevant evidence.	Fails to provide honest feedback to their colleagues when they do something they are not happy about.
	Contributes towards setting clear team goals and makes a significant contribution to the effort required to complete them.	Actively contributes to team goals.	Competes against colleagues to the detriment of shared goals.
Customer Experience & Communication			
Criteria	**Distinction**	**Pass**	**Fail**
Build effective relationships with colleagues and customers Gain trust and pay attention to colleagues and customers	Uses actively listening skills and uses the appropriate tone and questioning techniques particularly when talking to customers.	Uses a clear voice and polite tone. Speaks confidently and uses different types of questions appropriately.	Communicates unclearly.

concerns and needs Communicate effectively on a range of topics and with all sorts of different people	Confidently completes external documentation using an appropriate 'tone of voice'.	Completes internal documentation as required using legible, grammatically correct written communication for internal e-mails/repair order completion.	Writes illegible and documentation completed incorrectly.
	Is aware of how tone and body language impacts communications and adjusts to suit colleagues and customers and the situation.	Exhibits appropriate body language and attitude when dealing with colleagues and customers.	Neglects customers.
		Is trusted and deals with customers with honestly and with fairness.	Is untrustworthy, corrupt and customers are dealt with unfairly.
	Talks about technical issues automatically using the language that is appropriate to the audience.	Converses with others regarding technical issues explaining technical terminology when asked.	Uses spoken communication that is full of jargon and technical terminology.
	Deals with difficult situations appropriately and balances the needs of customers with the requirements of the organisation. Capable of ensuring the customers enjoy a positive experience irrespective of the issue.	Approaches colleagues and customers with respect and follows the appropriate procedures when dealing with a problem. Quickly refers difficult issues to others.	Is discourteous and has an unhelpful attitude.
	Takes pride in their appearance and checks that they look good before approaching a customer.	Wears appropriate clothes at all times and presents a clean appearance especially when meeting customers.	Wears inappropriate clothing and uses bad language.
Making it Happen & Commercial Awareness			
Criteria	**Distinction**	**Pass**	**Fail**
Deliver excellent results and achieve challenging goals. Contribute to problem solving discussions and enjoy finding solutions to own and other people's problem. Suggest ways to make the business more efficient and contribute to its commercial growth.	Takes an idea, whether their own or others, evaluates its feasibility and adds detail to make it work better.	Contributes ideas, thinks them through in detail and their implications and presents them clearly.	Does not put forward ideas.
	Analyses cause and effect and uses learnt techniques to solve complex problems. Appreciates the value of documenting what they are doing to create an audit trail.	Takes a systematic approach to problem solving. Knows their limitations and when best to escalate issues.	Makes no attempt to understand a problem and search for a solution to it.

.	Suggests how systems and processes can be improved in particular to reduce risks to the business.	Knows what they need to do and the roles of people close to them. Confidently uses systems and processes relevant to the role. Complies with legislation. Completes documentation with a clear understanding of its purpose.	Doers not understand their role within the organisation. Is not aware of the systems and legislation around their role.
	Suggests how to reduce costs and generate revenue.	Understands the business side of managing a workshop and takes steps to improve its overall efficiency.	Does not use internal processes and systems required for their job role.
	Always focused on the job in hand and makes confident judgements when choosing between quality and speed. Re-schedules work appropriately and keeps everyone informed.	Punctual and routinely meets deadlines. Thinks about the tasks ahead of them and how they should be prioritised. Reacts well to the unexpected.	Fails to meet deadlines.
	Takes account of the impact of their tasks on other business activities when organising their work. They keep everyone informed.	Confidently breaks down complex tasks and allocates time and resources appropriately.	They are disorganised and work in a cluttered environment.
	Takes pride in the place where they work and looks out for environmental issues they can solve.	Understands the environmental impact of the materials they use and takes steps to minimise waste.	They dispose waste with little regard to the impact on the environment.
	They are observant and vigilant and actively look for ways to make the place safer for themselves and others	Understands the importance of PPE and good housekeeping in the workshop. Routinely operates safely without the need for reminders.	Carries out work with little regard to health and safety requirements.
Learn to Learn & Striving For Excellence			
Criteria	**Distinction**	**Pass**	**Fail**
Constantly learn in order to improve own performance and that of the business Share knowledge and skills. Demonstrate a passion for engineering.	Careful analyses their strengths and weaknesses and what they need to learn next. Records their reflections in a learning journal, portfolio or blog.	Independently and regularly reflects on progress and sets goals and priorities for future development.	Does not think about their progress and does not set personal goals.
	Thinks how they can best support others, shares their knowledge and skills at the appropriate time and in a	Shares their knowledge and skills when requested.	Does not share their knowledge and skills with others.

	way that works best for them.		
	Demonstrates a passion for their job and engages in a wide range of activities e.g. self-study, related hobbies etc. to develop the competence they need to be excellent at my job.	Demonstrates an interest in learning and actively uses the opportunities to extend their knowledge and skills that are put in front of them.	Has little interest in engineering and new technologies.
	Actively seeks opportunities to share with their mentor and tutors their progress.	Provides reports on their progress when asked.	Does not keep their mentor or tutors up-to-date on the progress they are making.