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<td>Diagnose and Rectify Vehicle Transmission System and Driveline Faults</td>
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Carry Out Routine Vehicle Maintenance

Further guidance available

Observation of your task/work

Evidence recording

Computer based testing

Verbal Questioning

Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).

To complete this unit you must:

1. Carry out one major service

Your tutor or assessor will either set and observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
**Information for N/SVQs**

**General Requirements**

**You must:**

1. Produce evidence to show you meet all of the performance objectives consistently.

2. Produce evidence to show that your performance has covered all the items listed in the scope for this unit.

3. Produce evidence to show that you possess all the knowledge required.

4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.

5. Be observed by a qualified assessor carrying out work in:
   - your normal workplace
   - an approved centre, or
   - a combination of both.

6. Evidence from simulated activities is not acceptable for this unit.

**Specific performance evidence for this unit**

7. You must produce evidence of competently carrying out servicing activities on at least 3 different vehicles which collectively cover the scope for this unit.

Your assessor must physically observe you in your normal workplace successfully carrying out a range of servicing activities on at least 1 occasion which must include clearances, pressures, tensions and levels.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing. If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
### Evidence reference summary

<table>
<thead>
<tr>
<th>Portfolio reference number (PRN)</th>
<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
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**Note:** Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.

**Evidence reference summary**

**Evidence reference summary**

<table>
<thead>
<tr>
<th>Evidence reference summary</th>
<th>Portfolio reference number (PRN)</th>
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<tbody>
<tr>
<td>Major service – vehicle 1</td>
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<tr>
<td>Major service – vehicle 2</td>
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<td>Major service – vehicle 3</td>
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</table>

**Supplementary evidence (if used) PRN**

**On line test reference for this unit PRN**

### Unit assessment and verification declaration

<table>
<thead>
<tr>
<th>VRQ Candidate declaration:</th>
<th>N/SVQ Candidate declaration:</th>
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<tbody>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
</tr>
<tr>
<td>Candidate name:</td>
<td>Candidate name:</td>
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<tr>
<td>Candidate enrolment number:</td>
<td>Candidate enrolment number:</td>
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<tr>
<th>VRQ Assessor declaration:</th>
<th>N/SVQ Assessor declaration:</th>
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<tbody>
<tr>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
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<td>Assessor name:</td>
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<td>Assessor signature:</td>
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<td>Date:</td>
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<td>Countersignature: (if relevant)</td>
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<tr>
<th>VRQ Internal verifier Declaration:</th>
<th>N/SVQ Internal verifier Declaration:</th>
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<tr>
<td>(Leave blank if sampling of this unit did not take place.)</td>
<td>(Leave blank if sampling of this unit did not take place.)</td>
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<td>I have internally verified the assessment work on this unit in the following ways (please tick):</td>
<td>I have internally verified the assessment work on this unit in the following ways (please tick):</td>
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<tr>
<td>sampling candidate and assessment evidence</td>
<td>sampling candidate and assessment evidence</td>
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<tr>
<td>observation of assessment practice</td>
<td>observation of assessment practice</td>
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<tr>
<td>discussion with candidate</td>
<td>discussion with candidate</td>
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<td>other – please state:</td>
<td>other – please state:</td>
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<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
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<td>Internal verifier name:</td>
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<td>Countersignature: (if relevant)</td>
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<td>Date:</td>
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Performance objective checklist

To be competent you must ensure that: PRN

Wear suitable personal protective equipment and vehicle coverings throughout all vehicle maintenance activities.

Use suitable sources of technical information to support all your vehicle maintenance activities.

Use the correct specifications and tolerances for the vehicle when making assessments of system and component performance.

Where the customer’s vehicle falls outside the manufacturer’s original specification, record details accurately and use this adapted specification as the basis for your examination and assessment.

Examine the vehicle’s systems and components following:
- the manufacturer’s approved examination methods
- your workplace procedures
- health and safety requirements.

Ensure your examination methods identify accurately any vehicle system and component problems falling outside the servicing schedule specified.

Carry out adjustments, replacement of vehicle components and replenishment of consumable materials following the manufacturer’s current specification for:
- the particular service interval
- working methods and procedures
- use of equipment
- the tolerances for the vehicle.

Where system adjustments cannot be made within the manufacturer’s specification, record the details accurately and take action which complies with the customer’s instructions.

Work in a way which minimises the risk of damage to the vehicle and its systems.

Use suitable testing methods to evaluate the performance of all replaced and adjusted components and systems accurately, prior to returning the vehicle to the customer.

Report any problems or issues relating to the vehicle’s condition or conformity to the relevant person(s) promptly.

Ensure your maintenance records are accurate, complete and passed to the relevant person(s) promptly in the format required.

Complete all vehicle maintenance activities within the agreed timescale.

Report any anticipated delays in completion to the relevant persons(s) promptly.

Scope of this unit

All of the items listed below form part of this National Occupational Standard. PRN

1. Sources of technical information are:
   a. vehicle technical data
   b. schedules of inspection
   c. regulations.

2. Examination methods are:
   a. aural
   b. visual
   c. functional
   d. measurements.

3. Assessments are for:
   a. malfunction
   b. damage
   c. fluid levels
   d. leaks
   e. wear
   f. security
   g. condition and serviceability
   h. conformity
   i. necessity for adjustment(s).

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
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<tr>
<td>Candidate</td>
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Essential knowledge

<table>
<thead>
<tr>
<th>You need to understand:</th>
<th>PRN</th>
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<tbody>
<tr>
<td><strong>Legislative and organisational requirements and procedures</strong></td>
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<tr>
<td>1. The manufacturer’s and legal requirements relating to routine maintenance activities for vehicle systems and components.</td>
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<tr>
<td>2. The legal requirements relating to the vehicle (including road safety requirements).</td>
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<tr>
<td>3. The health and safety legislation and workplace procedures relevant to vehicle maintenance activities and personal and vehicle protection.</td>
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<tr>
<td>4. Your workplace procedures for:</td>
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<tr>
<td>• recording vehicle maintenance work and any variations from the original vehicle specification</td>
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<td>• the referral of problems</td>
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<td>• reporting delays to the completion of work</td>
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<tr>
<td>5. The importance of documenting vehicle maintenance information.</td>
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<td>6. The importance of working to agreed timescales and keeping others informed of progress.</td>
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<tr>
<td>7. The relationship between time and costs.</td>
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<tr>
<td>8. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
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<tr>
<td><strong>Use of technical information</strong></td>
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<tr>
<td>9. How to find, interpret and use sources of technical information for scheduled maintenance activities, including on-board diagnostic displays.</td>
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<tr>
<td>10. The importance of using the correct sources of technical information.</td>
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<tr>
<td>11. The purpose of and how to use identification codes.</td>
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<tr>
<td><strong>Vehicle system operation</strong></td>
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<tr>
<td>12. How engines, cooling systems, air supply and exhaust systems, fuel systems and ignition systems operate for the type(s) of vehicle on which you are working.</td>
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<tr>
<td>13. How clutch assemblies, clutch operating systems, manual gear boxes, automatic gear boxes, drivelines and hubs (if appropriate) and final drive assemblies operate for the type of vehicle on which you are working.</td>
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<tr>
<td>14. How suspension systems, steering systems, braking systems, non- electrical body systems, wheels and tyres operate for the type of vehicle on which you are working.</td>
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<tr>
<td>15. How batteries, starting systems, charging systems, lighting systems and ancillary equipment operate for the type of vehicle on which you are working.</td>
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<tr>
<td>16. The operating specifications and tolerances for the type(s) of vehicles on which you are working.</td>
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<tr>
<td><strong>Routine maintenance requirements</strong></td>
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<tr>
<td>17. How to conduct scheduled, routine examination methods and assessments against vehicle specifications to identify damage, corrosion, inadequate fluid levels, leaks, wear, security problems and general condition and serviceability.</td>
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<tr>
<td>18. Check and make adjustments to clearances, gaps, settings, alignment, pressures, tension, speeds and levels relevant to the engine area, transmission area, chassis area, electrical area and body (including to valves, ignition, fuel and emissions, brakes, transmission, lights, tyres, steering and body fittings).</td>
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<tr>
<td>19. How to replenish and replace routine service components and materials, including filters, drive, belts, wiper blades, brake linings and pads, lubricants and fluids.</td>
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<tr>
<td>20. How to recognise cosmetic damage to vehicle components and units outside normal service items.</td>
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<tr>
<td>21. How to identify codes and grades of lubricants.</td>
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<tr>
<td>22. How to work safely avoiding damage to the vehicle and its systems.</td>
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In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

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### Key and core skills signposting

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<th>Key Skills</th>
<th>Core Skills</th>
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<tr>
<td><strong>Communication:</strong> C1.1; C1.3; C2.2</td>
<td><strong>Communication:</strong> Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1</td>
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<tr>
<td><strong>Application of Number:</strong> N1.1; N1.2; N1.3?</td>
<td><strong>Numeracy:</strong> Access 3, Outcomes 2 and 4</td>
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<td><strong>Information Technology:</strong> Not applicable</td>
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<td><strong>Working with Others:</strong> WO1.1; WO1.2</td>
<td><strong>Working with Others:</strong> Access 3, Outcomes 1 and 2</td>
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<td><em>No parallel unit.</em></td>
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<td><strong>Problem Solving:</strong> PS2.1</td>
<td><strong>Problem Solving:</strong> Intermediate 1, Outcome 1</td>
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Syllabus

Carry out Routine Vehicle Maintenance.
This unit is about conducting routine examination, adjustment and replacement activities as part of the periodic servicing of vehicles.

Course Outline
To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red italic, that specific to motorcycles is highlighted by blue underlining and that specific to heavy vehicle in green bold. GOLA tests will only cover the general content.

Reference should also be made to the National Standards.

Outcomes
On completion of this unit, the student must be able to:

1. Explain the purpose of routine maintenance; identify sources of information and regulations; describe the purpose of inspections.
2. Describe the operating principles, components and features of petrol and diesel engines.
3. Describe the operating principles, components, features and maintenance requirements of lubrication and cooling systems.
4. Describe the operating principles, components, features and maintenance requirements of ignition systems and petrol fuel systems.
5. Describe the operating principles, components and features of diesel fuel systems.
6. Describe the operating principles, components and features of clutches and gearboxes.
7. Describe the operating principles, components and features of driveline and final drive systems.
8. Describe the operating principles, components and features of steering.
9. Describe the operating principles, components and features of suspension, wheels and tyres.
10. Describe the operating principles, components, service requirements and features of brakes.
11. Describe the operating principles, components, service requirements and features of electrical and electronic systems.
Outcome 1
Explain the purpose of routine maintenance; identify sources of information and regulations; describe the purpose of inspections.

Objectives
To achieve this outcome a student has to:

1. State the purpose of routine vehicle maintenance
2. State the
   a) reasons for observing time scales
      i. to adhere to completion times
      ii. keeping customers and management informed of progress
   b) types of documentation
      i. job cards
      ii. stores and material records
      iii. manufacturers warranty systems
   c) importance of accurate completion of records
   d) parts lists and identification codes.
3. Identify sources of information relating to vehicle maintenance
   a) information sources
      i. technical manuals
      ii. technical bulletins
      iii. servicing schedules
      iv. job card instructions
      v. inspection records
      vi. check lists
4. Describe the purpose and methods of vehicle inspection
   a) purpose of vehicle inspection:
      i. malfunction of systems and components
      ii. damage and corrosion to structural and support regions
      iii. leaks
      iv. water ingress
      v. component and system wear and security
   b) vehicle inspection techniques
      i. aural
      ii. visual
      iii. functional assessments
   c) fault finding techniques
      i. road tests
      ii. questioning
iii. review of symptoms
d) importance of recording details

5. Explain the need for vehicle protection prior to maintenance activities
   a) protection relating to:
      i. vehicle body panels
      ii. paint surfaces
      iii. seats
      iv. carpet
      v. floor mats.

6. Identify the current regulations relating to the repair and use of light vehicles
   a) Road Traffic Act
   b) VOSA regulations
   c) Highway Code.
Outcome 2
Describe the operating principles, components and features of petrol and diesel engines

Objectives
To achieve this outcome a student has to:

1. Describe the operating principles of petrol engines
   a) Basic overview and layout of spark ignition petrol engines:
      i. four stroke
      ii. two stroke
      iii. rotary
      iv. hybrid
   b) principles of:
      i. combustion
      ii. cycles of operation
      iii. valve control systems
      iv. camshaft and valve timing systems
   c) compression ratios

2. Describe the operating principles of four stroke diesel engines (also heavy)
   a) overview and layout of four stroke diesel engines
   b) principles:
      i. cycles of operation
      ii. fuel injection and ignition principles
         A spray pattern & formation
         B air/fuel mixing
         C methods of igniting the fuel
      iii. injection timing
   c) compression ratios

3. Identify and state the functions of engine components
   a) components
      i. engine block and cylinder liners
      ii. cylinder head and valves
      iii. crankshafts, camshafts and drives
      iv. pistons, piston rings and connecting rods
      v. bearings/shells bushes and thrust bearings
      vi. flywheel and flywheel ring gear
      vii. gaskets and oil seals.
      viii. crankcases and sumps

4. Describe
   a) engine configurations
i. inline
ii. flat
iii. vee 

b) engine layouts using single and twin camshafts

c) cylinder head, combustion chamber and piston design

5. Describe the operation of and service requirements of the

a. exhaust system

b. air supply system
Outcome 3
Describe the operating principles, components, features and maintenance requirements of lubrication and cooling systems.

Objectives
To achieve this outcome a student has to:

1. Describe the principles of engine lubrication systems
   a) overview and layout of engine lubrication systems
   b) identify and state the function of
      i. oil pan / sump and oil tanks
      ii. oil pumps (gear, vane, eccentric rotor)
      iii. oil pump drives and relief valves
      iv. filters (full flow and by-pass ) and strainers
      v. sensors, pressure gauges and warning lights
      vi. coolers
      vii. crankcase ventilation.
   c) lubricants
      i. synthetic, semi-synthetic and mineral
      ii. viscosity, SAE grading system and API classification
      iii. operating temperatures and pressures

2. Describe the types of engine lubrication systems
   a) wet sump
   b) dry sump

3. Explain the routine maintenance requirements for engine lubrication systems
   a) checking levels
   b) lubrication selection
   c) filter removal and replacement
   d) lubricant refilling and waste disposal.

4. Describe the operating principles of cooling systems
   a) layout of liquid cooled systems
   b) coolant circulation within liquid cooled systems
   c) basic air cooling.

5. Identify and state the functions of the components used in liquid cooled systems
   a) components
      i. radiator, hoses, pressure caps and expansion tanks
      ii. coolant pumps (mechanical and electrical)
      iii. thermostats and fans
      iv. temperature sensors, warning systems and control valves
      v. antifreeze and corrosion inhibitors

6. State the routine maintenance requirements for cooling systems
Outcome 4
Describe the operating principles, components, features and maintenance requirements of ignition and petrol fuel systems.

Objectives
To achieve this outcome a student has to:

1. Identify and state the functions of
   a) ignition systems
   b) components
      i. battery, wiring and ignition switch
      ii. coils (separate, distributorless, direct) and LT switching devices
      iii. spark plugs and HT leads
      iv. distributor
      v. timing control devices
      vi. pulse generators and ECUs
   c) ignition system controls during changes in engine load and speed.

2. Explain the principles and reasons for
   a) ignition timing
   b) dwell control
   c) ignition timing checking / adjustment

3. State the
   a) safety implications when handling petrol
   b) regulations regarding petrol storage and handling.

4. State the basic principles of carburation

5. Describe the
   a) layout and basic operation of
      i. single point
      ii. multi point (sequential and non-sequential)
   b) functions and operation of the
      i. fuel tanks, pipelines and filters
      ii. tank venting and emission control systems
      iii. fuel gauges and warning systems
      iv. fuel pumps
      v. injectors
      vi. throttle potentiometer and switch
      vii. idle speed control valve / auxiliary air device
      viii. lambda and coolant sensors
      ix. air flow sensors (air flow meter and air mass meter)
      x. MAP and air temperature sensors
      xi. electronic control units
xii. fuel pumps and fuel pressure regulators

xiii. relays

xiv. EGR systems
Outcome 5
Describe the operating principles, components and features of diesel fuel systems.

Objectives
To achieve this outcome a student has to

1. State the
   a) safety implications when handling diesel
   b) regulations regarding diesel storage and handling.

2. Describe the operating principles of diesel fuel systems *(also heavy)*
   a) layout and operation of
      i. inline pump systems
      ii. rotary pump systems
      iii. common rail systems
      iv. unit injector system
   b) identify and state the function of
      i. fuel tanks, pipes, water traps and filters
      ii. tank venting and emission systems
      iii. injection pumps and governors
      iv. injectors
      v. cold starting aids
      vi. fuel cut-off devices
      vii. sensors
      viii. ECU control of fuelling

3. Explain the principles and reasons for *(also heavy)*
   a) injection timing
   b) injection timing checking / adjustment
**Outcome 6**

Describe the operating principles, components and features of clutches and gearboxes.

**Objectives**

To achieve this outcome a student has to:

1. Identify and state the functions of
   a) clutches
      i. spring clutches
      ii. diaphragm clutches
      iii. single and multi plate clutches
      iv. dual mass flywheel/clutches
      v. electrically operated engagement (also heavy)
   b) components and basic operation
      i. pressure plates and driven/centre plates
      ii. release and spigot bearings
      iii. cables
      iv. master and slave cylinders
   c) reasons for fitting a clutch.

2. Identify and state the functions of
   a) manual gearboxes
      i. transverse
      ii. inline
   b) components and basic operation
      i. gear selector mechanisms
      ii. gears, bearings and shafts
      iii. constant mesh gears
      iv. synchromesh systems (also heavy)
      v. oil seals and gaskets
   c) gearbox lubrication and venting

3. Identify and state the functions of
   a) automatic gearboxes
      i. transverse
      ii. inline
   b) components and basic operation
      i. torque converters
      ii. gear selector mechanisms
      iii. gears, bearings and shafts
      iv. clutches and control mechanisms
      v. oil seals and gaskets
vi. sensors and actuators
vii. ECU
c) gearbox lubrication and venting
Outcome 7
Describe the operating principles, components and features of driveline and final drive systems.

Objectives
To achieve this outcome a student has to:

1. Identify and state the functions of
   a) drive shafts and chains used in
      i. front wheel drive systems
      ii. rear wheel drive systems
      iii. four wheel drive systems (also heavy)
   b) components and basic operation (also heavy)
      i. universal joints
      ii. sliding couplings
      iii. constant velocity joints
      iv. transfer couplings and units.

2. Identify and state the functions of
   a) final drive systems
      i. front wheel drive
      ii. rear wheel drive
      iii. four wheel drive (also heavy)
   b) components and basic operation
      i. final drive gears (helical and hypoid) (also heavy)
      ii. differentials (also heavy)
      iii. hubs, bearings and half shafts. (also heavy)
Outcome 8
Describe the operating principles, components and features of steering.

Objectives
To achieve this outcome a student has to:

1. Identify and state the functions of
   a) steering systems
   b) components and basic operation
      i. steering boxes (rack and pinion, worm and re-circulating ball) (also heavy)
      ii. steering arms and linkages (also heavy)
      iii. steering joints and bushes (also heavy)
      iv. headstock and handlebars
      v. idler gears (also heavy)
      vi. bearings (also heavy)
      vii. steering columns (collapsible and absorbing) (also heavy)
      viii. hydraulic pump and control valves (also heavy)
      ix. electrical PAS systems (also heavy)

2. State the meaning of
   i. slip angles
   ii. oversteer
   iii. understeer
   iv. neutral steer
   v. non-reversible
   vi. self-aligning torque.

3. Describe
   a) wheel alignment
      i. castor
      ii. camber (also heavy)
      iii. kingpin inclination / Swivel axis inclination (also heavy)
      iv. Ackermann principle (also heavy)
      v. toe in / toe out (also heavy)
      vi. toe out on turns (also heavy)
      vii. front to rear (also heavy)
      viii. off set
   b) steering geometry measurement and adjustments
Outcome 9
Describe the operating principles, components and features of suspension, wheels and tyres

Objectives
To achieve this outcome a student has to:

1. Identify and state the functions of
   a) suspension systems
      i. rigid axle (also heavy)
      ii. independent and non-independent (also heavy)
      iii. hydraulic (also heavy)
      iv. pneumatic (also heavy)
      v. hydro-pneumatic
   b) components and basic operation
      i. coil springs, leaf springs and torsion bars (also heavy)
      ii. pneumatic and hydro-pneumatic springs (also heavy)
      iii. dampers
      iv. trailing arms and semi-trailing arms (also heavy)
      v. wishbones and swivel joints (also heavy)
      vi. track control arms (also heavy)
      vii. bump and rebound stops
      viii. Macpherson struts (also heavy)
      ix. anti-roll bars and stabiliser bars (also heavy)
      x. swinging arms parallel link swinging half axles (also heavy)
      xi. torque reaction beams (also heavy)

2. State how to carry out suspension system measurements and adjustments

3. Describe the current legal requirements governing the use of tyres

4. Identify the markings on tyres
   a) speed rating
   b) direction of rotation profile
   c) load handling and ply rating
   d) pressure
   e) tread wear indicators.

5. Identify the different types of wheel and rim construction
   a) steel wheels
   b) alloy wheels
   c) wire wheels
   d) space saver wheels.

6. Identify methods of tyre construction
   a) tubed and tubeless
b) radial

c) bias belted tyres

d) braced tyres

e) valves.
Outcome 10
Describe the operating principles, components, service requirements and features of brakes.

Objectives
To achieve this outcome a student has to:

1. Identify and state the functions of
   a) disc and drum brake systems
      i. divided (split) systems
      ii. dual systems
      iii. antilock brake systems
      iv. air brakes
   b) components and basic operation
      i. hydraulic cylinders and calipers
      ii. discs and drums
      iii. brake pads and shoes
      iv. pipes and cables
      v. vacuum servos and hydraulic servos (also heavy)
      vi. warning lights and sensors
      vii. brake fluid and its specifications
      viii. pressure controlling valves
      ix. parking brakes
      x. ABS modulator
      xi. wheel speed sensors
      xii. ECU

2. Explain the routine maintenance requirements for braking systems
   a) acceptable levels of component wear
   b) checks required
      i. components for wear, security and serviceability
      ii. fluid levels and contamination
      iii. efficiency
Outcome 11
Describe the operating principles, components, service requirements and features of electrical and electronic systems.

Objectives
To achieve this outcome a student has to

1. Identify and state the functions of
   a) battery and charging systems
   b) components and basic operation
      i. lead acid battery
      ii. alternator
      iii. alternator drive systems.
2. State the basic electrical principles associated with
   a) batteries
      i. operating principle
      ii. charging rates
      iii. battery rating
   b) alternators
      i. voltage and current rating
      ii. rectification and regulation
      iii. cooling (air and coolant)
3. Identify and state the functions of
   a) engine starting systems
   b) components and basic operation
      i. starter motor
      ii. starter ring gear
      iii. starter solenoid
      iv. starter motor pinion and clutch
      v. ignition switch.
4. State the basic electrical principles associated with
   a) Starter motors
      i. commutator
      ii. brushes
      iii. armature
      iv. solenoid.
5. Explain the purpose and use of electrical wiring diagrams
   a) schematic
   b) destination
   c) flow
   d) layout
6. Identify and state the functions of
   a) auxiliary and lighting systems
   b) components and basic operation
      i. exterior and interior lights and bulbs (filament and arc) (also heavy)
      ii. indicators
      iii. central door locking, electric windows, mirrors, seats and sun roofs (also heavy)
      iv. anti theft devices
      v. fan, heater and de-misting systems (also heavy)
      vi. air conditioning and climate control (also heavy)
      vii. instrumentation and driver information systems

7. Describe the routine maintenance requirements for electrical and electronic systems

Assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>9.</td>
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<td>10.</td>
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<td>11.</td>
<td>3</td>
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</table>

Test duration 35mins  Total 25
Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.
Information for VRQs (Technical Certificates).

To complete this unit you must:
carry out the following on at least 1 occasion:

1. The removal and replacement of engine mechanical units and components.
2. The removal and replacement of units and components from 2 out of the 6 systems below:
   a) engine mechanical
   b) cooling systems
   c) air supply and exhaust systems
   d) fuel and ignition systems
   e) engine electrical systems
   f) lubrication systems.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that your performance has covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in:
   - your normal workplace
   - an approved centre, or
   - a combination of both.
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit
7. Your assessor must physically observe you in your normal workplace successfully carrying out the following on at least 1 occasion:
   - the removal and replacement of engine mechanical units and components
   - the removal and replacement of units and components from 3 out of the 6*systems below:
     - engine mechanical systems
     - cooling systems
     - air supply and exhaust systems
     - fuel and ignition systems
     - engine electrical systems
     - lubrication systems.

*However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of all the systems listed above.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>City &amp; Guilds</th>
<th>Portfolio reference number (PRN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.</td>
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<tr>
<td>VRQ</td>
<td>N/SVQ</td>
</tr>
<tr>
<td>Observed assessment</td>
<td>Approved centre or workplace</td>
</tr>
<tr>
<td>Removal and replacement of engine mechanical units</td>
<td>*</td>
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<tr>
<td>Removal and replacement of units and components 1</td>
<td>*</td>
</tr>
<tr>
<td>Removal and replacement of units and components 2</td>
<td>*</td>
</tr>
<tr>
<td>Removal and replacement of units and components 3</td>
<td></td>
</tr>
</tbody>
</table>

*Observation of any one system required

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

<table>
<thead>
<tr>
<th>VRQ Candidate declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
</tr>
</tbody>
</table>
| Candidate name:…………………………………………………..
| Candidate enrolment number:…………………………………….. |
| Candidate signature:……………………………………………. |
| Date: ………………….. |

<table>
<thead>
<tr>
<th>VRQ Assessor declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
</tr>
<tr>
<td>Assessor name: ………………………………………………….</td>
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<tr>
<td>Assessor signature: ……………………………………………..</td>
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<tr>
<td>Date: …………………………</td>
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<tr>
<td>Countersignature: (if relevant)…………………………………..</td>
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<tr>
<th>VRQ Internal verifier Declaration:</th>
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</thead>
<tbody>
<tr>
<td>(Leave blank if sampling of this unit did not take place.)</td>
</tr>
<tr>
<td>I have internally verified the assessment work on this unit in the following ways (please tick):</td>
</tr>
<tr>
<td>- sampling candidate and assessment evidence</td>
</tr>
<tr>
<td>- observation of assessment practice</td>
</tr>
<tr>
<td>- discussion with candidate</td>
</tr>
<tr>
<td>- other – please state:</td>
</tr>
<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
</tr>
<tr>
<td>Internal verifier name: ………………………………………</td>
</tr>
<tr>
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<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
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<tr>
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<td>Countersignature: (if relevant)……………………………….</td>
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<td>Date: ………………………</td>
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</table>
## Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
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<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings throughout all removal and</td>
<td></td>
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<tr>
<td>replacement activities.</td>
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<tr>
<td>Support your removal and replacement activities by reviewing</td>
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</tr>
<tr>
<td>• vehicle technical data</td>
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<tr>
<td>• removal and replacement procedures</td>
<td></td>
</tr>
<tr>
<td>• legal requirements.</td>
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</tr>
<tr>
<td>Prepare, test and use all the equipment required following manufacturers’ instructions.</td>
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<tr>
<td>Carry out all removal and replacement activities following;</td>
<td></td>
</tr>
<tr>
<td>• manufacturers’ instructions</td>
<td></td>
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<tr>
<td>• your workplace procedures</td>
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<tr>
<td>• health and safety requirements.</td>
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<tr>
<td>You work in a way which minimises the risk of:</td>
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<tr>
<td>• damage to other vehicle systems</td>
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<tr>
<td>• damage to other vehicle components and units</td>
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<td>• contact with leakage</td>
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<tr>
<td>• contact with hazardous substances.</td>
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<tr>
<td>Ensure replaced engine units and components conform to the vehicle operating specification and any</td>
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<tr>
<td>legal requirements.</td>
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<tr>
<td>Record and report any additional faults you notice during the course of your work promptly.</td>
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<tr>
<td>Use suitable testing methods to evaluate the performance of the reassembled system accurately.</td>
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<tr>
<td>Ensure the reassembled engine system performs to the vehicle operating specification and meets any</td>
<td></td>
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<tr>
<td>legal requirements prior to return to the customer.</td>
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<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the</td>
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<tr>
<td>format required.</td>
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<tr>
<td>Complete all removal and replacement activities within the agreed timescale.</td>
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<tr>
<td>You report any expected delays in completion to the relevant person(s) promptly.</td>
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</tbody>
</table>
Scope of this unit

1. Equipment is:
   a. hand tools
   b. special workshop tools
   c. general workshop equipment
   d. electrical testing equipment

2. Testing methods are:
   a. visual
   b. aural
   c. functional

3. Unit and components are:
   a. mechanical
   b. electrical

4. Engine systems are:
   a. engine mechanical systems
   b. cooling systems
   c. air supply and exhaust systems
   d. fuel and ignition systems
   e. engine electrical systems
   f. lubrication systems

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
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<td>Candidate</td>
<td>Date</td>
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## Essential knowledge

**You need to understand:**

### Legislative and organisational requirements and procedures
1. The legal requirements relating to the vehicle (including road safety requirements).
2. The health and safety legislation and workplace procedures relevant to vehicle maintenance activities and personal and vehicle protection.
3. Your workplace procedures for:
   - recording removal and replacement information
   - reporting delays to the completion of work.
4. The importance of documenting removal and replacement information.
5. The importance of working to agreed timescales and keeping others informed of progress.
6. The relationship between time and costs.
7. The importance of reporting anticipated delays to the relevant person(s) promptly.

### Use of technical information
8. How to find, interpret and use sources of information applicable to unit and component removal and replacement within engine systems.
9. The importance of using the correct sources of technical information.
10. The purpose of and how to use identification codes.

### Electrical and electronic principles
11. Vehicle earthing principles and earthing methods.
12. Electrical and electronic principles associated with vehicle engine systems, including types of sensors, actuators, their application and operation.
13. Types of circuit protection and why these are necessary.
15. How warning, charging and starter circuits work.
16. Electric symbols, units and terms.
17. Battery charging.
18. Electronic/electronic control system principles.

### Engine system operation and construction
19. How engine systems and their related units and components are constructed, dismantled and reassembled for the classification of vehicle worked upon.
20. How engine systems and their related units and components operate for the classification of vehicle worked upon.

### Equipment
21. How to prepare, test and use all the removal and replacement equipment required.

### Engine unit and component removal and replacement
22. How to remove and replace engine system mechanical and electrical units and components for the classification of vehicle worked upon.
23. How to file, fit, thread, cut and drill plastics and metals.
24. How to select and fit gaskets, sealants, fittings and fasteners.
25. How to test and evaluate the performance of replacement engine units and components and the reassembled system against the vehicle operating specifications and any legal requirements.
26. The relationship between testing methods and the engine units and components replaced – the use of appropriate test methods.
27. The properties of jointing materials and when and where they should be used.
28. The manufacturer’s specification for the type and quality of engine units and components to be used.
29. How to work safely avoiding damage to other vehicle systems, components and units and contact with leakage and hazardous substances.

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

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## Key and core skills signposting

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<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong></td>
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<tr>
<td>C1.1; C1.3; C2.2</td>
<td>Access 3, Outcomes 2 and 3</td>
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<tr>
<td></td>
<td>Intermediate 1, Outcome 1</td>
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<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong></td>
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<tr>
<td>N2.1; N2.2</td>
<td>Intermediate 1, Outcomes 1, 2 and 4</td>
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<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong></td>
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<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong></td>
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<td>WO1.1; WO1.2</td>
<td>Access 3, Outcomes 1 and 2</td>
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<td><strong>Improving Own Learning and Performance:</strong></td>
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<tr>
<td>Not applicable</td>
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<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong></td>
</tr>
<tr>
<td>PS2.1</td>
<td>Intermediate 1, Outcome 1</td>
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Syllabus

Remove and Replace Engine Units and Components

This unit is about removing and replacing units and components previously identified as faulty, damaged, deteriorated or where the customer has requested replacements. It is also about evaluating the performance of replaced units and components. The units and components concerned are those outside those replaced as part of normal routine, vehicle maintenance (servicing) activities.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red *italics*, that specific to motorcycles is highlighted by blue *underlining* and that specific to heavy vehicle in green *bold*. GOLA tests will only cover the general content.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe engine operating principles, functions and removal, replacements and adjustment procedures.
2. Describe engine lubrication system operating principles, functions and removal, replacements and adjustment procedures.
3. Describe engine cooling system operating principles, functions and removal, replacements and adjustment procedures.
4. Describe air supply and exhaust system operating principles, functions and removal, replacements and adjustment procedures.
5. Describe fuel system operating principles, functions and removal, replacements and adjustment procedures.
6. Describe ignition system operating principles, functions and removal, replacements and adjustment procedures.
7. Describe engine electrical components operating principles, functions and removal, replacements and adjustment procedures.
Outcome 1
Describe engine operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe
   a) the operating principles, components and functions of petrol and diesel engines
   b) for petrol and diesel engines the
      i. working principles
      ii. four stroke cycles
      iii. combustion processes
      iv. conversion of reciprocating to rotary motion
      v. meaning of tdc, bdc, stroke and bore
      vi. meaning of capacity and compression ratio
      vii. relationship between crankshaft and camshaft
      viii. reasons for using multi cylinders and alternative layouts
      ix. meaning of the term ‘firing order’ and state examples for four and six cylinder engines in-line and vee layouts
      x. meaning of valve timing, valve lead, lag, overlap and interpretation of valve timing diagrams
      xi. importance of valve clearances

2) Describe how to remove, replace and adjust engine components
   a) mountings, stabilisers and tie bars
   b) cylinder heads, manifolds (inlet and exhaust)
   c) crankshafts, flywheels, pistons and connecting rods
   d) timing belts and chains

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit engine components
   a) hand tools
   b) measuring equipment
      i. feeler gauges
      ii. dial test indicators
      iii. internal and external micrometers
      iv. Vernier and depth gauges
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) filter wrenches
   g) impact wrenches
   h) power tools
i) belt tension gauges
j) draining equipment
k) brushes, solvents and other cleaning equipment
l) lubricants, easing oils, and specialist fluids
m) locking and joining devices and materials

4) Describe
   a) how vehicle systems are evaluated for operational efficiency following component replacement
      i. i) workshop procedures
      ii. ii) road testing procedures
      iii. iii) manufacturers requirements
      iv. iv) legal requirements
   b) the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
      i. exhaust gas emissions testers
      ii. compression and leakage testers
      iii. torque setting equipment

5) State how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
**Outcome 2**
Describe engine lubrication system operating principles, functions and removal, replacements and adjustment procedures.

**Objectives**
To achieve this outcome a student has to:

1) Describe the
   a) components, operating principles, and functions of engine lubrication systems
      i. filter types
      ii. methods of filtration
         A. full flow
         B. bypass
      iii. types of system in use
         A. wet sump
         B. dry sump
      iv. classification of oils
         A. SAE
         B. API
      v. reasons for using synthetic and specialist oils

2) Describe how to remove, replace and adjust engine lubrication components
   a) filters
   b) pressure sensors and switches

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit engine lubrication components
   a) hand tools
   b) measuring equipment
      i. feeler gauges
      ii. dial test indicators
      iii. internal and external micrometers
      iv. Vernier and depth gauges
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) filter wrenches
   g) power tools
   h) draining equipment
   i) brushes, solvents and other cleaning equipment
   j) lubricants, easing oils, and specialist fluids
   k) locking and joining devices and materials

4) Describe how
a) vehicle systems are evaluated for operational efficiency following component replacement
   i. workshop procedures
   ii. road testing procedures
   iii. manufacturers requirements
   iv. legal requirements

b) describe the preparation and method of use of appropriate specialist equipment used to
   evaluate system performance following component replacement
   i. pressure cap testers
   ii. system pressure testers
   iii. chemical indicators for combustion leaks

5) State how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting
   from the above activities.
Outcome 3
Describe engine cooling system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:
1) Describe the components, operating principles, and functions of engine cooling systems
2) Describe how to remove, replace and adjust cooling system components
   a) cooling fans and control devices
   b) header tanks, radiators and pressure caps
   c) heater matrix’s and temperature control systems
   d) expansion tanks hoses, clips and pipes
   e) thermostats impellers and coolants
3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) special purpose wrenches and stud removers
   c) pressure cap and system pressure testers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) power tools
   g) belt tension gauges
   h) draining equipment
   i) brushes, solvents and other cleaning equipment
   j) lubricants, easing oils, and specialist fluids
   k) locking and joining devices and materials
   l) sealing materials
4) Describe
   a) how vehicle systems are evaluated for operational efficiency following component replacement
      i. workshop procedures
      ii. road testing procedures
      iii. manufacturers requirements
      iv. legal requirements
   b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
      i. system pressure testers
      ii. pressure cap testers
      iii. hydrometer, or anti-freeze testing equipment
      iv. chemical tests for the detection of combustion gas
5) State how records of workplace activities are completed as computer or paper based systems.
6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 4
Describe air supply and exhaust system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:
1) Describe the components, operating principles, and functions of air supply and exhaust systems
2) Describe how to remove, replace and adjust air supply and exhaust system components
   a) air filters
   b) dry and wet (gauze)
   c) pre cleaners
   d) manifold heaters – water, electrical and hot spot
   e) air intake temperature control systems
   f) crankcase emission control systems
   g) plenum chambers and manifolds
   h) rigid and flexible pipes, joints, clamping and sealing arrangements
   i) silencers and expansion boxes
   j) catalytic converters and sensors
   k) single, multi and branched pipe systems, flexible and resilient mountings
3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) special purpose wrenches and stud removers
   c) vehicle and unit lifting devices and supports
   d) torque wrenches
   e) impact wrenches
   f) power tools
   g) brushes, solvents and other cleaning equipment
   h) lubricants, easing oils, and specialist fluids
   i) locking and joining devices and sealing materials
4) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
      i. manufacturers requirements
      ii. legal requirements
   b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
      i. exhaust gas emissions testers
      ii. visual and audible inspections
5) State how records of workplace activities are completed as computer or paper based systems.
6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 5
Describe fuel system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe
   a) the components, operating principles, and functions of engine fuel systems
   b) for fuel systems the
      i. working principles
      ii. theoretically chemically correct composition for the air fuel ratio
      iii. methods of introducing fuel
         A. petrol fuel injection systems (single and multi-point: simultaneous and sequential)
         B. diesel fuel injection systems using rotary and in-line pumps (also heavy)
         C. diesel fuel injection using the common rail (pressure-time) system – principles of operation and functions of pump and injectors only (also heavy)
         D. carburation (fixed and variable choke) – outline only
      iv. describe the combustion cycle
         A. petrol engine - flame travel, pre-ignition and detonation
         B. diesel engine – phases of combustion (also heavy)
      v. methods of igniting the fuel petrol and diesel engines
      vi. constituents of exhaust gas and environmental effects - petrol and diesel engines (also heavy)
      vii. exhaust gas products for correct, rich and weak mixture and incorrect combustion from petrol and diesel engines (also heavy)

2) Describe how to remove, replace and adjust fuel supply system components
   a) petrol injection – single and multi point
   b) supply system components
      i. tanks, lines, filters water traps, sedimenters and heater (also heavy)
      ii. injectors
      iii. pumps – mechanical and electrical
      iv. bleed points
   c) diesel supply system components (also heavy)
      i. inline injection pumps and rotary injection pumps
      ii. injectors for rotary and in-line pumps on
      iii. cold starting aids
      iv. injector pipes, unions and clamping arrangements

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit fuel system components
   a) hand tools
   b) measuring equipment
i. feeler gauges  
ii. dial test indicators  
iii. internal and external micrometers  
iv. Vernier and depth gauges  
c) special purpose wrenches and stud removers  
d) vehicle and unit lifting devices and supports  
e) torque wrenches  
f) brushes, solvents and other cleaning equipment  
g) lubricants, easing oils, and specialist fluids  
h) locking and joining devices and materials

4) Describe  
   a) how vehicle systems are evaluated for operational efficiency following component replacement  
      i. workshop procedures  
      ii. road testing procedures  
      iii. manufacturers requirements  
      iv. legal requirements  
   b) Describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement  
      i. exhaust gas emissions testers  
      ii. compression and leakage testers  
      iii. engine analysers

5) State how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 6
Describe ignition system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe
   a) the components, operating principles, and functions of ignition systems
   b) for ignition systems the
      i. working principles
      ii. factors which influence coil output
      iii. effect of ignition polarity
      iv. effect of temperature, pressure and varying mixture strength on plug firing voltage
      v. principle of producing an emf by mutual induction

2) Describe how to remove, replace and adjust spark-ignition systems and components
   a) LT switching devices
   b) sensors - magnetic reluctor, Hall effect, optical
   c) switches, ballast resistors and resistive cables
   d) ignition coils – air/oil cooled and ballast resisted
   e) distributors, caps, leads and rotor arms
   f) spark plugs, capacitors and interference suppression devices

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) hand tools
   b) measuring equipment
      i. feeler gauges
      ii. plug gauge wires
   c) torque wrenches
   d) brushes, solvents and other cleaning equipment
   e) lubricants, easing oils, and specialist fluids
   f) locking and joining devices and materials

4) Describe
   a) how vehicle systems are evaluated for operational efficiency following component replacement
      i. workshop procedures
      ii. road testing procedures
      iii. manufacturers requirements
      iv. legal requirements
   b) the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
      i. exhaust gas emissions testers
ii. compression and leakage testers
iii. engine analysers
iv. multimeters

5) State how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 7
Describe engine electrical components operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe the functions and working principles of the electrical system components
   a) batteries
   b) starting systems
   c) charging systems
   d) combined starter-generator systems (also motorcycle)

2) Describe how to remove, replace and adjust engine electrical systems and components
   a) battery
   b) starter
   c) alternator
   d) combined starter-generators (also motorcycle)

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) hand tools
   b) measuring equipment
      i. multimeters
      ii. code readers
   c) torque wrenches
   d) brushes, solvents and other cleaning equipment
   e) lubricants, easing oils, and specialist fluids
   f) locking and joining devices and materials

4) Describe
   a) how vehicle systems are evaluated for operational efficiency following component replacement
      i. workshop procedures
      ii. functional/operational tests
      iii. manufacturers requirements
      iv. legal requirements
   b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
      i. electrical testers
      ii. multimeters
      iii. oscilloscopes
      iv. engine analysers
      v. battery testers

5) State how records of workplace activities are completed as computer or paper based systems.
6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.

Assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
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<td><strong>Total 25</strong></td>
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Test duration 35mins
Evidence requirements
To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.
Information for VRQs (Technical Certificates).

To complete this unit you must:
remove and replace electrical auxiliary units and components from 3 out of the 8 systems below:

1. Lighting systems
2. Wiper systems
3. Security and alarm systems
4. Comfort and convenience systems
5. Audio systems
6. Communication systems
7. Electric window systems
8. Monitoring and instrumentation systems.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that your performance has covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in:
   - your normal workplace
   - an approved centre, or
   - a combination of both.
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit
You must:

7. Produce evidence of removing and replacing at least 4 units or components, each from a different electrical auxiliary system. At least 3 of these 4 pieces of evidence must come from work in your normal workplace.
8. Your assessor must physically observe you in your normal workplace successfully carrying out on at least 1 occasion the removal and replacement of electrical auxiliary units and components from 2 out of the 8* systems below:
   - lighting systems
   - wiper systems
   - security and alarm systems
   - comfort and convenience systems
   - audio systems
   - communication systems
   - electric window systems
   - monitoring and instrumentation systems.

*However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of all the systems listed above.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
### Evidence reference summary

<table>
<thead>
<tr>
<th>Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.</th>
<th>Portfolio reference number (PRN)</th>
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<tbody>
<tr>
<td>[City &amp; Guilds Logo]</td>
<td>VRQ</td>
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<tr>
<td>Removing and replacing a unit or component 1</td>
<td>Observed assessment</td>
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<td>Removing and replacing a unit or component 3</td>
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<td>Removing and replacing a unit or component 4</td>
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#### Supplementary evidence (if used) PRN

#### On line test reference for this unit PRN

### Unit assessment and verification declaration

<table>
<thead>
<tr>
<th>VRQ Candidate declaration:</th>
<th>N/SVQ Candidate declaration:</th>
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<tbody>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
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<tr>
<td>Candidate name:</td>
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<td>Candidate enrolment number:</td>
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<thead>
<tr>
<th>VRQ Assessor declaration:</th>
<th>N/SVQ Assessor declaration:</th>
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<tbody>
<tr>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
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<td>Assessor name:</td>
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<td>Assessor signature:</td>
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<td>Countersignature: (if relevant):</td>
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<tr>
<th>VRQ Internal verifier Declaration:</th>
<th>N/SVQ Internal verifier Declaration:</th>
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<tr>
<td>(Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</td>
<td>(Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</td>
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<tr>
<td>sampling candidate and assessment evidence</td>
<td>sampling candidate and assessment evidence</td>
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<td>observation of assessment practice</td>
<td>observation of assessment practice</td>
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<td>discussion with candidate</td>
<td>discussion with candidate</td>
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<td>other – please state:</td>
<td>other – please state:</td>
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<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
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<td>Internal verifier name:</td>
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<td>Countersignature: (if relevant)</td>
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## Performance objective checklist

To be competent you must ensure that:

<table>
<thead>
<tr>
<th>To be competent you must ensure that</th>
<th>PRN</th>
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<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities.</td>
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<td>Support your removal and replacement activities by reviewing:</td>
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<td>- vehicle technical data</td>
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<td>- removal and replacement procedures</td>
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<td>- legal requirements.</td>
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<td>Prepare, test and use all the equipment required following manufacturers’ instructions.</td>
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<td>Carry out all removal and replacement activities following:</td>
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<td>- manufacturers’ instructions</td>
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<td>- your workplace procedures</td>
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<td>- health and safety requirements.</td>
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<td>You work in a way which minimises the risk of:</td>
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<td>- damage to other vehicle systems</td>
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<td>- damage to other vehicle components and units</td>
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<td>- contact with leakage</td>
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<td>- contact with hazardous substances.</td>
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<td>Ensure replaced auxiliary electrical units and components conform to the vehicle operating specification and any legal requirements.</td>
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<td>Record and report any additional faults you notice during the course of your work promptly.</td>
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<td>Use suitable testing methods to evaluate the performance of the reassembled system accurately.</td>
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<tr>
<td>Ensure the reassembled auxiliary electrical system performs to the vehicle operating specification and meets any legal requirements prior to return to the customer.</td>
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<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
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<td>Complete all removal and replacement activities within the agreed timescale.</td>
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<td>Report any expected delays in completion to the relevant person(s) promptly.</td>
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## Scope of this unit

All of the items listed below form part of this National Occupational Standard.

<table>
<thead>
<tr>
<th>Scope of this unit</th>
<th>PRN</th>
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<tbody>
<tr>
<td>1. Equipment is:</td>
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<td>a. hand tools</td>
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<td>b. special workshop tools</td>
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<td>c. general workshop equipment</td>
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<td>d. electrical meters.</td>
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<td>2. Testing methods are:</td>
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<td>a. visual</td>
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<td>b. aural</td>
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<td>c. functional.</td>
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<td>3. Electrical auxiliary units and components are for:</td>
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<td>a. lighting systems</td>
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<td>b. wiper systems</td>
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<td>c. security and alarm systems</td>
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<tr>
<td>d. comfort and convenience systems</td>
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<td>e. audio systems</td>
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<tr>
<td>f. communication systems</td>
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<tr>
<td>g. electric window systems</td>
<td></td>
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<tr>
<td>h. monitoring and instrumentation systems.</td>
<td></td>
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</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
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<table>
<thead>
<tr>
<th>Candidate</th>
<th>Date</th>
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</table>
Essential knowledge

<table>
<thead>
<tr>
<th>You need to understand:</th>
<th>PRN</th>
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</thead>
<tbody>
<tr>
<td><strong>Legislative and organisational requirements and procedures</strong></td>
<td></td>
</tr>
<tr>
<td>1. The legal requirements relating to the vehicle (including road safety and refrigerant handling requirements).</td>
<td></td>
</tr>
<tr>
<td>2. The health and safety legislation and workplace procedures relevant to vehicle maintenance activities and personal and vehicle protection.</td>
<td></td>
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<tr>
<td>3. Your workplace procedures for</td>
<td></td>
</tr>
<tr>
<td>- recording removal and replacement information</td>
<td></td>
</tr>
<tr>
<td>- the referral of problems</td>
<td></td>
</tr>
<tr>
<td>- reporting delays to the completion of work.</td>
<td></td>
</tr>
<tr>
<td>4. The importance of documenting removal and replacement information.</td>
<td></td>
</tr>
<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
<td></td>
</tr>
<tr>
<td>6. The relationship between time and costs.</td>
<td></td>
</tr>
<tr>
<td>7. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
<td></td>
</tr>
<tr>
<td><strong>Use of technical information</strong></td>
<td></td>
</tr>
<tr>
<td>8. How to find, interpret and use sources of information applicable to electrical unit and component removal and replacement.</td>
<td></td>
</tr>
<tr>
<td>9. The importance of using the correct sources of technical information.</td>
<td></td>
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<tr>
<td>10. The purpose of and how to use identification codes.</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical auxiliary system operation and construction</strong></td>
<td></td>
</tr>
<tr>
<td>11. How electrical auxiliary units and components are constructed, removed and replaced for the classification of vehicle worked upon.</td>
<td></td>
</tr>
<tr>
<td>12. How electrical auxiliary units and components operate for the classification of vehicle worked upon.</td>
<td></td>
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<tr>
<td><strong>Equipment</strong></td>
<td></td>
</tr>
<tr>
<td>13. How to prepare, test and use all the removal and replacement equipment required.</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical and electronic principles</strong></td>
<td></td>
</tr>
<tr>
<td>15. Electrical and electronic principles associated with electrical auxiliary systems, including types of sensors and actuators, their application and operation.</td>
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<tr>
<td>16. Types of circuit protection and why these are necessary.</td>
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<tr>
<td>17. Electrical safety procedures.</td>
<td></td>
</tr>
<tr>
<td>18. How lighting, warning, charging and starter circuits work.</td>
<td></td>
</tr>
<tr>
<td>19. Electric symbols, units and terms.</td>
<td></td>
</tr>
<tr>
<td>20. Electrical/electronic control system principles.</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical unit and component removal and replacement</strong></td>
<td></td>
</tr>
<tr>
<td>21. How to remove and replace electrical auxiliary units and components for the classification of vehicle worked upon.</td>
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</tr>
<tr>
<td>22. How to test and evaluate the performance of replacement electrical auxiliary units and components and the reassembled system against the vehicle operating specifications and any legal requirements.</td>
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</tr>
<tr>
<td>23. The relationship between testing methods and the electrical auxiliary units and components replaced and the use of appropriate test methods.</td>
<td></td>
</tr>
<tr>
<td>24. The manufacturer’s specification for the type and quality of electrical auxiliary units and components to be used.</td>
<td></td>
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<tr>
<td>25. How to work safely avoiding damage to other vehicle systems, components and units and contact with leakage and hazardous substances.</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
### Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong></td>
</tr>
<tr>
<td>C1.1; C1.3; C2.2</td>
<td>Access 3, Outcomes 2 and 3</td>
</tr>
<tr>
<td></td>
<td>Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong></td>
</tr>
<tr>
<td>N2.1?</td>
<td>Intermediate 1, Outcomes 1 and 2</td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong></td>
</tr>
<tr>
<td>WO1.1; WO1.2</td>
<td>Access 3, Outcomes 1 and 2</td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td><strong>No parallel unit.</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong></td>
</tr>
<tr>
<td>PS2.1</td>
<td>Intermediate 1, Outcome 1</td>
</tr>
</tbody>
</table>
Syllabus

*Remove and Replace Auxiliary Electrical Units and Components*

This unit is about removing and replacing units and components previously identified as faulty, damaged, deteriorated or where the customer has requested replacements. It is also about evaluating the performance of replaced units and components. The units and components concerned are those outside those replaced as part of normal routine, vehicle maintenance (servicing) activities.

**Course Outline**

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

<table>
<thead>
<tr>
<th>Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red <em>italics</em>, that specific to motorcycles is highlighted by blue <em>underlining</em> and that specific to heavy vehicle in green <strong>bold</strong>. GOLA tests will only cover the general content.</th>
</tr>
</thead>
</table>

Reference should also be made to the National Standards.

**Outcomes**

On completion of this unit, the student must be able to:

1. Describe basic electrical and electronic principles, units and circuits
2. Describe lighting system operating principles, functions and removal, replacements and adjustment procedures.
3. Describe wiper system operating principles, functions and removal, replacements and adjustment procedures.
4. Describe security and alarm system operating principles, functions and removal, replacements and adjustment procedures.
5. Describe comfort and convenience system operating principles, functions and removal, replacements and adjustment procedures.
6. Describe audio, visual, communication and navigation system operating principles, functions and removal, replacements and adjustment procedures.
7. Describe electric window, seat and sun roof system operating principles, functions and removal, replacements and adjustment procedures.
8. Describe monitoring and instrumentation systems operating principles, functions and removal, replacements and adjustment procedures.
Outcome 1
Describe basic electrical and electronic principles, units and circuits and evaluation techniques

Objectives
To achieve this outcome a student has to:

1. Describe the functions and working principles of an electrical system
   a) series and parallel circuits
   b) Ohm’s law
   c) Power equation
   d) Effects of electricity
   e) Induction (self and mutual).

2. Describe the function and operation of electrical systems and components
   a) electrical connections
   b) electrical switches and connections
   c) relays
   d) timers
   e) sensors and actuators
   f) fuses and fusible links
   g) basic electronic systems and circuits using
      i. resistors
      ii. capacitors
      iii. transistors
      iv. diodes
      v. zener diodes
   h) multiplexing systems
      i. protocols
      ii. transmission mediums (twister pair and fibre optic)
      iii. advantages and disadvantages.

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to work with electrical and electronic systems
   a) basic hand tools
   b) special workshop tools
   c) general workshop equipment
   d) measuring equipment
      i) multimeters
      ii) oscilloscopes
      iii) scanners
      iv) logic probes
   e) brushes, solvents and other cleaning equipment
   f) lubricants, easing oils, sealants and specialist fluids
   g) locking and joining devices and materials
h) electrical terminals (crimp and solder)

4.) Describe the testing methods used to evaluate the operation of electrical auxiliary units following replacement
   a visual
   b aural
   c simulated testing and measuring
   d functional

5) Describe the evaluation procedures and requirements required following replacement of electrical auxiliary components
   a workshop procedures
   b road testing procedures
   c manufacturers requirements
   d legal requirements
Outcome 2
Describe lighting system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. Describe the functions and working principles of the lighting system
   a) function to convert electrical energy for illumination and indicating purposes
   b) working principle converts electrical energy to heat
   c) focus, colour and beam aim

2. Describe how to remove, replace and adjust lighting systems and components
   a) electrical connections
   b) light units and reflectors
   c) bulbs (types and ratings)
   d) internal lights
   e) electrical switches and connections
   f) relays
   g) timers
   h) fuses and fusible links
   i) discharge (xenon etc.) lighting
   j) lighting circuits
   k) auxiliary lighting

3. The preparation and method of use of appropriate specialist equipment and procedures used to evaluate system performance following component replacement
   i) alignment testers
   ii) scanners / code readers
   iii) electrical measuring equipment

4. Understand how records of workplace activities are completed as computer or paper based systems.

5. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 3
Describe wiper system operating principles, functions and removal, replacements and adjustment procedures. (Note BMW CityScooter)

Objectives
To achieve this outcome a student has to:

1. Describe the functions and working principles of the wiper system
   a) function to clean screens and lights (also heavy)
   b) working principle converts electrical energy to movement
   c) speed control, timers and wash/wipe functions (also heavy)
   d) linkage operations
   e) blade parking systems

2. Describe how to remove, replace and adjust wiper systems and components
   a) electrical connections
   b) motors, linkages and blades
   c) electrical switches and connections
   d) relays
   e) timers
   f) fuses and fusible links
   g) wiper circuits

3. The preparation and method of use of appropriate specialist equipment and procedures used to evaluate system performance following component replacement
   a) scanners / code readers
   b) electrical measuring equipment

4. Understand how records of workplace activities are completed as computer or paper based systems.

5. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 4
Describe security and alarm system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. Describe the functions and working principles of the security and alarm systems
   a) anti theft methods
   b) immobilisation methods
   c) remote systems
   d) passive and active systems
   e) tracking systems.

2. Describe how to remove, replace and adjust security and alarm systems and components
   a) electrical connections
   b) horns and sirens
   c) sensors (movement, volumetric, mechanical)
   d) lights
   e) electrical switches and connections
   f) relays
   g) fuses and fusible links
   h) security and alarm circuits
   i) electronic control units

3. The preparation and method of use of appropriate specialist equipment and procedures used to evaluate system performance following component replacement
   a) scanners / code readers
   b) electrical measuring equipment

4. Understand how records of workplace activities are completed as computer or paper based systems.

5. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 5
Describe comfort and convenience system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. Describe the functions and working principles of the comfort and convenience systems
   a) electrically adjusted seats (also heavy)
   b) heated seats
   c) heated screens (also heavy)
   d) electric mirrors
   e) heating
   f) air conditioning (also heavy)
   g) climate control (also heavy)
   h) cruise control
   i) reversing systems (also heavy)
   j) circuits

2. Describe how to remove, replace and adjust comfort and convenience systems and components
   a) electrical connections
   b) motors
   c) sensors and actuators
   d) heating elements
   e) reversing warning systems (also heavy)
   f) mirrors
   g) electrical switches and connections
   h) relays
   i) timers
   j) fuses and fusible links
   k) heating and air conditioning components (also heavy)
      i. heater radiator/matrix
      ii. control valves and flaps
      iii. evaporator
      iv. condenser
      v. expansion valves
      vi. receiver drier units
      vii. pumps/compressors

3. The preparation and method of use of appropriate specialist equipment and procedures used to evaluate system performance following component replacement
   a) pressure testers
b) scanners / code readers

c) electrical measuring equipment

d) leak detectors

4 understand how records of workplace activities are completed as computer or paper based systems.

5 state the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 6
Describe audio, visual, communication and navigation system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. Describe the functions and working principles of the audio, visual, communication and navigation system
   a) supply information
   b) facilitate communication
   c) entertainment

2. Describe how to remove, replace and adjust audio, visual, communication and navigation systems and components
   a) electrical connections
   b) visual display units
   c) multimedia systems
   d) multi CD changers (also heavy)
   e) on board computers (also heavy)
   f) speakers
   g) satellite navigation unit
   h) aerials
   i) electrical switches and connections
   j) relays and timers
   k) fuses and fusible links

3. The preparation and method of use of appropriate specialist equipment and procedures used to evaluate system performance following component replacement
   a) scanners / code readers
   b) electrical measuring equipment

4. Understand how records of workplace activities are completed as computer or paper based systems.

5. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 7
Describe electric window, seat and sunroof system operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to: (also heavy)

1. Describe the functions and working principles of the electric window, seat and sunroof systems
   a) window movement
   b) sunroof movements
   c) seat movements
   d) motor reverse circuits
   e) links with locking and alarm systems (global closing)
   f) anti trap functions

2. Describe how to remove, replace and adjust electric window, seat and sunroof systems and components
   a) electrical connections
   b) motors
   c) mechanical regulators
   d) cables
   e) electrical switches and connections
   f) relays (including latching type)
   g) timers
   h) fuses and fusible links

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components

4. Understand how records of workplace activities are completed as computer or paper based systems.

5. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
**Outcome 8**
Describe Monitoring and instrumentation systems operating principles, functions and removal, replacements and adjustment procedures.

**Objectives**
To achieve this outcome a student has to:
1. Describe the functions and working principles of monitoring and instrumentation systems
   a) driver information systems
   b) driver warning systems
   c) driver advisory systems
2. Describe how to remove, replace and adjust monitoring and instrumentation systems and components
   a) electrical connections
   b) instrumentation systems
   c) illumination systems
   d) electrical switches and connections
   f) relays
   g) fuses and fusible links
   h) security and alarm circuits
   i) electronic control units
   i) the preparation and method of use of appropriate specialist equipment and procedures used to evaluate system performance following component replacement
      i) scanners / code readers
      ii) electrical measuring equipment
3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
4. Understand how records of workplace activities are completed as computer or paper based systems.
5. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Assessment

**Essential knowledge assessment**

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
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<tbody>
<tr>
<td>1</td>
<td>4</td>
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<td>2</td>
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<td>7</td>
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<td>8</td>
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</table>

**Test duration 35mins**  **Total 25**
MR04/V17

Remove and Replace Vehicle Chassis Units and Components

<table>
<thead>
<tr>
<th>Further guidance available</th>
<th>Observation of your task/work</th>
<th>Evidence recording</th>
<th>Computer based testing</th>
<th>?</th>
<th>Verbal Questioning</th>
</tr>
</thead>
</table>

**Evidence requirements**

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.
Information for VRQs (Technical Certificates).

To complete this unit you must:
Remove and replace units and components from each of the following systems:

1. Steering
2. Suspension
3. Braking

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:

1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - an approved centre, or
   - a combination of both.
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit
You must:

7. Produce evidence of removing and replacing 4 different units or components in total which must include items from steering, suspension and braking systems. Your evidence must include mechanical, electrical and hydraulic/fluid units or components.
8. Your assessor must physically observe you in your normal workplace on at least 1 occasion successfully removing and replacing units and components from each of the following systems:
   - steering
   - suspension
   - braking.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>Portfolio reference number (PRN)</th>
<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.</td>
<td></td>
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<tr>
<td>Removing and replacing units or components from steering, suspension and braking.</td>
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<tr>
<td>Removing and replacing units and components from steering.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Removing and replacing units and components from suspension.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removing and replacing units and components from braking.</td>
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</tbody>
</table>

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

**VRQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work

Candidate name: ...........................................
Candidate enrolment number: ...................................
Candidate signature: ...........................................
Date: ...........................................

**VRQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: ...........................................
Assessor signature: ...........................................
Date: ...........................................
Countersignature: (if relevant) ...........................................
Date: ...........................................

**VRQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ...........................................
Internal verifier signature: .......................... Date: ...........
Countersignature: (if relevant) ....................... Date: ...........

**N/SVQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work

Candidate name: ...........................................
Candidate enrolment number: ...................................
Candidate signature: ...........................................
Date: ...........................................

**N/SVQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: ...........................................
Assessor signature: ...........................................
Date: ...........................................
Countersignature: (if relevant) ...........................................
Date: ...........................................

**N/SVQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ...........................................
Internal verifier signature: .......................... Date: ...........
Countersignature: (if relevant) ....................... Date: ...........
## Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings throughout all removal and</td>
<td></td>
</tr>
<tr>
<td>replacement activities.</td>
<td></td>
</tr>
<tr>
<td>Support your removal and replacement activities by reviewing</td>
<td></td>
</tr>
<tr>
<td>• Vehicle technical data</td>
<td></td>
</tr>
<tr>
<td>• Removal and replacement procedures</td>
<td></td>
</tr>
<tr>
<td>• Legal requirements.</td>
<td></td>
</tr>
<tr>
<td>Prepare, test and use all the equipment required following manufacturers’ instructions.</td>
<td></td>
</tr>
<tr>
<td>Carry out all removal and replacement activities following;</td>
<td></td>
</tr>
<tr>
<td>• Manufacturers’ instructions</td>
<td></td>
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<tr>
<td>• Your workplace procedures</td>
<td></td>
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<tr>
<td>• Health and safety requirements.</td>
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<tr>
<td>You work in a way which minimises the risk of:</td>
<td></td>
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<tr>
<td>• Damage to other vehicle systems</td>
<td></td>
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<tr>
<td>• Damage to other vehicle components and units</td>
<td></td>
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<tr>
<td>• Contact with leakage</td>
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<tr>
<td>• Contact with hazardous substances.</td>
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<tr>
<td>Ensure replaced transmission and chassis units and components conform to the vehicle operating</td>
<td></td>
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<tr>
<td>specification and any legal requirements.</td>
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</tr>
<tr>
<td>Record and report any additional faults you notice during the course of your work promptly.</td>
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<tr>
<td>Use suitable testing methods to evaluate the performance of the reassembled system accurately.</td>
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<tr>
<td>Ensure the reassembled transmission and chassis system performs to the vehicle operating specification and meets any legal requirements prior to return to the customer.</td>
<td></td>
</tr>
<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
<td></td>
</tr>
<tr>
<td>Complete all removal and replacement activities within the agreed timescale.</td>
<td></td>
</tr>
<tr>
<td>You report any expected delays in completion to the relevant person(s) promptly.</td>
<td></td>
</tr>
</tbody>
</table>

## Scope of this unit

<table>
<thead>
<tr>
<th>All of the items listed below form part of this National Occupational Standard.</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Equipment is:</td>
<td></td>
</tr>
<tr>
<td>a. hand tools</td>
<td></td>
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<tr>
<td>b. special workshop tools</td>
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<tr>
<td>c. general workshop equipment</td>
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<tr>
<td>d. electrical testing equipment</td>
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<tr>
<td>2. Testing methods are:</td>
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<tr>
<td>a. visual</td>
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<tr>
<td>b. aural</td>
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<tr>
<td>c. functional</td>
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<tr>
<td>3. Units and components are:</td>
<td></td>
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<tr>
<td>a. mechanical</td>
<td></td>
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<tr>
<td>b. electrical</td>
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<tr>
<td>c. hydraulic</td>
<td></td>
</tr>
<tr>
<td>4. Chassis systems are:</td>
<td></td>
</tr>
<tr>
<td>a. steering</td>
<td></td>
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<tr>
<td>b. suspension</td>
<td></td>
</tr>
<tr>
<td>c. braking</td>
<td></td>
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</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
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</table>

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Date</th>
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<tbody>
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</tbody>
</table>
### Essential knowledge

#### You need to understand:

**Legislative and organisational requirements and procedures**
1. The legal requirements relating to the vehicle (including road safety requirements).
2. The health and safety legislation and workplace procedures relevant to vehicle maintenance activities and personal and vehicle protection.
3. Your workplace procedures for:
   - recording removal and replacement information
   - the referral of problems
   - reporting delays to the completion of work.
4. The importance of documenting removal and replacement information.
5. The importance of working to agreed timescales and keeping others informed of progress.
6. The relationship between time and costs.
7. The importance of reporting anticipated delays to the relevant person(s) promptly.

**Use of technical information**
8. How to find, interpret and use sources of information applicable to unit and component removal and replacement within chassis systems.
9. The importance of using the correct sources of technical information.
10. The purpose of and how to use identification codes.

**Electrical and electronic principles**
11. Vehicle earthing principles and earthing methods.
12. Electrical and electronic principles associated with chassis and transmission systems, including types of sensors and actuators, their application and operation.
13. Types of circuit protection and why these are necessary.
15. Electric symbols, units and terms.
16. Electrical and electronic control system principles.

**Chassis system operation and construction**
17. How chassis systems and their related units and components are constructed, removed and replaced for the classification of vehicle worked upon.
18. How chassis systems and their related units and components operate for the classification of vehicle worked upon.

**Equipment**
19. How to prepare, test and use all the removal and replacement equipment required.

**Chassis system unit and component removal and replacement**
20. How to remove and replace chassis system mechanical, electrical and hydraulic units and components for the classification of vehicle worked upon.
21. How to file, fit, tap, thread, cut and drill plastics and metals.
22. How to select and use gaskets, sealants, seals, fittings and fasteners.
23. How to test and evaluate the performance of replacement chassis system units and components and reassembled system against the vehicle operating specifications and any legal requirements.
24. The relationship between testing methods and the chassis system units and components replaced – the use of appropriate test methods.
25. When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements.
26. How to work safely avoiding damage to other vehicle systems, components and units and contact with leakage and hazardous substances.

---

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
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## Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
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<tbody>
<tr>
<td><strong>Communication:</strong></td>
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</tr>
<tr>
<td>C1.1; C1.3; C2.2</td>
<td>Access 3, Outcomes 2 and 3</td>
</tr>
<tr>
<td></td>
<td>Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong></td>
</tr>
<tr>
<td>N2.1; N2.2/1.2?? N1.3</td>
<td>Intermediate 1, Outcomes 1, 2 and (4? Or Access 3, Outcome 4)</td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong></td>
</tr>
<tr>
<td>WO2.2?</td>
<td>Intermediate 1, Outcome 2</td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td><strong>No parallel unit.</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong></td>
</tr>
<tr>
<td>PS2.1</td>
<td>Intermediate 1, Outcome 1</td>
</tr>
</tbody>
</table>
Syllabus

Remove and Replace Chassis Units and Components

This unit is about removing and replacing units and components where dismantling and re-assembly of chassis systems is required. It is also about evaluating the performance of replaced units and components. The units and components concerned are those outside those replaced as part of normal routine, vehicle maintenance (servicing) activities.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red *italics*, that specific to motorcycles is highlighted by blue *underlining* and that specific to heavy vehicle in green *bold*. GOLA tests will only cover the general content.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1) Describe suspension operating principles, functions and removal, replacements and adjustment procedures.

2) Describe steering operating principles, functions and removal, replacements and adjustment procedures.

3) Describe brakes operating principles, functions and removal, replacements and adjustment procedures.

4) Describe wheel and tyre operating principles, functions and removal, replacements and adjustment procedures.
Outcome 1
Describe suspension operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:
1) Describe the functions of the suspension system
   a) working principles
   b) materials used
   c) forces acting
   d) method of energy conversion
   e) graphical method of illustrating spring movement relative to time for damped and undamped springs
   f) definitions of
      i. bump
      ii. rebound
      iii. float
      iv. dive
      v. pitch
      vi. roll
      vii. compliance
2) Describe how to remove, replace and adjust suspension systems and components
   a) fixed and live axle
   b) struts
   c) wishbone
   d) trailing/semi trailing arm
   e) swinging arm and torsion beam
   f) springs (coil, leaf, torsion, gas and rubber)
   g) dampers
   h) swivel pins and struts
   i) joints and bushes
   j) axles, hubs and struts acting as suspension members
   k) bump and rebound stops
3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
4) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
e) legal requirements

5) Understand how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 2
Describe steering operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe the functions of steering systems
   a) working principles
   b) reasons for correct steering geometry
   c) methods of ensuring true rolling motion
   d) reasons for camber angle and swivel pin inclination
   e) principles of using caster angle for directional stability and self-centring action
   f) importance of correct wheel alignment

2) Describe how to remove, replace and adjust steering systems and components
   a) steering wheel, handlebars and column
   b) steering gearboxes, steering dampers
   c) steering idlers and joints
   d) steering swivels/headstocks
   e) hubs, bearings and seals
   f) drop arms and drag links
   g) track arms and track rod ends
   h) pumps and motors

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components

4) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
   e) legal requirements

5) Understand how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 3
Describe brakes operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe the functions of the braking system
   a) working principles
   b) use of friction to slow, stop or hold vehicle
   c) methods of transmitting, compensating and equalising driver’s effort
   d) factors affecting
      i. stopping distance
      ii. weight transference
      iii. brake fade and vapour lock
      iv. vehicle stability

2) Describe how to remove, replace and adjust braking systems and components
   a) pedal/lever, master and wheel cylinders, pressure reducers
   b) servo units and ABS components
   c) pads, discs and calipers
   d) drums, shoes and adjusting mechanisms
   e) cables, pipes and fluid
   f) switches and sensors
   g) wear, level and pressure indicating circuits

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components

4) describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
   e) legal requirements

5) Understand how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 4
Describe wheel and tyre operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe the functions of wheels and tyres
   a) working principles
   b) tread patterns for various conditions and operational requirements
   c) tyre rating and load carrying capacity
   d) types, sizes and speed ratings
   e) meaning of the terms
      i. aspect ratio
      ii. asymmetrical tyres
   f) reasons for types of material used in tyre/wheel construction
   g) reasons for wheel balancing
   h) reasons for using tread depth indicators
   i) reasons for the use of left and right hand threads when securing wheels

2) Describe how to remove, replace
   a) tyres from
      i. well base wheels
      ii. semi-drop centre
      iii. detachable flange
      iv. run flat
      v. spacesaver or specialist tyres
   b) wheels
      i. valves
      ii. balance weights
      iii. locating and securing devices

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components

4) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
   e) legal requirements

5) Understand how records of workplace activities are completed as computer or paper based systems.
6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.

**Assessment**

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
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<tbody>
<tr>
<td>1.</td>
<td>6</td>
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<td>2.</td>
<td>7</td>
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<tr>
<td>3.</td>
<td>7</td>
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<tr>
<td>4.</td>
<td>5</td>
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</tbody>
</table>

Test duration 35mins

Total 25
MR04HV/V18

Remove and Replace Commercial Vehicle Chassis Units and Components

<table>
<thead>
<tr>
<th>Evidence requirements</th>
<th>To complete this unit you will be required to undertake knowledge and practical tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For the knowledge test you must pass the City &amp; Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.</td>
</tr>
<tr>
<td></td>
<td>If you are completing an apprenticeship which includes both N/SVQ &amp; VRQ (Technical Certificate) you will only take this test once.</td>
</tr>
<tr>
<td></td>
<td>The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.</td>
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<tr>
<td></td>
<td>You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.</td>
</tr>
<tr>
<td></td>
<td>If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.</td>
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<tr>
<td></td>
<td>Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.</td>
</tr>
</tbody>
</table>
Information for VRQs (Technical Certificates).

To complete this unit you must:
remove and replace units and components from each of the following systems:

1. steering
2. suspension
3. braking

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this.

Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
**Information for N/SVQs**

**General Requirements**

**You must:**

1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both
6. Evidence from simulated activities is not acceptable for this unit.

**Specific Performance Evidence for this Unit**

**You must:**

7. Produce evidence of removing and replacing 4 different units or components in total which must include items from steering, suspension and braking systems. Your evidence must include mechanical, electrical and hydraulic/fluid and/or pneumatic units or components.
8. Your assessor must physically observe you in your normal workplace on at least 1 occasion successfully removing and replacing units and components from each of the following systems:
   - steering
   - suspension
   - braking

With your assessor you must complete a suitable **City & Guilds evidence recording form** for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>Portfolio reference number (PRN)</th>
<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed assessment</td>
<td>Approved centre or workplace</td>
<td>Observed assessment</td>
</tr>
</tbody>
</table>

Removing and replacing units or components from steering, suspension and braking

Removing and replacing units and components from steering

Removing and replacing units and components from suspension

Removing and replacing units and components from braking

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

<table>
<thead>
<tr>
<th>VRQ Candidate declaration:</th>
<th>N/SVQ Candidate declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
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</tr>
<tr>
<td>Candidate name:…………………………………………………..</td>
<td>Candidate name:…………………………………………………..</td>
</tr>
<tr>
<td>Candidate enrolment number:………………………………………</td>
<td>Candidate enrolment number:………………………………………</td>
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<tr>
<td>Candidate signature:…………………………………………….</td>
<td>Candidate signature:…………………………………………….</td>
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<td>Date: ………………………………………………………………</td>
<td>Date: ………………………………………………………………</td>
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<tr>
<th>VRQ Assessor declaration:</th>
<th>N/SVQ Assessor declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
</tr>
<tr>
<td>Assessor name: ……………………………………………………..</td>
<td>Assessor name: ……………………………………………………..</td>
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<tr>
<td>Assessor signature: ……………………………………………….</td>
<td>Assessor signature: ……………………………………………….</td>
</tr>
<tr>
<td>Date: ………………………………………………………………</td>
<td>Date: ………………………………………………………………</td>
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<td>Countersignature: (if relevant)……………………………………</td>
<td>Countersignature: (if relevant)……………………………………</td>
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<table>
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<tr>
<th>VRQ Internal verifier Declaration:</th>
<th>N/SVQ Internal verifier Declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</td>
<td>(Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</td>
</tr>
<tr>
<td>sampling candidate and assessment evidence</td>
<td>sampling candidate and assessment evidence</td>
</tr>
<tr>
<td>observation of assessment practice</td>
<td>observation of assessment practice</td>
</tr>
<tr>
<td>discussion with candidate</td>
<td>discussion with candidate</td>
</tr>
<tr>
<td>other – please state:</td>
<td>other – please state:</td>
</tr>
<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for verification and/or certification.</td>
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</tr>
<tr>
<td>Internal verifier name: …………………………………………..</td>
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<tr>
<td>Internal verifier signature: ……………. Date: ……………</td>
<td>Internal verifier signature: ……………. Date: ……………</td>
</tr>
<tr>
<td>Countersignature: (if relevant) …………… Date: ……………</td>
<td>Countersignature: (if relevant) …………… Date: ……………</td>
</tr>
</tbody>
</table>
## Performance objective checklist

**To be competent you must ensure that:**

| Wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities. | PRN |

| Support your removal and replacement activities by reviewing: | |
| - vehicle technical data | |
| - removal and replacement procedures | |
| - legal requirements. | |

<table>
<thead>
<tr>
<th>Prepare, test and use all the equipment required following manufacturers’ instructions.</th>
<th></th>
</tr>
</thead>
</table>

| Carry out all removal and replacement activities following: | |
| - manufacturers’ instructions | |
| - your workplace procedures | |
| - health and safety requirements. | |

| You work in a way which minimises the risk of: | |
| - damage to other vehicle systems | |
| - damage to other vehicle components and units | |
| - contact with leakage | |
| - contact with hazardous substances. | |

| Ensure replaced transmission and chassis units and components conform to the vehicle operating specification and any legal requirements. | |

| Record and report any additional faults you notice during the course of your work promptly. | |

| Use suitable testing methods to evaluate the performance of the reassembled system accurately. | |

| Ensure the reassembled transmission and chassis system performs to the vehicle operating specification and meets any legal requirements prior to return to the customer. | |

| Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required. | |

| Complete all removal and replacement activities within the agreed timescale. | |

| Report any expected delays in completion to the relevant person(s) promptly. | |

## Scope

**All of the items listed below form part of this National Occupational Standard.**

| PRN |

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<td>d. electrical testing equipment</td>
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| 2. Testing methods are: | |
| --- |
| a. visual | |
| b. aural | |
| c. functional | |

| 3. Units and components are: | |
| --- |
| a. mechanical | |
| b. electrical | |
| c. hydraulic | |

| 4. Chassis systems are | |
| --- |
| a. steering | |
| b. suspension | |
| c. braking | |

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

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<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
Essential knowledge

**You need to understand:**

**Legislative and organisational requirements and procedures**
1. The legal requirements relating to the vehicle (including road safety requirements).
2. The health and safety legislation and workplace procedures relevant to vehicle maintenance activities and personal and vehicle protection.
3. Your workplace procedures for
   - recording removal and replacement information
   - the referral of problems
   - reporting delays to the completion of work
4. The importance of documenting removal and replacement information
5. The importance of working to agreed timescales and keeping others informed of progress.
6. The relationship between time and costs.
7. The importance of reporting anticipated delays to the relevant person(s) promptly.

**Use of technical information**
8. How to find, interpret and use sources of information applicable to unit and component removal and replacement within chassis systems.
9. The importance of using the correct sources of technical information
10. The purpose of and how to use identification codes.

**Electrical and electronic principles**
11. Vehicle earthing principles and earthing methods.
12. Electrical and electronic principles associated with chassis and transmission systems, including types of sensors and actuators, their application and operation.
13. Types of circuit protection and why these are necessary.
15. Electric symbols, units and terms.
16. Electrical and electronic control system principles.

**Chassis system operation and construction**
17. How chassis systems and their related units and components are constructed, removed and replaced for the classification of vehicle worked upon.
18. How chassis systems and their related units and components operate for the classification of vehicle worked upon.

**Equipment**
19. How to prepare, test and use all the removal and replacement equipment required.

**Chassis system unit and component removal and replacement**
20. How to remove and replace chassis system mechanical, electrical and hydraulic units and components for the classification of vehicle worked upon.
21. How to file, fit, tap, thread, cut and drill plastics and metals.
22. How to select and use gaskets, sealants, seals, fittings and fasteners.
23. How to test and evaluate the performance of replacement chassis system units and components and the reassembled system against the vehicle operating specifications and any legal requirements.
24. The relationship between testing methods and the chassis system units and components replaced – the use of appropriate test methods.
25. When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements.
26. How to work safely avoiding damage to other vehicle systems, components and units and contact with leakage and hazardous substances.

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
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<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</table>
### Key/Core skills

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong></td>
</tr>
<tr>
<td>C1.1; C1.3; C2.2</td>
<td>Access 3, Outcomes 2 and 3</td>
</tr>
<tr>
<td></td>
<td>Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong></td>
</tr>
<tr>
<td>N2.1; N2.2</td>
<td>Intermediate 1, Outcomes 1, 2 and 4</td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong></td>
</tr>
<tr>
<td>WO1.1; WO1.2</td>
<td>Access 3, Outcomes 1 and 2</td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td><strong>No parallel unit.</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong></td>
</tr>
<tr>
<td>PS2.1</td>
<td>Intermediate 1, Outcome 1</td>
</tr>
</tbody>
</table>
**Syllabus**

**MR04HV Remove and Replace Commercial Vehicle Chassis Units and Components**

This unit is about removing and replacing units and components where dismantling and re-assembly of chassis systems is required. It is also about evaluating the performance of replaced units and components. The units and components concerned are those outside those replaced as part of normal routine, vehicle maintenance (servicing) activities.

**Course Outline**

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

**Outcomes**

On completion of this unit, the student must be able to:

1) Describe suspension operating principles, functions and removal, replacements and adjustment procedures.

2) Describe steering operating principles, functions and removal, replacements and adjustment procedures.

3) Describe brakes operating principles, functions and removal, replacements and adjustment procedures.

4) Describe wheel and tyre operating principles, functions and removal, replacements and adjustment procedures.
**Outcome 1**
Describe suspension operating principles, functions and removal, replacements and adjustment procedures.

**Objectives**
To achieve this outcome a student has to:

1) **Describe the functions of the suspension system**
   a) working principles
   b) materials used
   c) forces acting
   d) method of energy conversion
   e) graphical method of illustrating spring movement relative to time for damped and undamped springs
   f) definitions of
      i. **bump**
      ii. **rebound**
      iii. **float**
      iv. **dive**
      v. **pitch**
      vi. **roll**
      vii. **compliance**

2) **Describe how to remove, replace and adjust suspension systems and components**
   a) fixed, live axle and steered axle
   b) trailing/semi trailing arm
   c) springs leaf, coil, torsion, pneumatic (air) and rubber
   d) dampers
   e) swivel pins, joints and bushes
   f) axles, hubs and linkage/bars which act as suspension members
   g) bump and rebound stops

3) **Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components**

4) **Describe how vehicle systems are evaluated for operational efficiency following component replacement**
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
   e) legal requirements

5) **Understand how records of workplace activities are completed as computer or paper based systems.**

6) **State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.**
Outcome 2
Describe steering operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe the functions of steering systems
   a) working principles
   b) reasons for correct steering geometry
   c) methods of ensuring true rolling motion
   d) reasons for camber angle and swivel pin inclination
   e) principles of using caster angle for directional stability and self-centring action
   f) importance of correct front wheel alignment
   g) importance of correct axle alignment

2) Describe how to remove, replace and adjust steering systems and components
   a) steering wheel, column and steering gearboxes
   b) steering rods, links and joints
   c) steering swivels and king pins
   d) front hubs, bearings and seals
   e) drop arms and drag links
   f) track arms and track rod ends
   g) pumps and motors

3) Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components

4) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
   e) legal requirements

5) Understand how records of workplace activities are completed as computer or paper based systems.

6) State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
**Outcome 3**
Describe brakes operating principles, functions and removal, replacements and adjustment procedures.

**Objectives**
To achieve this outcome a student has to:

1) Describe the functions of the braking system
   a) working principles
   b) use of friction to slow, stop or hold vehicle
   c) methods of transmitting, compensating and equalising driver’s effort
   d) factors affecting
      i. stopping distance
      ii. weight transference
      iii. brake fade
      iv. vehicle stability

2) Describe how to remove, replace and adjust braking systems and components
   a) pedal, foot valve, brake chambers, slack adjusters
   b) drums, shoes and operating mechanisms
   c) pads, discs and callipers
   d) pipes, reservoirs and control valves
   e) ABS components
   f) switches and sensors
   g) wear, level and pressure indicating circuits

3) demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components

4) describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
   e) legal requirements

5) understand how records of workplace activities are completed as computer or paper based systems.

6) state the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 4
Describe wheel and tyre operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1) Describe the functions of wheels and tyres
   a) working principles
   b) tread patterns for various conditions and operational requirements
   c) tyre rating and load carrying capacity
   d) types, sizes, speed ratings and aspect ratio
   e) twin wheels low profile (super single) applications
   f) reasons for types of material used in tyre/wheel construction
   g) reasons for wheel balancing
   h) wheel lock nut security and indicating methods

2) Describe how to remove, replace
   a) tyres from
      i. semi-drop centre
      ii. detachable flange
      iii. run flat
      iv. specialist tyres and tread
   b) wheels
      i. valves
      ii. balance weights
      iii. locating and securing devices

3) demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components

4) describe how vehicle systems are evaluated for operational efficiency following component replacement
   a) workshop procedures
   b) road testing procedures
   c) special equipment
   d) manufacturers requirements
   e) legal requirements

5) understand how records of workplace activities are completed as computer or paper based systems.

6) state the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>6</td>
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<tr>
<td>2.</td>
<td>7</td>
</tr>
<tr>
<td>3.</td>
<td>7</td>
</tr>
<tr>
<td>4.</td>
<td>5</td>
</tr>
<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>


MR05/V19

Conduct Pre and Post Work Inspections

<table>
<thead>
<tr>
<th>Further guidance available</th>
<th>Observation of your task/work</th>
<th>Evidence recording</th>
<th>Computer based testing</th>
<th>Verbal Questioning</th>
</tr>
</thead>
</table>

**Evidence requirements**

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

**Information for VRQs (Technical Certificates).**

To complete this unit you must:

produce evidence of carrying out the following on different vehicles:

1. pre-work inspection
2. post-work inspection

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this.

Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:
1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit
You must:
7. Produce evidence of carrying out the following on different vehicles:
   1. 2 pre-work inspections
   2. 2 post-work inspections

Your assessor must observe you in your normal workplace successfully carrying out either a pre or lost work inspection on at least 1 occasion.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>Portfolio reference number (PRN)</th>
<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed assessment</td>
<td>Approved centre or workplace</td>
<td>Observed assessment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Pre-work inspection</th>
<th>Pre-work inspection</th>
<th>Post-work inspection</th>
<th>Post-work inspection</th>
</tr>
</thead>
</table>

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

**VRQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work
Candidate name:………………………………………………..
Candidate enrolment number:…………………………………
Candidate signature:…………………………………………
Date: …………………………

**VRQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
Assessor name: ……………………………………………….
Assessor signature:…………………………………………..
Date: …………………………
Countersignature: (if relevant)………………………………
Date: …………………………

**VRQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:
I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.
Internal verifier name: ………………………………………
Internal verifier signature: ……………………………… Date: ………
Countersignature: (if relevant) …………………………… Date: ………

**N/SVQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work
Candidate name:………………………………………………..
Candidate enrolment number:…………………………………
Candidate signature:…………………………………………
Date: …………………………

**N/SVQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
Assessor name: ……………………………………………….
Assessor signature:…………………………………………..
Date: …………………………
Countersignature: (if relevant)………………………………
Date: …………………………

**N/SVQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:
I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.
Internal verifier name: ………………………………………
Internal verifier signature: ……………………………… Date: ………
Countersignature: (if relevant) …………………………… Date: ………
## Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
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</thead>
<tbody>
<tr>
<td>Wear suitable personal protective equipment throughout all inspection activities.</td>
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<tr>
<td>Use suitable sources of technical information to support your inspection activities.</td>
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<tr>
<td>Carry out systematic vehicle inspections following:</td>
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<tr>
<td>* your workplace procedures</td>
<td></td>
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<tr>
<td>* health and safety requirements.</td>
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<tr>
<td>Conduct all vehicle testing following:</td>
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<tr>
<td>* the manufacturer’s instructions</td>
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<tr>
<td>* your workplace procedures</td>
<td></td>
</tr>
<tr>
<td>* health and safety requirements.</td>
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<tr>
<td>Ensure your comparison of the vehicle against specification accurately identifies any:</td>
<td></td>
</tr>
<tr>
<td>* differences from the vehicle specification</td>
<td></td>
</tr>
<tr>
<td>* vehicle appearance and condition faults</td>
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<tr>
<td>Work in a way which minimises the risk of damage to the vehicle and its systems, other people and</td>
<td></td>
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<tr>
<td>their property.</td>
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<tr>
<td>Make suitable recommendations for future action based upon the results of your tests and inspections.</td>
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<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the</td>
<td></td>
</tr>
<tr>
<td>format required.</td>
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<tr>
<td>Complete all inspection activities within the agreed timescale and to specification.</td>
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<tr>
<td>Report any anticipated delays in completion to the relevant person(s) promptly.</td>
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</tbody>
</table>

## Scope of this unit

<table>
<thead>
<tr>
<th>All of the items listed below form part of this National Occupational Standard.</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Inspections</strong> are</td>
<td></td>
</tr>
<tr>
<td>a. pre-work</td>
<td></td>
</tr>
<tr>
<td>b. post work</td>
<td></td>
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<tr>
<td><strong>2. Test methods</strong> are</td>
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</tr>
<tr>
<td>a. visual</td>
<td></td>
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<tr>
<td>b. aural</td>
<td></td>
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<tr>
<td>c. functional</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</tbody>
</table>
### Essential knowledge

<table>
<thead>
<tr>
<th>You need to understand:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legislative and organisational requirements and procedures</strong></td>
<td></td>
</tr>
<tr>
<td>1. The health and safety legislation and workplace procedures relevant to conducting pre and post work vehicle inspections and personal and vehicle protection.</td>
<td></td>
</tr>
<tr>
<td>2. Your workplace procedures for:</td>
<td></td>
</tr>
<tr>
<td>• recording pre and post work inspections and any variations from acceptable tolerances</td>
<td></td>
</tr>
<tr>
<td>• the referral of problems</td>
<td></td>
</tr>
<tr>
<td>• reporting delays to the completion of work</td>
<td></td>
</tr>
<tr>
<td>3. The importance of making accurate records of the results of your tests and inspections and interpreting them correctly.</td>
<td></td>
</tr>
<tr>
<td>4. The importance of working to agreed timescales and keeping others informed of progress.</td>
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<tr>
<td>5. The relationship between time and costs.</td>
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</tr>
<tr>
<td>6. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
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<tr>
<td><strong>Sources of information</strong></td>
<td></td>
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<tr>
<td>7. How to find, interpret and use technical information.</td>
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<tr>
<td>8. The importance of using technical information to inform your inspection and testing of vehicles.</td>
<td></td>
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<tr>
<td><strong>Testing methods and the conduct of Inspections</strong></td>
<td></td>
</tr>
<tr>
<td>9. How vehicle systems operate (including the engine area, transmission area, chassis or frame area and electrical area) and the operational requirements for the vehicle(s) on which you are working.</td>
<td></td>
</tr>
<tr>
<td>10. How to follow procedures for the systematic pre and post work inspection of vehicles.</td>
<td></td>
</tr>
<tr>
<td>11. How to test the operation of vehicle systems and vehicle condition</td>
<td></td>
</tr>
<tr>
<td>12. How to compare test and inspection results against vehicle specifications and legal requirements.</td>
<td></td>
</tr>
<tr>
<td>13. How to record test and inspection results in the format required.</td>
<td></td>
</tr>
<tr>
<td>14. How to make recommendations based upon the results of your inspections.</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

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</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
## Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication</strong>: C1.1; C1.3; C2.2</td>
<td><strong>Communication</strong>: Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number</strong>: N2.1; N2.2; N2.3?</td>
<td><strong>Numeracy</strong>: Intermediate 1, Outcomes 1, 2 and 4</td>
</tr>
<tr>
<td><strong>Information Technology</strong>: ICT1.1; ICT1.2; ICT1.3?</td>
<td><strong>Information Technology</strong>: Access 3, Outcomes 1, 2 and 3?</td>
</tr>
<tr>
<td><strong>Working with Others</strong>: WO2.2</td>
<td><strong>Working with Others</strong>: Intermediate 1, Outcome 2</td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance</strong>: Not applicable</td>
<td><strong>Problem Solving</strong>: Not applicable</td>
</tr>
<tr>
<td><strong>Problem Solving</strong>: PS3.1; PS3.2; PS3.3</td>
<td><strong>Problem Solving</strong>: Intermediate 2, Outcomes 1, 2 and 3</td>
</tr>
</tbody>
</table>
Syllabus

**MR05 Conduct Pre and Post Work Vehicle Inspections.**
This unit is about carrying out pre and post work inspections of vehicles using a variety of basic testing and inspection methods.

Course Outline
To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes
On completion of this unit, the student must be able to:

1. Describe pre-work vehicle inspections and recording procedures
2. Describe post-work vehicle inspections and recording procedures
3. Describe the procedures for recording the results of inspection activity
Outcome 1
Describe the pre-work vehicle inspections, using visual, aural and operational test methods and the recording of the results

Objectives
To achieve this outcome a student has to:

1) State the systematic procedures for pre-work inspections to establish the condition of the vehicle prior to diagnosis, maintenance or repair for

a) State, for vehicle bodywork checks for
   i. external damage, inoperative or missing components
   ii. internal seat belts, trim, mileage and fuel tank reading
   iii. compliance with manufacturers and legal requirements

b) State, for petrol and diesel engine systems, tests used to evaluate
   i. compression pressures
   ii. cylinder leakage pressure
   iii. lubrication system pressure
   iv. cooling system pressure, operating temperature and fan operation
   v. petrol and diesel fuel systems for compliance with manufacturers and legal requirements
   vi. engine support and location systems
   vii. air supply, emission control and exhaust systems

c) State, for manual and automatic transmission system checks for
   i. fluid leakage
   ii. security of mountings and location components
   iii. operation and security of drivers controls

d) State, for final drive and drive shaft systems tests used for
   i. fluid or lubricant leakage
   ii. security of mountings

e) State, for steering, suspension, wheel and tyre systems tests used for
   i. fluid or lubricant leakage
   ii. security and location system components
   iii. operation and security of drivers control system
   iv. compliance with manufacturers and legal requirements

f) State, for braking systems tests used for
   i. fluid leaks
   ii. operation and security of system components
   iii. compliance with manufacturers and legal requirements

g) State, for frame, chassis and monocoque/subframe systems tests used to
   i. assess under body protection
   ii. locate corrosion
   iii. locate bent or damaged members
iv. compliance with manufacturers and legal

h) State, for batteries, charging systems and starting systems tests used for
i. operation of the system
ii. security and location of units
iii. security and serviceability of connections/terminals/cables
iv. security and serviceability of drive devices
v. effectiveness of earth connections

i) State, for lighting, warning and indicating systems tests used for
i. operation of the system
ii. security and location of units
iii. security and serviceability of connections/terminals/cables
iv. effectiveness of earth connections

j) State, for alarm and immobiliser systems tests/checks used for
i. operation of the system
ii. security and location of units
iii. security and serviceability of connections/terminals/cables
iv. effectiveness of earth connections

2) State the inspection methods as
a) visual test methods
b) aural test methods
c) functional test methods

3) State the
a) sources of technical information used to assess vehicle condition
   i. inspection schedules
   ii. manufacturers manuals
   iii. Trade Association check lists
   iv. workplace procedures
   v. information and data sheets
   vi. VOSA (MOT) and legal requirements
b) state the methods of accessing data from
   i. computers
   ii. internet
   iii. paper based systems

4) State the source’s of agreed timescales
a) manufacturers recommended work times
b) job times
   i. set by the company
   ii. agreed with the customer

5) Record the results of the pre-work inspections using
a) computers
b) paper based systems

6) State the recommendations for maintenance and/or repair or replacement based on the results from the pre-work inspections
Outcome 2
Describe the post-work vehicle inspections and recording procedures

Objectives
To achieve this outcome a student has to:

1) State the systematic procedures for post-work inspections, to establish the condition of the vehicle following diagnosis, maintenance or repair. Compare the post-work inspection results with the pre-work results and to ensure that the vehicle systems comply with the requirements the law, the customer and meets manufacturers specifications for
   a) vehicle bodywork
   b) petrol and diesel engine systems
   c) manual and automatic transmission systems
   d) final drive and drive shaft systems
   e) steering, suspension, wheel and tyre systems
   f) braking systems
   g) frame, chassis and monocoque/subframe systems
   h) batteries, charging systems and starting systems
   i) lighting, warning and indicating systems

2) State how to record
   a) the results of the post-work inspections
   b) any additional work recommended following diagnosis, maintenance or repair using
      i. computers
      ii. paper based systems

3) Carry out all inspection activities following:
   a) manufacturers' instructions
   b) your workplace procedures
   c) health and safety requirements
   d) legal requirements.

4) Work in a way which minimises the risk of damage to the vehicle and its systems

5) Complete all inspection activities within the agreed timescale.
Outcome 3
Describe the procedures for recording the results of inspection activity

Objectives
To achieve this outcome a student has to describe the:

1) Importance of documenting inspection procedures

2) Procedures for recording inspection activities
   a) computer based
   b) hard copy

3) Procedures for recording the faults identified on components or units

4) Importance of ensuring the records are
   a) accurate
   b) complete
   c) in the format required
   d) passed promptly to the relevant person

5) Procedures for
   a) disposing of waste material resulting from the removal and inspection activities
   b) returning defective units and components to storage or for re-cycling, including refrigerant handling requirements
Assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>
# MR06/V20

## Inspect Vehicles

<table>
<thead>
<tr>
<th>Further guidance available</th>
<th>Observation of your task/work</th>
<th>Evidence recording</th>
<th>Computer based testing</th>
<th>Verbal Questioning</th>
</tr>
</thead>
</table>

## Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.
Information for VRQs (Technical Certificates).

To complete this unit you must:
Produce evidence of inspecting 2 different vehicles from 2 of the following:

- pre-delivery
- pre-purchase
- pre-MOT test
- safety
- post-accident

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
**Information for N/SVQs**

**General Requirements**

**You must:**

1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace
6. Evidence from simulated activities is not acceptable for this unit.

**Specific Performance Evidence for this Unit**

**You must:**

7. Produce evidence of inspecting at least 4 different vehicles. Your evidence must include at least 2* of the following types of inspection:
   - pre-delivery
   - pre-purchase
   - pre-MOT test
   - safety
   - post-accident

8. Your assessor must observe you carrying out inspection of vehicles in your normal workplace on at least 1 occasion.

*However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of all the types of inspections listed.

With your assessor you must complete a suitable **City & Guilds evidence recording form for each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.
### Evidence reference summary

<table>
<thead>
<tr>
<th>City &amp; Guilds</th>
<th>Portfolio reference number (PRN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.</td>
<td>VRQ</td>
</tr>
<tr>
<td></td>
<td>Observed assessment</td>
</tr>
</tbody>
</table>

- Inspecting vehicle 1
- Inspecting vehicle 2
- Inspecting vehicle 3
- Inspecting vehicle 4

### Supplementary evidence (if used) PRN

### On line test reference for this unit PRN

### Unit assessment and verification declaration

**VRQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work.

Candidate name: ................................................
Candidate enrolment number: ................................
Candidate signature: ..............................................
Date: .....................................................

**VRQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: ................................................
Assessor signature: ..............................................
Date: .....................................................
Countersignature: (if relevant) ................................
Date: .....................................................

**VRQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:
I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ..........................................
Internal verifier signature: .......................... Date: ....
Countersignature: (if relevant) .......................... Date: ....

**N/SVQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work.

Candidate name: ................................................
Candidate enrolment number: ................................
Candidate signature: ..............................................
Date: .....................................................

**N/SVQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: ................................................
Assessor signature: ..............................................
Date: .....................................................
Countersignature: (if relevant) ................................
Date: .....................................................

**N/SVQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:
I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ..........................................
Internal verifier signature: .......................... Date: ....
Countersignature: (if relevant) .......................... Date: ....
## Performance objective checklist

**To be competent you must ensure that:**

<table>
<thead>
<tr>
<th>PRN</th>
<th>Wear suitable personal protective equipment throughout all vehicle inspection activities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRN</td>
<td>Use suitable sources of technical information to support your vehicle inspection activities.</td>
</tr>
<tr>
<td>PRN</td>
<td>Where necessary, confirm that equipment has been calibrated to meet manufacturers’ and legal requirements.</td>
</tr>
<tr>
<td>PRN</td>
<td>Carry out systematic vehicle inspections following:</td>
</tr>
<tr>
<td></td>
<td>• your workplace procedures</td>
</tr>
<tr>
<td></td>
<td>• health and safety requirements.</td>
</tr>
<tr>
<td>PRN</td>
<td>Conduct all vehicle testing following:</td>
</tr>
<tr>
<td></td>
<td>• the manufacturer’s instructions</td>
</tr>
<tr>
<td></td>
<td>• the recognised test methods</td>
</tr>
<tr>
<td></td>
<td>• your workplace procedures</td>
</tr>
<tr>
<td></td>
<td>• health and safety requirements.</td>
</tr>
<tr>
<td>PRN</td>
<td>Ensure your comparison of the vehicle against specification accurately identifies any:</td>
</tr>
<tr>
<td></td>
<td>• differences from the vehicle specification</td>
</tr>
<tr>
<td></td>
<td>• vehicle appearance and condition faults</td>
</tr>
<tr>
<td></td>
<td>• non-compliance with statutory requirements</td>
</tr>
<tr>
<td>PRN</td>
<td>Work in a way which minimises the risk of damage to the vehicle and its systems, other people and their property.</td>
</tr>
<tr>
<td>PRN</td>
<td>Make suitable recommendations for future action based upon the results of your tests and inspections.</td>
</tr>
<tr>
<td>PRN</td>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
</tr>
<tr>
<td>PRN</td>
<td>Complete all inspection activities within the agreed timescale and to specification.</td>
</tr>
<tr>
<td>PRN</td>
<td>Report any anticipated delays in completion to the relevant person(s) promptly.</td>
</tr>
</tbody>
</table>

## Scope of this unit

All of the items listed below form part of this National Occupational Standard. **PRN**

### 1. Vehicle inspections are

| a. | pre-delivery |
| b. | pre-purchase |
| c. | pre-MOT test |
| d. | safety |
| e. | post-accident |

### 2. Test methods are

| a. | visual |
| b. | aural |
| c. | functional |
| d. | measurement |

### 3. Equipment

| a. | emissions testing |
| b. | brake testing |
| c. | headlamp alignment |
| d. | wheel alignment |
| e. | torque setting |
| f. | specialist diagnostic equipment |

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
### Essential knowledge

#### You need to understand:

<table>
<thead>
<tr>
<th>Legislative and organisational requirements and procedures</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. the health and safety legislation and workplace procedures relevant to conducting vehicle inspections and personal and vehicle protection.</td>
<td></td>
</tr>
<tr>
<td>2. the legislation relevant to the types of vehicle inspections described in the Scoping Statement for this unit.</td>
<td></td>
</tr>
<tr>
<td>3. your workplace procedures for recording vehicle inspections and any variations from acceptable tolerances reporting delays to the completion of work</td>
<td></td>
</tr>
<tr>
<td>4. the importance of making accurate records of the results of your tests and inspections and interpreting them correctly.</td>
<td></td>
</tr>
<tr>
<td>5. the importance of working to agreed timescales and keeping others informed of progress.</td>
<td></td>
</tr>
<tr>
<td>6. the relationship between time, costs and profitability.</td>
<td></td>
</tr>
<tr>
<td>7. the importance of reporting anticipated delays to the relevant person(s) promptly.</td>
<td></td>
</tr>
</tbody>
</table>

#### Sources of information

| 8. how to find, interpret and use technical information. |     |
| 9. the importance of using technical information to inform your inspection and testing of vehicles. |     |

#### Testing methods and the conduct of Inspections

| 10. how vehicle systems operate (including the engine area, transmission area, chassis or frame area and electrical area) and the operational tolerances for the vehicle(s) on which you are working. |     |
| 11. how to follow procedures for the systematic inspection of vehicles. |     |
| 12. how to test the operation of vehicle systems and vehicle condition, including workshop based and road tests. |     |
| 13. how to compare test and inspection results against vehicle specifications and legal requirements. |     |
| 14. how to record test and inspection results in the format required. |     |
| 15. how to make recommendations based upon the results of your inspections. |     |
| 16. the implications of failing to carry out an inspection correctly. |     |

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Date</th>
</tr>
</thead>
</table>
### Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
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<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong> Access 3, Outcomes 1, 2, 3</td>
</tr>
<tr>
<td>C1.1; C.2; C1.3?</td>
<td></td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong></td>
</tr>
<tr>
<td>WO1.1; WO1.2</td>
<td>Access 3, Outcomes 1 and 2</td>
</tr>
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<td><strong>Improving Own Learning and Performance:</strong></td>
<td><strong>No parallel unit.</strong></td>
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<tr>
<td>Not applicable</td>
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<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong></td>
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<tr>
<td>PS2.1</td>
<td>Intermediate 1, Outcome 1</td>
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Syllabus

Inspect vehicles
This unit is about carrying out a range of in depth inspections using a variety of testing methods and equipment

Course Outline
To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes
On completion of this unit, the student must be able to:

1) Describe the procedures for preparing tools and equipment required to carry out vehicle inspections
2) Describe the procedures for carrying out vehicle inspections and interpreting the results of the inspections
3) Describe the procedures for recommending rectification of defects identified by the inspection procedures
4) Describe the procedures for recording the results of rectification procedures
Outcome 1
 Describe the procedures for preparing tools and equipment required to carry out vehicle inspections

Objectives
 To achieve this outcome a student has to state the:

1) Types of inspection
   a) Pre-delivery
   b) Pre-purchase
   c) Pre VOSA (MOT) test
   d) Safety
   e) post accident

2) Equipment used for inspections
   a) emissions testing
   b) brake testing
   c) headlamp alignment
   d) wheel alignment and balancing
   e) torque setting
   f) specialist diagnostic equipment
   g) compression and leakage testers
   h) cooling system testers
   i) body alignment checking equipment
   j) electronic analysers and fault code readers (scanners)
   k) multimeters
   l) pyrometers

3) Sources and use of technical information
   a) computers
   b) electronic transmissions
   c) manufacturers data
   d) trade bulletins and data manuals

4) Procedures for
   a) preparing, connecting and testing the inspection and testing equipment prior to use
   b) systematic collection of sufficient information to enable precise identification of the systems
   c) using the tools and equipment correctly and safely at all times
   d) obtaining and checking the data required for inspection
   e) using the tools and equipment needed for inspection
Outcome 2
Describe the procedures for carrying out vehicle inspections and interpreting the results of the inspections

Objectives
To achieve this outcome a student has to describe
1) How vehicle systems operate
   a) Petrol and diesel engines
   b) Cooling systems
   c) Lubrication systems
   d) Petrol and diesel fuel supply and injection systems
   e) Manual and automatic gearbox systems
   f) Propeller shafts, drive shafts and associated joints
   g) Final drive systems
   h) Steering and suspension systems (including wheels and tyres)
   i) Anti-lock braking systems
   j) Traction control systems
   k) Electrical and electronic systems
   l) Body and chassis systems
2) How to follow procedures for the systematic inspection of vehicle systems and condition
3) The procedures for testing vehicles using
   a) workshop based tests
   b) road tests
4) The test methods used for vehicle inspection
   a) visual
   b) aural
   c) functional
   d) measurement
5) The implications of failing to carry out an inspection correctly
6) The methods of finding, interpreting and using information to ensure the systems and units inspected will comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits
7) Health and safety legislation and employers workshop practices relating to
   a) personal protection
   b) vehicle protection
   c) recording fault location and rectification activities
   d) referral of problems
e) reporting delays to the completion of work
f) importance of working to agreed timescales and keeping others informed of progress
g) relationship between time, costs and profitability
h) importance of reporting anticipated delays promptly

8) Methods of finding, interpreting and using information prior to inspection to ensure the systems and units will comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits

9) Health and safety legislation and employers workshop practices relating to
   a) personal protection
   b) vehicle protection
   c) recording fault location and rectification activities
   d) referral of problems
   e) reporting delays to the completion of work
   f) importance of working to agreed timescales and keeping others informed of progress
   g) relationship between time, costs and profitability
   h) importance of reporting anticipated delays promptly

10) Recommendations based upon the inspection procedures
    a) servicing
    b) repair

11) How to select the most appropriate methods of inspection

12) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer
Outcome 3
Describe the procedures for recommending rectification of defects identified by the inspection procedures

Objectives
To achieve this outcome a student has to:
1) Describe how to compare results of inspections with
   a) manufacturers specifications
   b) legal requirements
2) Describe the procedures for recommending rectification to those systems which fail to comply with manufacturers or legal requirements recommendations based upon the inspection procedures
   a) servicing or repair
   b) replacing components
   c) repairing components
Outcome 4
Describe the procedures for recording the results of inspection procedures

Objectives
To achieve this outcome a student has to describe the:

1) Importance of documenting inspection activities
2) Procedures for recording inspection activities
   a) computer based
   b) hard copy
3) Importance of ensuring the records are
   a) accurate
   b) complete
   c) in the format required
   d) passed promptly to the relevant person
4) Procedures for
   a) disposing of waste material resulting from the inspection activities
   b) returning defective units and components to storage or for re-cycling.

Assessment
Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
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<td>4</td>
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<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
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</table>
Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.
Information for VRQs (Technical Certificates).

To complete this unit you must:
Produce evidence of diagnosing and rectifying 1 fault in each of the following:

1. Engine mechanical systems
2. Engine electrical systems
3. Engine hydraulic and fluid systems.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:
1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both.
6. Simulated activities will be acceptable to assess candidates’ diagnosis and rectification of faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be diagnosed and rectified to ensure that all the evidence requirements can be met.

Specific Performance Evidence for this Unit
You must:
7. Produce evidence of diagnosing and rectifying 1 fault in each of the following:
   - engine mechanical systems
   - engine electrical systems
   - engine hydraulic and fluid systems.
8. Your identification of faults must have involved a 2 or more step diagnostic activity using a prescribed process or format.
9. Of the 3 pieces of evidence above, 2 must come from work carried out in your normal workplace.

Your assessor must physically observe you on at least 1 occasion undertaking an engine related diagnostic and rectification activity.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>City &amp; Guilds</th>
<th>Portfolio reference number (PRN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engine mechanical systems</th>
<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>Engine electrical systems</td>
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<tr>
<td>Engine hydraulic and fluid systems</td>
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</tr>
</tbody>
</table>

*Observation of any one system required

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

VRQ Candidate declaration:
I confirm that the evidence listed for this unit is authentic and a true representation of my own work
Candidate name:…………………………………………………..
Candidate enrolment number:……………………………………..
Candidate signature:………………………………………………
Date: ………………………

VRQ Assessor declaration:
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
Assessor name: …………………………………………………
Assessor signature:……………………………………………….
Date: ………………………
Countersignature: (if relevant)……………………………………
Date: ………………………

VRQ Internal verifier Declaration:
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
sampling candidate and assessment evidence
observation of assessment practice
discussion with candidate
other – please state:
I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.
Internal verifier name: ……………………………. Date: …………
Internal verifier signature: ……………………. Date: ……………
Countersignature: (if relevant) ……………………. Date: …………

N/SVQ Candidate declaration:
I confirm that the evidence listed for this unit is authentic and a true representation of my own work
Candidate name:…………………………………………………..
Candidate enrolment number:……………………………………..
Candidate signature:………………………………………………
Date: ………………………

N/SVQ Assessor declaration:
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
Assessor name: …………………………………………………
Assessor signature:……………………………………………….
Date: ………………………
Countersignature: (if relevant)……………………………………
Date: ………………………

N/SVQ Internal verifier Declaration:
(Leave blank if sampling of this unit did not take place.)
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observation of assessment practice
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other – please state:
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Internal verifier name: ……………………………. Date: …………
Internal verifier signature: ……………………. Date: ……………
Countersignature: (if relevant) ……………………. Date: …………
## Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings when using diagnostic methods and carrying out rectification activities.</td>
<td></td>
</tr>
<tr>
<td>Support the identification of faults, by reviewing vehicle:</td>
<td></td>
</tr>
<tr>
<td>• technical data</td>
<td></td>
</tr>
<tr>
<td>• diagnostic test procedures.</td>
<td></td>
</tr>
<tr>
<td>Prepare, connect and test all the required equipment following manufacturers’ instructions prior to use.</td>
<td></td>
</tr>
<tr>
<td>Use diagnostic methods which are relevant to the symptoms presented.</td>
<td></td>
</tr>
<tr>
<td>Collect sufficient diagnostic information in a systematic way to enable an accurate diagnosis of engine system faults.</td>
<td></td>
</tr>
<tr>
<td>Identify and record any system deviation from acceptable limits accurately.</td>
<td></td>
</tr>
<tr>
<td>Ensure your assessment of dismantled sub-assemblies, components and units identifies their condition and suitability for repair or replacement, accurately.</td>
<td></td>
</tr>
<tr>
<td>Inform the relevant person(s) promptly where repairs are uneconomic or unsatisfactory to perform.</td>
<td></td>
</tr>
<tr>
<td>Use the equipment required, correctly and safely throughout all rectification activities.</td>
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</tr>
<tr>
<td>Carry out all rectification activities following:</td>
<td></td>
</tr>
<tr>
<td>• manufacturers’ instructions</td>
<td></td>
</tr>
<tr>
<td>• your workplace procedures</td>
<td></td>
</tr>
<tr>
<td>• health and safety requirements</td>
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</tr>
<tr>
<td>Work in a way which minimises the risk of:</td>
<td></td>
</tr>
<tr>
<td>• damage to other vehicle systems</td>
<td></td>
</tr>
<tr>
<td>• damage to other components and units</td>
<td></td>
</tr>
<tr>
<td>• contact with leakages</td>
<td></td>
</tr>
<tr>
<td>• contact with hazardous substances</td>
<td></td>
</tr>
<tr>
<td>Ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements.</td>
<td></td>
</tr>
<tr>
<td>When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.</td>
<td></td>
</tr>
<tr>
<td>Record and report any additional faults you notice during the course of work promptly.</td>
<td></td>
</tr>
<tr>
<td>Use testing methods which are suitable for assessing the performance of the system rectified.</td>
<td></td>
</tr>
<tr>
<td>Ensure the engine system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.</td>
<td></td>
</tr>
<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
<td></td>
</tr>
<tr>
<td>Complete all system diagnostic activities within the agreed timescale.</td>
<td></td>
</tr>
<tr>
<td>Report any anticipated delays in completion to the relevant person(s) promptly.</td>
<td></td>
</tr>
</tbody>
</table>
### Scope of this unit

All of the items listed below form part of this National Occupational Standard. PRN

<table>
<thead>
<tr>
<th>1. Faults occur within</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. the engine mechanical system</td>
</tr>
<tr>
<td>b. the engine electrical and electronic systems</td>
</tr>
<tr>
<td>c. the engine hydraulic and fluid systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Diagnostic methods are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. measurement</td>
</tr>
<tr>
<td>b. functional testing</td>
</tr>
<tr>
<td>c. electrical and electronic systems testing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Equipment is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. diagnostic and rectification equipment for engine mechanical systems</td>
</tr>
<tr>
<td>b. diagnostic and rectification equipment for engine electrical systems</td>
</tr>
<tr>
<td>c. diagnostic and rectification equipment for engine hydraulic and fluid systems</td>
</tr>
<tr>
<td>d. specialist repair tools</td>
</tr>
<tr>
<td>e. general workshop equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Rectification activities are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. dismantling</td>
</tr>
<tr>
<td>b. replacement of units and components</td>
</tr>
<tr>
<td>c. adjustment of units and components</td>
</tr>
<tr>
<td>d. repairs to wiring and connectors</td>
</tr>
<tr>
<td>e. re-programming vehicle systems</td>
</tr>
<tr>
<td>f. reassembly</td>
</tr>
<tr>
<td>g. functional testing.</td>
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</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
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<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</tbody>
</table>
## Essential knowledge

**You need to understand:**

<table>
<thead>
<tr>
<th>Legislative and organisational requirements and procedures</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying engine faults.</td>
<td></td>
</tr>
<tr>
<td>2. Legal requirements relating to the vehicle (including road safety requirements).</td>
<td></td>
</tr>
<tr>
<td>3. Your workplace procedures for - recording removal and replacement information - the referral of problems - reporting delays to the completion of work.</td>
<td></td>
</tr>
<tr>
<td>4. The importance of, documenting diagnostic and rectification information.</td>
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<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
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<tr>
<td>6. The relationship between time, costs and profitability.</td>
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<tr>
<td>7. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
<td></td>
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</tbody>
</table>

### Electrical and electronic principles

8. Electrical and electronic principles associated with engine systems, including types of sensors and actuators, their application and operation.

9. How electrical and electronic engine systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles.

10. The interaction between electrical, electronic and mechanical components within vehicle engine systems

11. Electrical symbols, units and terms.

12. Electrical safety procedures.

### Use of diagnostic and rectification equipment

13. How to prepare and test the accuracy of diagnostic testing equipment.

14. How to use diagnostic and rectification equipment for engine mechanical, electrical, electronic, hydraulic and fluid systems; specialist engine repair tools and general workshop equipment

### Engine faults, their diagnosis and correction

15. How engine mechanical, electrical, electronic and hydraulic and fluid systems are constructed, operate, dismantled and reassembled.

16. The types and causes of engine mechanical, electrical, electronic and hydraulic and fluid system, component, unit faults and failures.

17. Engine mechanical, electrical, electronic and hydraulic and fluid component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action.

18. How to find, interpret and use sources of information on engine electrical and electronic operating specifications, diagnostic test procedures, repair procedures and legal requirements.

19. Vehicle operating specifications for limits, fits and tolerances relating to engine mechanical, electrical, electronic and hydraulic and fluid systems for the vehicle(s) on which you work.

20. How to select the most appropriate diagnostic testing method for the symptoms presented.

21. How to carry out systematic diagnostic testing of engine mechanical, electrical and electronic, hydraulic and fluid systems using a prescribed process or format and the diagnostic methods listed in the Scoping Statement for this unit.

22. How to assess the condition evident within mechanical, electrical, electronic, hydraulic and fluid components and units.

23. How to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults.

24. How to carry out the rectification activities listed in the Scoping Statement for this unit in order to correct faults in the engine mechanical, electrical, electronic and hydraulic and fluid systems.

25. The relationship between test methodology and the faults repaired – the use of appropriate testing methods.

26. How to make cost effective recommendations for rectification.

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In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

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## Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
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<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong> Access 3, Outcomes 2 and 3</td>
</tr>
<tr>
<td>C1.1; C1.3; C2.2</td>
<td>Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong> Intermediate 1, Outcomes 1, 2 and 4</td>
</tr>
<tr>
<td>N2.1; N2.2; N2.3?</td>
<td></td>
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<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong> Access 3, Outcomes 1, 2 and 3</td>
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<tr>
<td>ICT1.1; ICT1.2; ICT1.3?</td>
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<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong> Intermediate 1, Outcome 2</td>
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<td>WO2.2</td>
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<tr>
<td><strong>Improving Own Learning and</strong></td>
<td><strong>No parallel unit.</strong></td>
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<td><strong>Performance:</strong></td>
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<td>Not applicable</td>
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<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong> Intermediate 2, Outcomes 1, 2 and 3</td>
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<tr>
<td>PS3.1; PS3.2; PS3.3</td>
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</table>
Syllabus

Diagnose and Rectify Vehicle Engine and Component Faults

This unit is about diagnosing and rectifying faults occurring in the vehicle engine mechanical, electrical, hydraulic and fluid systems.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red *italics*, that specific to motorcycles is highlighted by blue *underlining* and that specific to heavy vehicle in green **bold**. GOLA tests will only cover the general content.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1) Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis of engine systems.

2) Describe the procedures for preparing vehicle engine systems for diagnostic activities.

3) Describe the procedures for carrying out diagnostic inspections and tests and interpreting the results of these inspections.

4) Describe the procedures for rectification of defects identified by diagnostic procedures.

5) Describe the procedures for recording the results of rectification procedures.
Outcome 1
Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis of engine systems

Objectives
To achieve this outcome a student has to describe the
1) Preparation of equipment used for engine system diagnosis
   a) engine mechanical systems
      i. cylinder compression and leakage testers
      ii. clock gauges and degree plates
      iii. torque setting equipment
   b) engine electrical systems
      i. electronic analysers
      ii. fault code readers (EOBD/OBD scanners)
      iii. multimeters
      iv. oscilloscopes
   c) engine hydraulic and fluid systems
   d) specialist repair tools
   e) general workshop equipment
2) Procedures used to check the accuracy of the diagnostic and testing equipment
3) Methods of finding, interpreting and using information on engine mechanical, electrical, hydraulic and fluid systems to check they comply with
   a) legal requirements
      b) manufacturers specifications for
         i. repair procedures
         ii. limits, tolerances and fits
4) How to select the most appropriate diagnostic testing methods for the symptoms presented
5) Health and safety legislation and workplace procedures relating to diagnosing system faults
6) Legal and road safety requirements relating to the vehicle
**Outcome 2**
Describe the procedures for preparing vehicle engine systems for diagnostic activities

**Objectives**
To achieve this outcome a student has to describe the:

1) Procedures for preparing engine mechanical, electrical, hydraulic and fluid systems diagnosis
2) How engine mechanical, electrical, hydraulic and fluid systems
   a) are constructed
   b) operate
   c) are dismantled
   d) are re-assembled
3) Diagnostic information which is required
   a) wear
   b) run out
   c) pressures and compressions
   d) flow
   e) leakage
   f) electrical measurements
      i. voltage
      ii. pulse displays
      iii. electronic systems date
   g) control unit outputs/signals
4) Systems which are to be diagnosed
   a) engine mechanical (including pressure chargers)
   b) cooling systems
   c) electronic ignition
   d) petrol fuel injection
   e) diesel fuel injection
   f) lubrication and cooling
   g) engine management systems
   h) exhaust gas recirculation and emission control
   i) starting charging systems
   j) kick starting systems
5) Functional testing procedures
   a) engine balance
   b) power balance
   c) performance testing
   d) road testing
e) electrical testing

6) Hydraulic and fluid systems
   a) fuels
   b) oils and lubrication
   c) cooling systems
   d) air conditioning (also heavy)

7) Electrical and electronic principles associated with engine systems including types of sensors and actuators, application and operation

8) How electrical and electronic engines and systems operate and the interaction between electrical, electronic and mechanical components
   a) electrical component function
   b) inputs
   c) outputs
   d) voltages
   e) oscilloscope patterns
   f) digital and fibre optics principles

9) Electrical symbols and terms and safety procedures
Outcome 3
Describe the procedures for carrying out diagnostic inspections and interpreting the results of these inspections

Objectives
To achieve this outcome a student has to describe the:

1) Fault types where
   a) multiple failures occur within an individual system and involves a 2 or more stage diagnostic facility
   b) a cross system fault where an individual failure can affect several vehicle systems and involves a 2 or more stage diagnostic facility

2) Recommendations based upon the diagnostic procedures
   a) servicing
   b) dismantling for further inspection and testing
   c) repair
   d) replacement

3) Diagnosis procedures and diagnostic methods
   a) single system faults using a prescribed process or format
   b) multi and cross system faults using a prescribed process or format
   c) measurement
   d) functional testing
   e) electrical and electronic systems testing
   f) fault code reading

4) How to carry out systematic diagnostic testing of engine mechanical, electrical and electronic, hydraulic and fluid systems.

5) How to assess the condition of mechanical, electrical, electronic, hydraulic and fluid components and units

6) How to interpret test results and vehicle data to identify location and cause of faults.
Outcome 4
Describe the procedures for rectification of defects identified by diagnostic procedures

Objectives
To achieve this outcome a student has to describe the:

1) Rectification activities for engine mechanical, electrical, hydraulic and fluid systems diagnosis
   a) dismantling
   b) replacement of units and components
   c) adjustment of units and components
   d) repairs to wiring and connectors
   e) re-programming vehicle systems
   f) reassembly
   g) functional testing

2) Types and causes of engine mechanical, electrical, electronic and hydraulic and fluid system, component and unit faults and failures

3) Engine mechanical, electrical, electronic and hydraulic and fluid system, component replacement procedures, the circumstances which will necessitate replacement and other causes of action

4) How to carry out rectification activities on engine, mechanical, electrical, electronic and hydraulic and fluid systems.

5) How to make cost effective recommendations for rectification and the relationship between time, costs and profitability
Outcome 5
Describe the procedures for recording the results of rectification procedures and removal of materials

Objectives
To achieve this outcome a student has to describe the:
1) Importance of documenting diagnostic and rectification information
2) procedures for recording diagnostic and rectification activities
   a) computer based
   b) hard copy
3) Procedures for
   a) disposing of waste material resulting from the diagnostic and rectification activities
   b) returning defective units and components to storage or for re-cycling
4) Procedures for recording the faults identified on components or units

Assessment
Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
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<td>2</td>
<td>5</td>
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<td>3</td>
<td>8</td>
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<td>4</td>
<td>5</td>
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<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>
**Evidence requirements**

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.
Information for VRQs (Technical Certificates).

To complete this unit you must:
Produce evidence of diagnosing and rectifying 1 fault in each of the following systems:

1. Steering
2. Suspension
3. Braking

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
**Information for N/SVQs**

**General Requirements**

You must:

4. Produce evidence to show you meet all of the performance objectives consistently.
5. Produce evidence to show that you have covered all the items listed in the scope for this unit.
6. Produce evidence to show that you possess all the knowledge required.
7. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
8. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both.
9. Simulated activities will be acceptable to assess candidates’ diagnosis and rectification of faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be diagnosed and rectified to ensure that all the evidence requirements can be met.

**Specific Performance Evidence for this Unit**

You must:

10. Produce evidence of diagnosing and rectifying 1 fault in each of the following systems:
    - steering
    - suspension
    - the braking.
11. Your identification of faults must have involved a 2 or more step diagnostic activity using a prescribed process or format.
12. Of the 3 pieces of evidence above, 2 must come from work carried out in your normal workplace.

Your assessor must physically observe you on at least 1 occasion undertaking a chassis related diagnostic and rectification activity.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
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</thead>
<tbody>
<tr>
<td>Observed assessment</td>
<td>Approved centre or workplace</td>
<td>Observed assessment</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Steering</th>
<th>Suspension</th>
<th>Braking</th>
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<td>*</td>
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<tr>
<th>Supplementary evidence (if used) PRN</th>
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<tr>
<th>On line test reference for this unit PRN</th>
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## Unit assessment and verification declaration

<table>
<thead>
<tr>
<th>VRQ Candidate declaration:</th>
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</thead>
<tbody>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work.</td>
</tr>
<tr>
<td>Candidate name:…………………..</td>
</tr>
<tr>
<td>Candidate enrolment number:………………..</td>
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<td>Candidate signature:…………………..</td>
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<thead>
<tr>
<th>VRQ Assessor declaration:</th>
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<tbody>
<tr>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
</tr>
<tr>
<td>Assessor name: …………………..</td>
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<td>Countersignature: (if relevant)…………………..</td>
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<thead>
<tr>
<th>VRQ Internal verifier Declaration:</th>
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<tbody>
<tr>
<td>(Leave blank if sampling of this unit did not take place.)</td>
</tr>
<tr>
<td>I have internally verified the assessment work on this unit in the following ways (please tick):</td>
</tr>
<tr>
<td>sampling candidate and assessment evidence</td>
</tr>
<tr>
<td>observation of assessment practice</td>
</tr>
<tr>
<td>discussion with candidate</td>
</tr>
<tr>
<td>other – please state:</td>
</tr>
<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
</tr>
<tr>
<td>Internal verifier name: …………………..</td>
</tr>
<tr>
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<tr>
<td>Countersignature: (if relevant) ………………….. Date: …………………..</td>
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</table>
### Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
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<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings when using diagnostic methods and carrying out rectification activities.</td>
<td></td>
</tr>
<tr>
<td>Support the identification of faults, by reviewing vehicle:</td>
<td></td>
</tr>
<tr>
<td>• technical data</td>
<td></td>
</tr>
<tr>
<td>• diagnostic test procedures.</td>
<td></td>
</tr>
<tr>
<td>Prepare, connect and test all the required equipment following manufacturers’ instructions prior to use.</td>
<td></td>
</tr>
<tr>
<td>Use diagnostic methods which are relevant to the symptoms presented.</td>
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</tr>
<tr>
<td>Collect sufficient diagnostic information in a systematic way to enable an accurate diagnosis of transmission and chassis system faults.</td>
<td></td>
</tr>
<tr>
<td>Identify and record any system deviation from acceptable limits accurately.</td>
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<tr>
<td>Ensure your assessment of dismantled sub-assemblies, components and units identifies their condition and suitability for repair or replacement, accurately.</td>
<td></td>
</tr>
<tr>
<td>Inform the relevant person(s) promptly where repairs are uneconomic or unsatisfactory to perform.</td>
<td></td>
</tr>
<tr>
<td>Use the equipment required, correctly and safely throughout all rectification activities.</td>
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</tr>
<tr>
<td>Carry out all rectification activities following:</td>
<td></td>
</tr>
<tr>
<td>• manufacturers’ instructions</td>
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<tr>
<td>• your workplace procedures</td>
<td></td>
</tr>
<tr>
<td>• health and safety requirements.</td>
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</tr>
<tr>
<td>Work in a way which minimises the risk of:</td>
<td></td>
</tr>
<tr>
<td>• damage to other vehicle systems</td>
<td></td>
</tr>
<tr>
<td>• damage to other components and units</td>
<td></td>
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<tr>
<td>• contact with leakages</td>
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<tr>
<td>• contact with hazardous substances.</td>
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<tr>
<td>Ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements.</td>
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<tr>
<td>When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.</td>
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</tr>
<tr>
<td>Record and report any additional faults you notice during the course of work promptly.</td>
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</tr>
<tr>
<td>Use testing methods which are suitable for assessing the performance of the system rectified.</td>
<td></td>
</tr>
<tr>
<td>Ensure the transmission or chassis system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.</td>
<td></td>
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<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
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<tr>
<td>Complete all system diagnostic activities within the agreed timescale.</td>
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<tr>
<td>Report any anticipated delays in completion to the relevant person(s) promptly.</td>
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</table>
### Scope of this unit

All of the items listed below form part of this National Occupational Standard.

<table>
<thead>
<tr>
<th>PRN</th>
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<tbody>
<tr>
<td>1. <strong>Chassis systems are</strong></td>
</tr>
<tr>
<td>a. steering</td>
</tr>
<tr>
<td>b. suspension</td>
</tr>
<tr>
<td>c. braking.</td>
</tr>
<tr>
<td>2. <strong>Diagnostic methods are:</strong></td>
</tr>
<tr>
<td>a. measurement</td>
</tr>
<tr>
<td>b. functional testing</td>
</tr>
<tr>
<td>c. electrical and electronic systems testing.</td>
</tr>
<tr>
<td>3. <strong>Equipment is:</strong></td>
</tr>
<tr>
<td>a. diagnostic and rectification equipment for chassis mechanical systems</td>
</tr>
<tr>
<td>b. diagnostic and rectification equipment for chassis electrical systems</td>
</tr>
<tr>
<td>c. diagnostic and rectification equipment for chassis hydraulic and fluid systems</td>
</tr>
<tr>
<td>d. specialist repair tools</td>
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<tr>
<td>e. general workshop equipment.</td>
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4. **Faults are:**

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<tr>
<th>PRN</th>
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<tbody>
<tr>
<td>a. mechanical</td>
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<tr>
<td>b. electrical and electronic</td>
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<tr>
<td>c. hydraulic and fluid.</td>
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5. **Rectification activities are:**

<table>
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<tr>
<th>PRN</th>
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<tbody>
<tr>
<td>a. dismantling</td>
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<tr>
<td>b. replacement of units and components</td>
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<tr>
<td>c. adjustment of units and components</td>
</tr>
<tr>
<td>d. repairs to wiring and connectors</td>
</tr>
<tr>
<td>e. re-programming vehicle systems</td>
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<td>f. reassembly</td>
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<tr>
<td>g. functional testing.</td>
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</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</table>
## Essential knowledge

### You need to understand:

<table>
<thead>
<tr>
<th>PRN</th>
<th>Legislative and organisational requirements and procedures</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying chassis faults.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Legal requirements relating to the vehicle (including road safety requirements).</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Your workplace procedures for: - recording removal and replacement information - the referral of problems - reporting delays to the completion of work.</td>
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</tr>
<tr>
<td>4.</td>
<td>The importance of documenting diagnostic and rectification information.</td>
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<tr>
<td>5.</td>
<td>The importance of working to agreed timescales and keeping others informed of progress.</td>
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<tr>
<td>6.</td>
<td>The relationship between time, costs and profitability.</td>
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<tr>
<td>7.</td>
<td>The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
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<table>
<thead>
<tr>
<th>PRN</th>
<th>Electrical and electronic principles</th>
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<tbody>
<tr>
<td>8.</td>
<td>Electrical and electronic principles associated with chassis systems, including types of sensors and actuators, their application and operation.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>How electrical and electronic chassis systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>The interaction between electrical, electronic and mechanical components within vehicle chassis systems</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Electrical symbols, units and terms.</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Electrical safety procedures.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PRN</th>
<th>Use of diagnostic and rectification equipment</th>
<th></th>
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<tbody>
<tr>
<td>13.</td>
<td>How to prepare and test the accuracy of diagnostic testing equipment.</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>How to use diagnostic and rectification equipment for chassis mechanical, electrical, hydraulic and fluid systems, specialist repair tools and general workshop equipment.</td>
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<table>
<thead>
<tr>
<th>PRN</th>
<th>Chassis faults, their diagnosis and correction</th>
<th></th>
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<tbody>
<tr>
<td>15.</td>
<td>How chassis mechanical, electrical, electronic and hydraulic and fluid systems are constructed, dismantled, reassembled and operate.</td>
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</tr>
<tr>
<td>16.</td>
<td>The types and causes of chassis mechanical, electrical, electronic and hydraulic and fluid system, component and unit faults and failures.</td>
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<tr>
<td>17.</td>
<td>Chassis mechanical, electrical and hydraulic and fluid component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action.</td>
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<tr>
<td>18.</td>
<td>How to find, interpret and use sources of information on chassis electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements.</td>
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<tr>
<td>19.</td>
<td>Vehicle operating specifications for limits, fits and tolerances relating to chassis mechanical, electrical, electronic and hydraulic and fluid systems for the vehicle(s) on which you work.</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>How to select the most appropriate diagnostic testing method for the symptoms presented.</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>How to carry out systematic diagnostic testing of chassis mechanical, electrical and electronic, hydraulic and fluid systems using a prescribed process or format.</td>
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<tr>
<td>22.</td>
<td>How to assess the condition evident within chassis mechanical, electrical, electronic, hydraulic and fluid components and units.</td>
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<tr>
<td>23.</td>
<td>How to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults.</td>
<td></td>
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<tr>
<td>24.</td>
<td>How to carry out the rectification activities listed in the Scoping Statement for this unit in order to correct faults in the chassis mechanical, electrical, electronic and hydraulic and fluid systems.</td>
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</tr>
<tr>
<td>25.</td>
<td>The relationship between test methodology and the faults repaired – the use of appropriate testing methods.</td>
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<tr>
<td>26.</td>
<td>How to make cost effective recommendations for rectification.</td>
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</table>

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

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### Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
</table>
| **Communication:**  
  C1.1; C1.3; C2.2                   | **Communication:**  
  Access 3, Outcomes 2 and 3  
  Intermediate 1, Outcome 1         |
| **Application of Number:**  
  N2.1; N2.2; N2.3?                  | **Numeracy:**  
  Intermediate 1, Outcomes 1, 2 and 4              |
| **Information Technology:**  
  ICT1.1; ICT1.2; ICT1.3?            | **Information Technology:**  
  Access 3, Outcomes 1, 2 and 3?                  |
| **Working with Others:**  
  WO2.2                              | **Working with Others:**  
  Intermediate 1, Outcome 2               |
| **Improving Own Learning and Performance:**  
  Not applicable                      | *No parallel unit.*                                    |
| **Problem Solving:**  
  PS3.1; PS3.2; PS3.3               | **Problem Solving:**  
  Intermediate 2, Outcomes 1, 2 and 3             |
Syllabus

Diagnose and Rectify Vehicle Chassis System Faults
This unit is about diagnosing and rectifying faults occurring in the vehicle steering, suspension, and braking systems

Course Outline
To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red *italics*, that specific to motorcycles is highlighted by blue *underlining* and that specific to heavy vehicle in green **bold**. GOLA tests will only cover the general content.

Reference should also be made to the National Standards.

Outcomes
On completion of this unit, the student must be able to:
1) Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis vehicle steering, suspension, and braking systems
2) Describe the procedures for preparing vehicle steering, suspension, and braking systems for diagnostic activities
3) Describe the procedures for carrying out diagnostic inspections and tests and interpreting the results of these inspections
4) Describe the procedures for rectification of defects identified by diagnostic procedures
5) Describe the procedures for recording the results of rectification procedures
Outcome 1
Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis vehicle steering, suspension, and braking systems

Objectives
To achieve this outcome a student has to describe the
1) a) Preparation of diagnostic equipment used for diagnosis of transmission, driveline, steering, suspension, and braking systems
   i. diagnostic and rectification equipment for chassis electrical systems
   ii. diagnostic and rectification equipment for chassis mechanical systems
   iii. diagnostic and rectification equipment for chassis hydraulic and fluid systems
   iv. specialist repair tools
   v. general workshop equipment
   vi. pressure and flow gauges
   vii. clock gauges and degree plates
   viii. torque setting equipment
   ix. belt tension gauges

b) electrical systems
   i. electronic analysers and fault code readers (scanners)
   ii. multimeters

c) specialist repair tools for hydraulic and fluid systems
d) pre-load gauges
e) general workshop equipment

2) Procedures used to check the accuracy of the diagnostic and testing equipment

3) Methods of finding, interpreting and using information on transmission, driveline, steering, suspension, and braking systems to check they comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits

4) How to select the most appropriate diagnostic testing methods for the symptoms presented

5) Health and safety legislation and workplace procedures relating to diagnosing system faults

6) Legal and road safety requirements relating to the vehicle

7) Procedures for
   a) systematic collection of sufficient diagnostic information to enable precise identification of the fault
   b) using the tools and equipment correctly and safely at all times

8) Procedures used to obtain and check the data required for diagnosis

9) Procedures for using the tools and equipment needed for diagnosis
Outcome 2

Describe the procedures for preparing vehicle steering, suspension, and braking systems for diagnostic activities

Objectives

To achieve this outcome a student has to describe the

1) Way in which chassis mechanical, electrical, electronic hydraulic and fluid systems
   a) are constructed
   b) operate
   c) are dismantled
   d) are re-assembled

2) Diagnostic information which is required
   a) wear
   b) run out
   c) pressures
   d) flow
   e) leakage
   f) electrical measurements
      i. voltage
      ii. pulse displays
      iii. electronic systems date
      iv. fault codes
      v. sensor measurements
      vi. control unit outputs/signals

3) Systems which are to be diagnosed
   a) suspension systems including hydro-pneumatic systems
      i. self levelling
      ii. manually adjustable
      iii. ride height
      iv. damper settings
   b) assisted steering systems
      i. electrical/electronic
      ii. progressive
      iii. two-stage (city/parking modes)
      iv. hydraulic
   c) non assisted steering systems
   d) rear and four wheel steering
   e) braking systems
   f) ABS/traction control systems
   g) wheels and tyres (relating to their effect on steering, suspension and brakes)
4) Functional testing procedures
   a) suspension alignment
   b) steering alignment
   c) PAS pressure testing
   d) current draw
   e) performance testing
   f) road testing

5) Hydraulic and fluid systems
   a) hydraulic braking systems
   b) hydro-pneumatic suspension systems
   c) power steering

6) Electrical and electronic principles associated with chassis systems including types of sensors and actuators, application and operation

7) How electrical and electronic chassis systems operate
   a) electrical component function
   b) inputs
   c) outputs
   d) voltages
   e) oscilloscope patterns
   f) digital and fibre optics principles

8) The interaction between electrical, electronic and mechanical components

9) Electrical symbols and terms and electrical safety procedures

10) Health and safety legislation and employers workshop practices relating to
   a) personal protection
   b) vehicle protection
   c) recording fault location and rectification activities
   d) referral of problems
   e) reporting delays to the completion of work
   f) importance of working to agreed timescales and keeping others informed of progress
   g) relationship between time, costs and profitability
   h) importance of reporting anticipated delays promptly

11) Reasons why failure has occurred

12) Recommendations based upon the inspection procedures
   a) servicing
   b) repair
Outcome 3
Describe the procedures for carrying out diagnostic inspections and tests and interpreting the results of these inspections

Objectives
To achieve this outcome a student has to describe the
1) Fault types where
   a) multiple failures occur within an individual system and involves a two or more stage diagnostic facility
   b) a cross system fault where an individual failure can affect several vehicle systems and involves a two more stage diagnostic facility
2) Recommendations based upon the diagnostic procedures
   a) servicing
   b) dismantling for further inspection and testing
   c) repair
   d) replacement
3) Diagnosis procedures covering
   a) single system faults using a prescribed process or format
   b) multi and cross system faults using a prescribed process or format
4) Diagnostic methods
   a) measurement
   b) functional testing
   c) electrical and electronic systems testing
5) How to carry out systematic diagnostic testing of chassis mechanical, electrical and electronic, hydraulic and fluid systems.
6) how to assess the condition of mechanical, electrical, electronic, hydraulic and fluid components and units
7) How to interpret test results and vehicle data to identify location and cause of faults.
8) Rectification by
   a) dismantling
   b) replacement of units or components
   c) adjustment of units and components
   d) repairs to wiring and connectors
   e) re-programming vehicle systems
   f) re-assembly
   g) functional testing
9) How to select the most appropriate methods of diagnosis
10) Interaction between electrical, electronic and mechanical components
11) Chassis electrical systems interlink, interact (including multiplexing)
12) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer
Outcome 4
Describe the procedures for rectification of defects identified by diagnostic procedures

Objectives
To achieve this outcome a student has to describe the:

1) Rectification activities for diagnosis of steering, suspension, and braking systems
   a) dismantling
   b) replacement of units and components
   c) adjustment of units and components
   d) repairs to wiring and connectors
   e) re-programming vehicle systems
   f) reassembly
   g) functional testing

2) Types and causes of mechanical, electrical, electronic and hydraulic and fluid system, component and unit faults and failures

3) Mechanical, electrical, electronic and hydraulic and fluid system, component replacement procedures, the circumstances which will necessitate replacement and other causes of action

4) How to carry out rectification activities on mechanical, electrical, electronic and hydraulic and fluid systems.

5) How to make cost effective recommendations for rectification

6) The relationship between time, costs and profitability

7) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer
**Outcome 5**
Describe the procedures for recording the results of rectification procedures

**Objectives**
To achieve this outcome a student has to describe the
1) Importance of documenting diagnostic and rectification information
2) Procedures for recording diagnostic and rectification activities
   a) computer based
   b) hard copy
3) Procedures for
   a) disposing of waste material resulting from the diagnostic and rectification activities
   b) returning defective units and components to storage or for re-cycling,
4) Procedures for recording the faults identified on components or units

**Assessment**
Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
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<tr>
<td>1</td>
<td>5</td>
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<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>
## Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

## Information for VRQs (Technical Certificates)

To complete this unit you must:

Produce evidence of diagnosing and rectifying 1 fault in each of the following systems:

1. steering
2. suspension
3. braking

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this.

Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:
1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both
6. Simulated activities will be acceptable to assess candidates’ diagnosis and rectification of faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be diagnosed and rectified to ensure that all the evidence requirements can be met.

Specific Performance Evidence for this Unit
You must:
7. Produce evidence of diagnosing and rectifying 1 fault in each of the following systems:
   - steering
   - suspension
   - the braking
8. Your identification of faults must have involved a 2 or more step diagnostic activity using a prescribed process or format.
9. Of the 3 pieces of evidence above, 2 must come from work carried out in your normal workplace.
10. Your assessor must physically observe you on at least 1 occasion undertaking a chassis related diagnostic and rectification activity.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio reference number (PRN)</td>
</tr>
<tr>
<td><strong>VRQ</strong></td>
</tr>
<tr>
<td>Observed assessment</td>
</tr>
</tbody>
</table>

| Steering | * |  |
|Suspension | * |  |
|Braking | * |  |

*Observation of any one system required

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

<table>
<thead>
<tr>
<th>VRQ Candidate declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
</tr>
<tr>
<td>Candidate name:…………………………………………………..</td>
</tr>
<tr>
<td>Candidate enrolment number:…………………………………….</td>
</tr>
<tr>
<td>Candidate signature:……………………………………………</td>
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<tr>
<td>Date: ………………………</td>
</tr>
<tr>
<td>N/SVQ Candidate declaration:</td>
</tr>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
</tr>
<tr>
<td>Candidate name:…………………………………………………..</td>
</tr>
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</tr>
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<tr>
<td>Date: ………………………</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>VRQ Assessor declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
</tr>
<tr>
<td>Assessor name: …………………………………………………</td>
</tr>
<tr>
<td>Assessor signature: ……………………………………………</td>
</tr>
<tr>
<td>Date: ………………………</td>
</tr>
<tr>
<td>Countersignature: (if relevant)…………………………………</td>
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<td>Date: ………………………</td>
</tr>
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<td>Countersignature: (if relevant)…………………………………</td>
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<td>Date: ………………………</td>
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</table>

<table>
<thead>
<tr>
<th>VRQ Internal verifier Declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have internally verified the assessment work on this unit in the following ways (please tick):</td>
</tr>
<tr>
<td>sampling candidate and assessment evidence</td>
</tr>
<tr>
<td>observation of assessment practice</td>
</tr>
<tr>
<td>discussion with candidate</td>
</tr>
<tr>
<td>other – please state:</td>
</tr>
<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
</tr>
<tr>
<td>Internal verifier name: …………………………………………..</td>
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<tr>
<td>Internal verifier signature: ……………………………………..</td>
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<tr>
<td>Countersignature: (if relevant) …………………………………</td>
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<tr>
<td>Date: ………………………</td>
</tr>
<tr>
<td>N/SVQ Internal verifier Declaration:</td>
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<td>I have internally verified the assessment work on this unit in the following ways (please tick):</td>
</tr>
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<tr>
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<tr>
<td>discussion with candidate</td>
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<tr>
<td>other – please state:</td>
</tr>
<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
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<td>Internal verifier name: …………………………………………..</td>
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<td>Internal verifier signature: ……………………………………..</td>
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<tr>
<td>Countersignature: (if relevant) …………………………………</td>
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<tr>
<td>Date: ………………………</td>
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</tbody>
</table>
Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings when using diagnostic methods and carrying out rectification activities.</td>
<td></td>
</tr>
<tr>
<td>Support the identification of faults, by reviewing vehicle:</td>
<td></td>
</tr>
<tr>
<td>• technical data</td>
<td></td>
</tr>
<tr>
<td>• diagnostic test procedures.</td>
<td></td>
</tr>
<tr>
<td>Prepare, connect and test all the required equipment following manufacturers' instructions prior to use.</td>
<td></td>
</tr>
<tr>
<td>Use diagnostic methods which are relevant to the symptoms presented.</td>
<td></td>
</tr>
<tr>
<td>Collect sufficient diagnostic information in a systematic way to enable an accurate diagnosis of transmission and chassis system faults.</td>
<td></td>
</tr>
<tr>
<td>Identify and record any system deviation from acceptable limits accurately.</td>
<td></td>
</tr>
<tr>
<td>Ensure your assessment of dismantled sub-assemblies, components and units identifies their condition and suitability for repair or replacement, accurately.</td>
<td></td>
</tr>
<tr>
<td>Inform the relevant person(s) promptly where repairs are uneconomic or unsatisfactory to perform.</td>
<td></td>
</tr>
<tr>
<td>Use the equipment required, correctly and safely throughout all rectification activities.</td>
<td></td>
</tr>
<tr>
<td>Carry out all rectification activities following:</td>
<td></td>
</tr>
<tr>
<td>• manufacturers' instructions</td>
<td></td>
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<tr>
<td>• your workplace procedures</td>
<td></td>
</tr>
<tr>
<td>• health and safety requirements.</td>
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<tr>
<td>Work in a way which minimises the risk of:</td>
<td></td>
</tr>
<tr>
<td>• damage to other vehicle systems</td>
<td></td>
</tr>
<tr>
<td>• damage to other components and units</td>
<td></td>
</tr>
<tr>
<td>• contact with leakages</td>
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</tr>
<tr>
<td>• contact with hazardous substances.</td>
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<tr>
<td>Ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements.</td>
<td></td>
</tr>
<tr>
<td>When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.</td>
<td></td>
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<tr>
<td>Record and report any additional faults you notice during the course of work promptly.</td>
<td></td>
</tr>
<tr>
<td>Use testing methods which are suitable for assessing the performance of the system rectified.</td>
<td></td>
</tr>
<tr>
<td>Ensure the transmission or chassis system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.</td>
<td></td>
</tr>
<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
<td></td>
</tr>
<tr>
<td>Complete all system diagnostic activities within the agreed timescale.</td>
<td></td>
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<tr>
<td>Report any anticipated delays in completion to the relevant person(s) promptly.</td>
<td></td>
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</tbody>
</table>

Scope of this unit

<table>
<thead>
<tr>
<th>All of the items listed below form part of this National Occupational Standard.</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chassis systems are</td>
<td></td>
</tr>
<tr>
<td>a. steering</td>
<td></td>
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<tr>
<td>b. suspension</td>
<td></td>
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<tr>
<td>c. braking</td>
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<tr>
<td>2. Diagnostic methods are</td>
<td></td>
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<tr>
<td>a. measurement</td>
<td></td>
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<tr>
<td>b. functional testing</td>
<td></td>
</tr>
<tr>
<td>c. electrical and electronic systems testing</td>
<td></td>
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<tr>
<td>3. Equipment is</td>
<td></td>
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<tr>
<td>a. diagnostic and rectification equipment for chassis mechanical systems</td>
<td></td>
</tr>
<tr>
<td>b. diagnostic and rectification equipment for chassis electrical systems</td>
<td></td>
</tr>
<tr>
<td>c. diagnostic and rectification equipment for chassis hydraulic and fluid systems</td>
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<tr>
<td>d. specialist repair tools</td>
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<tr>
<td>e. general workshop equipment</td>
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<td>4. Faults are</td>
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</tr>
<tr>
<td>a. mechanical</td>
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<tr>
<td>b. electrical and electronic</td>
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<tr>
<td>c. hydraulic and fluid</td>
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<tr>
<td>5. Rectification activities are</td>
<td></td>
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<tr>
<td>a. dismantling</td>
<td></td>
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<tr>
<td>b. replacement of units and components</td>
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<tr>
<td>c. adjustment of units and components</td>
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<tr>
<td>d. repairs to wiring and connectors</td>
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<tr>
<td>e. re-programming vehicle systems</td>
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<tr>
<td>f. reassembly</td>
<td></td>
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<tr>
<td>g. functional testing</td>
<td></td>
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</tbody>
</table>
In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
## Essential knowledge

<table>
<thead>
<tr>
<th>You need to understand:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legislative and organisational requirements and procedures</strong></td>
<td></td>
</tr>
<tr>
<td>1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying chassis faults.</td>
<td></td>
</tr>
<tr>
<td>2. Legal requirements relating to the vehicle (including road safety requirements).</td>
<td></td>
</tr>
<tr>
<td>3. Your workplace procedures for - recording removal and replacement information - the referral of problems - reporting delays to the completion of work</td>
<td></td>
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<tr>
<td>4. The importance of, documenting diagnostic and rectification information.</td>
<td></td>
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<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
<td></td>
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<tr>
<td>6. The relationship between time, costs and profitability.</td>
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</tr>
<tr>
<td>7. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
<td></td>
</tr>
</tbody>
</table>

| **Electrical and electronic principles** |   |
| 8. Electrical and electronic principles associated with chassis systems, including types of sensors and actuators, their application and operation. |   |
| 9. How electrical and electronic chassis systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles. |   |
| 10. The interaction between electrical, electronic and mechanical components within vehicle chassis systems. |   |
| 11. Electrical symbols, units and terms. |   |
| 12. Electrical safety procedures. |   |

| **Use of diagnostic and rectification equipment** |   |
| 13. How to prepare and test the accuracy of diagnostic testing equipment. |   |
| 14. How to use diagnostic and rectification equipment for chassis mechanical, electrical, hydraulic and fluid systems, specialist repair tools and general workshop equipment. |   |

| **Chassis faults, their diagnosis and correction** |   |
| 15. How chassis mechanical, electrical, electronic and hydraulic and fluid systems are constructed, dismantled, reassembled and operate. |   |
| 16. The types and causes of chassis mechanical, electrical, electronic and hydraulic and fluid system, component and unit faults and failures |   |
| 17. Chassis mechanical, electrical and hydraulic and fluid component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action. |   |
| 18. How to find, interpret and use sources of information on chassis electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements. |   |
| 19. Vehicle operating specifications for limits, fits and tolerances relating to chassis mechanical, electrical, electronic and hydraulic and fluid systems for the vehicle(s) on which you work. |   |
| 20. How to select the most appropriate diagnostic testing method for the symptoms presented. |   |
| 21. How to carry out systematic diagnostic testing of chassis mechanical, electrical and electronic, hydraulic and fluid systems using a prescribed process or format. |   |
| 22. How to assess the condition evident within chassis mechanical, electrical, electronic, hydraulic and fluid components and units. |   |
| 23. How to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults. |   |
| 24. How to carry out the rectification activities listed in the Scoping Statement for this unit in order to correct faults in the chassis mechanical, electrical, electronic and hydraulic and fluid systems. |   |
| 25. The relationship between test methodology and the faults repaired – the use of appropriate testing methods |   |
| 26. How to make cost effective recommendations for rectification. |   |

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
<tr>
<td>Key Skills</td>
<td>Core Skills</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong> Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td>C1.1; C1.3; C2.2</td>
<td>Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong> Intermediate 1, Outcomes 1, 2 and 4</td>
</tr>
<tr>
<td>N2.1; N2.2; N2.3?</td>
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<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong> Access 3, Outcomes 1, 2 and 3?</td>
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<td>ICT1.1; ICT1.2; ICT1.3?</td>
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<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong> Intermediate 1, Outcome 2</td>
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<td>WO2.2</td>
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<tr>
<td><strong>Improving Own Learning and Performance:</strong> Not applicable</td>
<td>No parallel unit.</td>
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<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong> Intermediate 2, Outcomes 1, 2 and 3</td>
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<td>PS3.1; PS3.2; PS3.3</td>
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</table>
**Syllabus**

**MR08HV Diagnose and Rectify Commercial Vehicle Chassis System Faults**
This unit is about diagnosing and rectifying faults occurring in the vehicle steering, suspension, and braking systems

**Course Outline**
To assist Centres in developing training courses, further guidance is given relating to the essential knowledge in the National Standards.

This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail. Reference should also be made to the National Standards

**Outcomes**
On completion of this unit, the student must be able to:

1) Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis vehicle steering, suspension, and braking systems

2) Describe the procedures for preparing vehicle steering, suspension, and braking systems for diagnostic activities

3) Describe the procedures for carrying out diagnostic inspections and tests and interpreting the results of these inspections

4) Describe the procedures for rectification of defects identified by diagnostic procedures

5) Describe the procedures for recording the results of rectification procedures
Outcome 1
Describe the procedures for preparing tools and equipment required to carry out diagnostic
analysis vehicle steering, suspension, and braking systems

Objectives
To achieve this outcome a student has to describe the
1) a) Preparation of diagnostic equipment used for diagnosis of transmission, driveline, steering,
suspension, and braking systems
   i. diagnostic and rectification equipment for chassis electrical systems
   ii. diagnostic and rectification equipment for chassis mechanical systems
   iii. diagnostic and rectification equipment for chassis hydraulic and fluid systems
   iv. specialist repair tools
   v. general workshop equipment
   vi. pressure and flow gauges
   vii. clock gauges and degree plates
   viii. torque setting equipment
   ix. belt tension gauges
b) electrical systems
   i. electronic analysers and fault code readers (scanners)
   ii. multimeters

c) specialist repair tools for hydraulic and fluid systems

d) pre-load gauges
e) general workshop equipment
2) Procedures used to check the accuracy of the diagnostic and testing equipment
3) Methods of finding, interpreting and using information on transmission, driveline, steering,
suspension, and braking systems to check they comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits
4) How to select the most appropriate diagnostic testing methods for the symptoms presented
5) Health and safety legislation and workplace procedures relating to diagnosing system faults
6) Legal and road safety requirements relating to the vehicle
7) Procedures for
   a) systematic collection of sufficient diagnostic information to enable precise identification of
      the fault
   b) using the tools and equipment correctly and safely at all times
8) Procedures used to obtain and check the data required for diagnosis
9) Procedures for using the tools and equipment needed for diagnosis
Outcome 2
Describe the procedures for preparing vehicle steering, suspension, and braking systems for diagnostic activities

Objectives
To achieve this outcome a student has to describe the
1) Way in which chassis mechanical, electrical, electronic hydraulic and fluid systems
   a) are constructed
   b) operate
   c) are dismantled
   d) are re-assembled
2) Diagnostic information which is required
   a) wear
   b) run out
   c) pressures
   d) flow
   e) leakage
   f) electrical measurements
      i. voltage
      ii. pulse displays
      iii. electronic systems date
      iv. fault codes
      v. sensor measurements
      vi. control unit outputs/signals
3) Systems which are to be diagnosed
   a) suspension systems, metal, rubber, air spring types
      i. self levelling, mechanical, electric/electronic control
      ii. reactive and non-reactive twin rear axle systems
      iii. lift axles
   b) assisted steering systems
      i. electrical/electronic
      ii. progressive
      iii. two-stage (city/parking modes)
      iv. hydraulic
   c) non assisted steering systems
   d) rear and four wheel steering
   e) braking systems
   f) ABS/traction control systems
   g) wheels and tyres
4) Functional testing procedures
   a) suspension alignment
b) steering alignment
c) PAS pressure testing
d) current draw
e) performance testing
f) road testing

5) Hydraulic and pneumatic systems
   a) air braking systems
   b) air suspension systems
   c) power steering

6) Electrical and electronic principles associated with chassis systems including types of sensors and actuators, application and operation

7) How electrical and electronic chassis systems operate
   a) electrical component function
   b) inputs
   c) outputs
   d) voltages
   e) oscilloscope patterns
   f) digital and fibre optics principles

8) The interaction between electrical, electronic and mechanical components

9) Electrical symbols and terms and electrical safety procedures

10) Health and safety legislation and employers workshop practices relating to
    a) personal protection
    b) vehicle protection
    c) recording fault location and rectification activities
    d) referral of problems
    e) reporting delays to the completion of work
    f) importance of working to agreed timescales and keeping others informed of progress
    g) relationship between time, costs and profitability
    h) importance of reporting anticipated delays promptly

11) Reasons why failure has occurred

12) Recommendations based upon the inspection procedures
    a) servicing
    b) repair
Outcome 3
Describe the procedures for carrying out diagnostic inspections and tests and interpreting the results of these inspections

Objectives
To achieve this outcome a student has to describe the

1) Fault types where
   a) multiple failures occur within an individual system and involves a 2 or more stage diagnostic facility
   b) a cross system fault where an individual failure can affect several vehicle systems and involves a two more stage diagnostic facility

2) Recommendations based upon the diagnostic procedures
   a) servicing
   b) dismantling for further inspection and testing
   c) repair
   d) replacement

3) Diagnosis procedures covering
   a) single system faults using a prescribed process or format
   b) multi and cross system faults using a prescribed process or format

4) Diagnostic methods
   a) measurement
   b) functional testing
   c) electrical and electronic systems testing

5) How to carry out systematic diagnostic testing of engine mechanical, electrical and electronic, hydraulic and fluid systems.

6) How to assess the condition of mechanical, electrical, electronic, hydraulic, air components and units

7) How to interpret test results and vehicle data to identify location and cause of faults.

8) Rectification by
   a) dismantling
   b) replacement of units or components
   c) adjustment of units and components
   d) repairs to wiring and connectors
   e) re-programming vehicle systems
   f) re-assembly
   g) functional testing

9) How to select the most appropriate methods of diagnosis

10) Interaction between electrical, electronic and mechanical components

11) Transmission and chassis electrical systems interlink, interact (including multiplexing)

12) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer
**Outcome 4**
Describe the procedures for rectification of defects identified by diagnostic procedures

**Objectives**
To achieve this outcome a student has to describe the:

1) Rectification activities for diagnosis of steering, suspension, and braking systems
   a) dismantling
   b) replacement of units and components
   c) adjustment of units and components
   d) repairs to wiring and connectors
   e) re-programming vehicle systems
   f) reassembly
   g) functional testing

2) Types and causes of mechanical, electrical, electronic and hydraulic and air system, component and unit faults and failures

3) Mechanical, electrical, electronic and hydraulic and air system, component replacement procedures, the circumstances which will necessitate replacement and other causes of action

4) How to carry out rectification activities on mechanical, electrical, electronic and hydraulic and fluid systems.

5) How to make cost effective recommendations for rectification

6) The relationship between time, costs and profitability

7) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer
Outcome 5
Describe the procedures for recording the results of rectification procedures

Objectives
To achieve this outcome a student has to describe the
1) Importance of documenting diagnostic and rectification information
2) Procedures for recording diagnostic and rectification activities
   a) computer based
   b) hard copy
3) Procedures for
   a) disposing of waste material resulting from the diagnostic and rectification activities
   b) returning defective units and components to storage or for recycling,
4) Procedures for recording the faults identified on components or units

Assessment
Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
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<tr>
<td>3</td>
<td>8</td>
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<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>
Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).

To complete this unit you must:

1. produce evidence of conducting a full valet.

Your tutor or assessor will either set and observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:
1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both
6. Produce evidence of valeting one vehicle classification i.e. light, commercial vehicles or motorcycles, mopeds or scooters.
7. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit
You must:
8. Produce evidence of conducting a full valet on 3 vehicles.
9. Your assessor must observe you carrying out 1 full valet.

Your evidence must include you valeting 2 vehicles within your normal workplace.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
### Evidence reference summary

<table>
<thead>
<tr>
<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Note:** Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.

Full valet 1

Full valet 2

Full valet 3

### Supplementary evidence (if used) PRN

### On line test reference for this unit PRN

### Unit assessment and verification declaration

#### VRQ Candidate declaration:
I confirm that the evidence listed for this unit is authentic and a true representation of my own work.

Candidate name: .................................................

Candidate enrolment number: ................................

Candidate signature: ...........................................

Date: ......................................................

#### VRQ Assessor declaration:
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: .................................................

Assessor signature: ...........................................

Date: ......................................................

Countersignature: (if relevant) ................................

Date: ......................................................

#### VRQ Internal verifier Declaration:
(Leave blank if sampling of this unit did not take place.)

I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ..............................................

Internal verifier signature: ...................... Date: ........

Countersignature: (if relevant) ...................... Date: ........

#### N/SVQ Candidate declaration:
I confirm that the evidence listed for this unit is authentic and a true representation of my own work.

Candidate name: .................................................

Candidate enrolment number: ................................

Candidate signature: ...........................................

Date: ......................................................

#### N/SVQ Assessor declaration:
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: .................................................

Assessor signature: ...........................................

Date: ......................................................

Countersignature: (if relevant) ................................

Date: ......................................................

#### N/SVQ Internal verifier Declaration:
(Leave blank if sampling of this unit did not take place.)

I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ..............................................

Internal verifier signature: ...................... Date: ........

Countersignature: (if relevant) ...................... Date: ........
### Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear suitable protective equipment and use vehicle coverings where necessary throughout all valeting activities</td>
<td></td>
</tr>
<tr>
<td>Carry out all valeting procedures in the designated area</td>
<td></td>
</tr>
<tr>
<td>Check and prepare all the equipment required following manufacturers instructions prior to use</td>
<td></td>
</tr>
<tr>
<td>Store safely and return any loose customer possessions likely to be affected by valeting activities</td>
<td></td>
</tr>
<tr>
<td>Use external and internal cleaning materials which are suitable for the vehicles surfaces and specification</td>
<td></td>
</tr>
<tr>
<td>Use all cleaning materials and equipment following</td>
<td></td>
</tr>
<tr>
<td>• The manufacturers instructions</td>
<td></td>
</tr>
<tr>
<td>• Your workplace procedures</td>
<td></td>
</tr>
<tr>
<td>• Health and safety requirements</td>
<td></td>
</tr>
<tr>
<td>Clean all surfaces following the customer contract and agreed timescale</td>
<td></td>
</tr>
<tr>
<td>Report any vehicle damage you notice to the relevant person(s) promptly</td>
<td></td>
</tr>
<tr>
<td>Leave all interior and exterior surfaces free from residual cleaning and finishing agents</td>
<td></td>
</tr>
<tr>
<td>Dispose of all waste materials and cleaning materials to conform with legal and workplace requirements</td>
<td></td>
</tr>
<tr>
<td>Report any anticipated delays in completion to the relevant person(s) promptly</td>
<td></td>
</tr>
</tbody>
</table>

### Scope of this unit

<table>
<thead>
<tr>
<th>All of the items listed below form part of this National Occupational Standard.</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Equipment is</strong></td>
<td></td>
</tr>
<tr>
<td>a. vehicle wash equipment</td>
<td></td>
</tr>
<tr>
<td>b. vacuum cleaners</td>
<td></td>
</tr>
<tr>
<td>c. polishing machines</td>
<td></td>
</tr>
<tr>
<td>d. hand cleaning equipment</td>
<td></td>
</tr>
<tr>
<td><strong>2. Materials are</strong></td>
<td></td>
</tr>
<tr>
<td>a. sprays</td>
<td></td>
</tr>
<tr>
<td>b. polishes</td>
<td></td>
</tr>
<tr>
<td>c. de-waxing agents</td>
<td></td>
</tr>
<tr>
<td>d. cleaning chemicals</td>
<td></td>
</tr>
<tr>
<td>e. waxes</td>
<td></td>
</tr>
<tr>
<td>f. trim and tyre dressings</td>
<td></td>
</tr>
<tr>
<td><strong>3. Surfaces are</strong></td>
<td></td>
</tr>
<tr>
<td>a. paintwork</td>
<td></td>
</tr>
<tr>
<td>b. glass</td>
<td></td>
</tr>
<tr>
<td>c. rubber</td>
<td></td>
</tr>
<tr>
<td>d. hard trim</td>
<td></td>
</tr>
<tr>
<td>e. soft trim</td>
<td></td>
</tr>
<tr>
<td>f. wheels and tyres</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Essential knowledge

### You need to understand:

<table>
<thead>
<tr>
<th>Legislative, organisational and customer requirements and procedures</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection.</td>
<td></td>
</tr>
<tr>
<td>2. The safety and environmental requirements applicable when valeting vehicles.</td>
<td></td>
</tr>
<tr>
<td>3. Your workplace procedures for</td>
<td></td>
</tr>
<tr>
<td>- recording removal and replacement information</td>
<td></td>
</tr>
<tr>
<td>- the referral of problems</td>
<td></td>
</tr>
<tr>
<td>- reporting delays to the completion of work</td>
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</tr>
<tr>
<td>4. Any specific customer instructions</td>
<td></td>
</tr>
<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
<td></td>
</tr>
<tr>
<td>6. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
<td></td>
</tr>
<tr>
<td>7. The relationship between time and cost.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment and materials</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. How to prepare and check vehicle valeting equipment.</td>
<td></td>
</tr>
<tr>
<td>9. How to use vehicle valeting equipment.</td>
<td></td>
</tr>
<tr>
<td>10. The properties and use of vehicle exterior and interior cleaning materials.</td>
<td></td>
</tr>
<tr>
<td>11. The manufacturers’ instructions and safety data sheets for the use of external and internal cleaning materials.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valeting vehicles</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. How to clean and restore paintwork, clean glass, plastic, rubber, engines and engine compartments, soft trim, hard trim, wheels and tyres.</td>
<td></td>
</tr>
<tr>
<td>13. The importance of working in an organised and sequential manner when cleaning vehicles.</td>
<td></td>
</tr>
<tr>
<td>14. How to dispose of waste materials and <strong>cleaning materials</strong>.</td>
<td></td>
</tr>
<tr>
<td>15. The importance of disposing of waste safely and the consequences of not doing so to others and the environment.</td>
<td></td>
</tr>
<tr>
<td>16. The importance of protecting customer possessions from <strong>cleaning materials</strong> and the cleaning process.</td>
<td></td>
</tr>
<tr>
<td>17. How to work safely avoiding damage to the vehicle and its systems</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
### Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong></td>
</tr>
<tr>
<td>C1.1; C 1.2; C1.3?</td>
<td>Access 3, Outcomes 1, 2? and 3</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong></td>
</tr>
<tr>
<td>WO1.1; WO1.2</td>
<td>Access 3, Outcomes 1 and 2</td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td><strong>No parallel unit.</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong></td>
</tr>
<tr>
<td>PS2.1</td>
<td>Intermediate 1, Outcome 1</td>
</tr>
</tbody>
</table>
Syllabus

**MR09 Valet Vehicles**

This unit is about carrying a full exterior and interior valet of vehicles, including hard and soft trim surfaces where relevant.

**Course Outline**

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

**Outcomes**

On completion of this unit, the student must be able to:

1) identify and interpret sources of manufacturer approved technical information

2) identify and undertake procedures relevant to the selection, checking and storing of approved tools and equipment

3) identify and undertake manufacturer approved procedures for the cleaning and valeting of repaired vehicles

4) identify and undertake manufacturer and workplace approved quality checks
Outcome 1
Identify and interpret sources of manufacturer approved technical information

Objectives
To achieve this outcome a student must be able to:

1) Describe and follow manufacturer technical data
   a) recognised vehicle interior and exterior surfaces, procedures, systems and materials
      i. material lists
      ii. research technical data
      iii. substrate identification information
      iv. soft and hard trim
      v. vehicle repair warranty specifications
   b) manufacturer approved tools and equipment
      i. promotional and sales literature
      ii. tools and equipment lists

2) Describe and follow manufacturer and workplace approved processes and procedures
   a) recommended repair procedures
      i. workshop manuals
      ii. technical data sheets
      iii. electronic systems (including CD ROMs)
   b) workplace documentation
      i. job cards
      ii. work records
      iii. quality procedures
      iv. statutory workshop notices
      v. manufacturer guides and recommendations

3) Describe and follow manufacturer and workplace approved and agreed timescales
   a) approved valeting schedules
   b) repair estimators guidelines and procedures
   c) policy for reporting anticipated delays and problems

4) Describe and follow approved health and safety regulations and guidelines
   a) national legislation
      i. COSHH
      ii. HASAWA
      iii. EPA
      iv. PPE at work regulations
      v. Manual handling regulations
      vi. Risk assessment
   b) local regulations
i. duty of care (special waste regulations)
ii. PPE guidance
iii. workplace policies
Outcome 2
Identify and undertake procedures relevant to the selection, checking and storing of approved tools and equipment

Objectives
To achieve this outcome a student must be able to:

1) Select approved tools and equipment
   a) air supply equipment
      i. air line
      ii. compressor
      iii. regulator/transformer
      iv. air duster gun (blower)
   b) general tools and equipment
      i. hand tools
         A. scrappers
         B. brushes
         C. soft sponges
         D. honey comb sponges
         E. cloths and wipes
      ii. sundries
         A. leathers
         B. sponges
         C. wipes
      iii. materials
         A. polish
         B. compounds
         C. waxes
         D. detergents and shampoo
         E. traffic film remover
         F. acid cleaner (alloy wheels)
         G. plastic and trim cleaner
         H. fabric cleaner
         I. glass cleaner and polishers
         J. tyre treatment
      iv. power tools
         A. vacuum
         B. hydro mist
         C. steam cleaner
         D. pressure washer
         E. polisher
c) health and safety equipment
   i. select and use PPE
      A. overalls
      B. gloves
      C. boots
      D. ear protection
      E. eye and face protection
      F. before and after work skin creams
      G. respirator face mask (organic vapour and dust types)
   ii. legislation requirements
      A. visual inspection
      B. maintenance record
      C. local and national requirements for flammable stores
      D. waste disposal (duty of care)

2) Undertake approved routine maintenance activities
   a) visual checks
      i. PAT labelling
      ii. damaged air lines and couplers
      iii. filter replacement (portable vacuum systems)
   b) functional
      i. compressor lubrication
      ii. air receiver drainage
      iii. power tools
   c) aural
      i. compressed air leaks

3) Undertake approved storage of tools and equipment
   a) boxes and trays
   b) cupboards and racks
   c) shadow boards
   d) flammable store
**Outcome 3**
Identify and undertake manufacturer approved procedures for the cleaning and valeting of repaired vehicles

**Objective**
To achieve this outcome a student must be able to:
1) Interpret and follow manufacturer approved schedules and agreed timescales
   a) approved valeting schedules
      i. workshop manuals
      ii. electronic systems
   b) work progress documentation and procedures
      i. job cards
      ii. work estimates
      iii. consumable requests
   c) customer contract
2) Select and carry out procedures to identify vehicle internal and external surfaces
   a) internal surfaces
      i. floor coverings
         A. carpet
         B. rubber
         C. heel and footwell mats
      ii. seat covers
         A. fabric
         B. leather
      iii. plastics
         A. dash trim
         B. door trim
   iv. instrumentation
         A. instrumentation panel (dash board)
         B. switches and controls
         C. steering wheel (including smart wheels)
         D. in car entertainment systems
   v. glass surfaces
      A. rear view mirror
      B. courtesy mirror
      C. side and rear windows
      D. windscreen
   vi. comfort and safety features
      A. personal storage
      B. centre console
C. sill protectors
D. seat belt restraints

b) external surfaces
i. painted
   A. metallic
   B. mica finishes
   C. solid colour
   D. direct gloss finishes
ii. glass
   A. side and rear windows
   B. windscreen
   C. door mirrors
iii. wheels
   A. steel
   B. alloy
   C. plastic trim
   D. custom design
iv. tyres
   A. rubber
v. plastics
   A. bumper finishes
   B. side mouldings
   C. door mirror
vi. engine and engine compartment
   A. protection of sensitive components (electronic systems)
   B. avoiding accidental damage
   C. solvents and emulsifiers
vii. underside
   A. sills
   B. wheel arches
   C. floor section

3) Select and carry out procedures to clean and restore vehicle surfaces
   a) interior processes and techniques
      i. safe storage of customers belongings
         A. boxing
         B. labelling
      ii. dust and debris removal
         A. vacuum
         B. static dusters
         C. damp wipes
D. dry dusters  
E. brush  
F. combs (pet hair)  

iii. fabric  
A. hand processes  
B. machine processes  
C. detergent and foams  

iv. leather  
A. cleaners  
B. restorers  
C. manufacturer treatments  

v. stain removal  
A. hand processes  
B. machine processes  
C. detergent and foams  

vi. glass  
A. cleaner  
B. polish  

vii. instrument panel  
A. dry processes  
B. damp processes  
C. manufacturer sprays and treatments  

viii. headlining and door panel  
A. dry processes  
B. damp processes  

ix. decorative metal and wood finishes  
A. dry processes  
B. damp processes  
C. manufacturer sprays and treatments  

b) exterior processes and techniques  

i. de-waxing  
A. hand methods  
B. machine methods  

ii. traffic film removal  
A. chemicals  
B. power wash  
C. pastes and putties  

iii. compounding and polishing  
A. hand processes  
B. machine processes
iv. glazing and waxing
   A. hand processes
   B. machine processes
v. steam cleaning
   A. detergent
   B. de-waxing
   C. rinsing
vi. power washing
   A. detergent
   B. de-waxing
   C. rinsing
vii. renovating plastic finishes
   A. painted effect
   B. natural effect
viii. wheels and tyres
   A. brake dust
   B. wheel scuffs
   C. tyre dressing
ix. glass
   A. cleaning
   B. polishing
x. contamination from road debris and insects
   A. tar splatter
   B. stone chips
   C. dried insects
   D. bird droppings
xi. soft tops
   A. washing
   B. re-sealing (weather proofing)
Outcome 4
Identify and undertake manufacturer and workplace approved quality checks

Objectives
To achieve this outcome a student must be able to:
1) Interpret and follow manufacturer and workplace approved processes for checking that the repair meets the quality standard
   a) visual methods
      i. all cleaning residue has been removed
      ii. all surfaces are free from smears
2) Interpret and follow manufacturer warranty procedure for the repair of vehicle bodies
   a) specific manufacturer warranty procedures
   b) describe the advantages of selecting manufacturer approved materials and processes
3) Interpret and follow workplace procedures for reporting anticipated delays and problems to the appropriate authority
   a) maintain the appropriate records
   b) processes and schedules following agreed timescales
   c) procedures to demonstrate the relationship between time, cost and profit
   d) keep fully inform workplace supervisors where standards and timescales are not being met

Assessment
Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
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<td>3</td>
<td>11</td>
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<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>
Identify and Agree Customer Vehicle Needs

**Evidence requirements**

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

---

**Information for VRQs (Technical Certificates).**

To complete this unit you must:

produce evidence, including records, to show that you have dealt with 3 different customers.

Your tutor or assessor will either set and observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace
6. Produce performance evidence of you dealing with customers with regard to their vehicles
7. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit

You must:

8. Produce evidence, including records, to show that you have dealt with 3 different customers.
9. Your assessor must physically observe you in your normal workplace dealing with at least 1 customer.
10. All your evidence must come from dealing with customers in your normal workplace.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
### Evidence reference summary

<table>
<thead>
<tr>
<th>Customer 1</th>
<th>Customer 2</th>
<th>Customer 3</th>
</tr>
</thead>
</table>

**Portfolio reference number (PRN)**

<table>
<thead>
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<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed assessment</td>
<td>Approved centre or workplace</td>
<td>Observed assessment</td>
</tr>
</tbody>
</table>

**Note:** Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.

---

### Supplementary evidence (if used) PRN

---

### On line test reference for this unit PRN

---

### Unit assessment and verification declaration

#### VRQ Candidate declaration:

I confirm that the evidence listed for this unit is authentic and a true representation of my own work.

Candidate name: ........................................................................

Candidate enrolment number: ..............................................

Candidate signature: ..............................................................

Date: ..........................................................

#### VRQ Assessor declaration:

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: ........................................................................

Assessor signature: ..............................................................

Date: ..........................................................

Countersignature: (if relevant) ..............................................

Date: ..........................................................

---

#### N/SVQ Candidate declaration:

I confirm that the evidence listed for this unit is authentic and a true representation of my own work.

Candidate name: ........................................................................

Candidate enrolment number: ..............................................

Candidate signature: ..............................................................

Date: ..........................................................

#### N/SVQ Assessor declaration:

I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: ........................................................................

Assessor signature: ..............................................................

Date: ..........................................................

Countersignature: (if relevant) ..............................................

Date: ..........................................................

---

#### VRQ Internal verifier Declaration:

(Leave blank if sampling of this unit did not take place.)

I have internally verified the assessment work on this unit in the following ways (please tick):

- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: .............................................. Date: .........

Internal verifier signature: .............................................. Date: .........

Countersignature: (if relevant) .............................................. Date: .........

#### N/SVQ Internal verifier Declaration:

(Leave blank if sampling of this unit did not take place.)

I have internally verified the assessment work on this unit in the following ways (please tick):

- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: .............................................. Date: .........

Internal verifier signature: .............................................. Date: .........

Countersignature: (if relevant) .............................................. Date: .........
### Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain sufficient, relevant information from the customer to make an assessment of their own and perceived vehicle needs.</td>
<td></td>
</tr>
<tr>
<td>Provide customers with accurate, current and relevant advice and information on:</td>
<td></td>
</tr>
<tr>
<td>• suitable vehicle repair and service procedures</td>
<td></td>
</tr>
<tr>
<td>• potential courses of action</td>
<td></td>
</tr>
<tr>
<td>• the implications of courses of action</td>
<td></td>
</tr>
<tr>
<td>• the estimated costs.</td>
<td></td>
</tr>
<tr>
<td>Provide advice and information clearly and in a form and manner which the customer will understand.</td>
<td></td>
</tr>
<tr>
<td>Actively encourage customers to ask questions and seek clarification during your conversation.</td>
<td></td>
</tr>
<tr>
<td>Support the accurate identification and clarification of customer and vehicle needs, by referring to:</td>
<td></td>
</tr>
<tr>
<td>• vehicle data</td>
<td></td>
</tr>
<tr>
<td>• operating procedures.</td>
<td></td>
</tr>
<tr>
<td>Before accepting the vehicle, agree with the customer and record:</td>
<td></td>
</tr>
<tr>
<td>• the extent and nature of the work to be undertaken</td>
<td></td>
</tr>
<tr>
<td>• the terms and conditions of acceptance</td>
<td></td>
</tr>
<tr>
<td>• the cost</td>
<td></td>
</tr>
<tr>
<td>• the timescale.</td>
<td></td>
</tr>
<tr>
<td>Confirm your customer’s understanding of the agreement you have made.</td>
<td></td>
</tr>
<tr>
<td>Ensure your recording systems are complete, accurate, in the format required and signed by the customer where necessary.</td>
<td></td>
</tr>
<tr>
<td>Pass all completed records to the next person in the process promptly.</td>
<td></td>
</tr>
<tr>
<td>Gain further customer approval where the contracted agreement is likely to be exceeded.</td>
<td></td>
</tr>
</tbody>
</table>

### Scope of this unit

<table>
<thead>
<tr>
<th>All of the items listed below form part of this National Occupational Standard.</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>No items listed for this unit.</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Date</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
### Essential knowledge

**You need to understand:**

<table>
<thead>
<tr>
<th>Legislative and organisational requirements and procedures</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The fundamental legal requirements of current consumer legislation and the consequences of your own actions in respect of this legislation.</td>
<td></td>
</tr>
<tr>
<td>2. The terms and conditions applicable to the acceptance of customer vehicles.</td>
<td></td>
</tr>
<tr>
<td>3. The content and limitations of vehicle and component warranties for the vehicles dealt with by your company.</td>
<td></td>
</tr>
<tr>
<td>4. The limits of your own authority for accepting vehicles.</td>
<td></td>
</tr>
<tr>
<td>5. The importance of keeping customers informed of progress.</td>
<td></td>
</tr>
<tr>
<td>7. Your workplace requirements for the completion of records.</td>
<td></td>
</tr>
<tr>
<td>8. How to complete and process all the necessary documentation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer communication and care</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. How to communicate effectively with, and listen to, customers.</td>
<td></td>
</tr>
<tr>
<td>10. How to adapt your language when explaining technical matters to non-technical customers.</td>
<td></td>
</tr>
<tr>
<td>11. How to use effective questioning techniques.</td>
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<tr>
<td>12. How to care for customers and achieve customer satisfaction</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Company products and services</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. The courses of action available to resolve vehicle problems.</td>
<td></td>
</tr>
<tr>
<td>14. The range and type of services offered by your company.</td>
<td></td>
</tr>
<tr>
<td>15. The effect of resource availability upon the receipt of customer vehicles and the completion work.</td>
<td></td>
</tr>
<tr>
<td>16. How to access costing and work completion time information.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vehicle information systems, servicing and repair requirements</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. How to use and interpret vehicle data and operating procedures.</td>
<td></td>
</tr>
<tr>
<td>18. Vehicle repair and service procedures for the type(s) of vehicles on which you work.</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<table>
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<tr>
<th>Candidate</th>
<th>Date</th>
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## Key and core skills signposting

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<tr>
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<th>Core Skills</th>
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<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong> Access 3, Outcome 2</td>
</tr>
<tr>
<td>C1.3; C2.1a; C2.1b; C2.2;</td>
<td>Intermediate 1, Outcomes 1 and 3</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong> Access 3, Outcomes 2 and 4</td>
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<tr>
<td>N1.1; N1.2; N1.3</td>
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</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong> Dependent upon systems in use</td>
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<tr>
<td>Dependent upon systems in use</td>
<td>Dependent upon systems in use</td>
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<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong> Intermediate 1, Outcomes 1 and 2</td>
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<tr>
<td>WO2.1; WO2.2</td>
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<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td>No parallel unit.</td>
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<tr>
<td>Not applicable</td>
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<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong> Intermediate 1, Outcomes 1 and 2</td>
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<tr>
<td>PS2.1; PS2.2</td>
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</tbody>
</table>
Syllabus

Identify and Agree Customer Vehicle Needs

This unit is about gaining information from customers on their perceived needs; giving advice and information and agreeing a course of action; contracting for the agreed work and completing all necessary records and instructions.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe the legal and organisational requirements and procedures necessary in the process of vehicle repair
2. Describe how to ensure effective communication with customers and follow customers care procedures
3. Describe a typical range of products and services offered by vehicle repair organisations
4. Describe vehicle information systems, servicing and repair requirements
Outcome 1
Describe the legal and organisational requirements and procedures necessary in the process of vehicle repair

Objectives
To achieve this outcome the student has to:

1) State the current requirements of consumer legislation
   a) compare an agreement and a legally binding contract
   b) state how contracts are formed
      i. orally
      ii. in writing
      iii. by conduct
   c) explain the basic elements of a contract for vehicle repair of servicing
      i. offer
      ii. acceptance
      iii. intention
      iv. consideration
      v. validity
      vi. express terms
      vii. implied terms
      viii. discharge by performance or agreement
      ix. breach
   d) guarantees / Warranties
      i. State what is meant by a guarantee or warranty
      ii. State the relationship between terms in a guarantee and rights in common law
      iii. State typical examples of items included in a new vehicle warranty package
   e) relationship between principal and agent
      i. Define an agent in relation to booking and controlling vehicle repair and servicing work
      ii. State how an agents actions when accepting vehicles for service or repair, are binding on the principal
      iii. State why a the person accepting a vehicle for service or repair must be aware of their own authority
   f) state the contractual responsibility of the company when external customers jobs are contracted out to a specialist repairer
   g) Sale of Goods Act goods sold to customers (consumers) must be
      i. of satisfactory quality:- the goods must do their job properly and be free from defects and be safe and durable
      ii. fit for their purpose:- if the customer asks for something particular, the goods must do that job
      iii. as described:- any description given by the trader verbally, by advertising or on the packaging must be correct
   h) Sale of Services, Act the service provided must
i. be carried out with reasonable care and skill: otherwise the work must be corrected at no extra charge

ii. be charged the price quoted: if no price was agreed then a ‘reasonable’ price must be charged

iii. work must be completed by the time agreed: if no deadline was set, then in a ‘reasonable’ time, otherwise the customer can claim compensation

2) State a procedure for keeping customers informed on the progress of a repair particularly when addition work is necessary

3) State the
   a) legal responsibility of the company for the care of customers vehicles whilst in their possession
   b) importance of completing, documentation
      i. job cards,
      ii. customer invoice details
      iii. customer records
      iv. manufacturers records
   c) a procedure to be followed to ensure correct and comprehensive completion of service documentation and records
   d) procedure to be followed when documenting warranty jobs
   e) reasons for retaining defective parts removed during warranty work.
Outcome 2
Describe how to ensure effective communication with customers and follow customers care procedures

Objectives
To achieve this outcome the student has to:

1) Communicate with Customers
   a) State the personal qualities, interpersonal skills and professional competence of employees who deal directly with customers
      i. image
      ii. self motivation
      iii. punctuality
      iv. honesty
      v. responsibility
      vi. general technical knowledge
      vii. diagnostic skills
      viii. vehicle and specification knowledge
      ix. knowledge of vehicle legislation (vehicle roadworthiness)
      x. estimating skills
   b) Describe the types of communication necessary when employees deal directly with customers
      i. verbal
      ii. face to face
      iii. telephone
      iv. questioning:-- using closed, open, probing and controlling questions v listening
   c) Describe how customers needs for non-technical explanations of technical topics can be met
      i. use of verbal explanations
      ii. printed literature
      iii. exploded views
      iv. use of actual new or used parts

2) Describe appropriate procedures
   a) used for dealing with customers
      i. general enquires
      ii. specific enquires
      iii. complaints
   b) used to maximising customer satisfaction
      i. ensuring that the vehicle is returned in a clean condition
      ii. when a job will overrun the promised completion time
      iii. completion of customer and vehicle records
      iv. use of customer satisfaction research/records
Outcome 3
Describe a typical range of products and services offered by vehicle repair organisations

Objectives
To achieve this outcome the student has to:
1) State the actions necessary to correct vehicle faults and problems to include typical faults on the following units and their control system
   a) engines and engine systems
   b) clutches
   c) gearboxes/transmissions faults/final drives systems
   d) suspension/steering systems
   e) braking systems
   f) electrical and electronic systems
   g) chassis /body systems
2) List services offered by repair and service organisations and repair specialists
   a) routine servicing
   b) diagnostic and fault finding on systems listed in 1
   c) repairs and replacement on systems listed in 1
   d) specialist repairers, on systems listed in 1
3) State how resources affect the volume of work passing through a service department and completion times
   a) workshop vehicle bay area
   b) general work/bench area
   c) vehicle parking area/vehicle movement
   d) availability of hand tools
   e) availability and location of major equipment
   f) availability of vehicle mechanics /technicians
   g) total productive time available
   h) effectiveness of workshop control system
   i) access to labour costs, parts costs and additional costs
Outcome 4
Describe vehicle information systems, servicing and repair requirements

Objectives
To achieve this outcome the student has to:

1) Describe methods of accessing data from
   a) workshop manuals
   b) manufacturer’s data and information sheets
   c) service schedules
   d) parts lists
   e) MOT inspection manuals and guides
   f) trade association check lists
   g) legal and technical data reference books
   h) computers
   i) microfiche

2) Describe how to retrieve and interpret required vehicle data
   a) tension and torque settings
   b) clearances and gaps
   c) dimensions
   d) pressures and vacuum
   e) flow rates
   f) angles
   g) model numbers
   h) capacities
   i) cross reference charts
   j) braking efficiencies
   k) fluid /lubricant specifications
   l) colour and numerical coding
   m) electrical data

3) Describe in sequence typical repair and service procedures for
   a) engines and engine systems
   b) clutches
   c) gearboxes/transmissions faults/final drives systems
   d) suspension/steering systems
   e) braking systems
   f) electrical and electronic systems
   g) chassis /body systems
Assessment

**Essential knowledge assessment**

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
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<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Test duration 60mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>
Evidence requirements
To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).
To complete this unit you must:

Produce evidence of overhauling the following types of mechanical unit:

1. Engines
2. Gear boxes

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently.

2. Produce evidence to show that you have covered all the items listed in the scope for this unit.

3. Produce evidence to show that you possess all the knowledge required.

4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.

5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both.

6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit

You must:

7. Produce evidence of overhauling 4 units, comprising of 1 or more of the following types of mechanical unit:
   - engines
   - gear boxes
   - final drives
   - steering
   - suspension
   - motorcycle chassis assemblies.

8. The overhaul of 3 of the above units must have been undertaken in your normal workplace.

9. Your assessor must physically observe you overhauling at least 2 units, 1 of which must be in your normal workplace.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>Portfolio reference number (PRN)</th>
<th>VRQ</th>
<th>N/SVQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.</td>
<td>Observed assessment</td>
<td>Approved centre or workplace</td>
<td>Observed assessment</td>
</tr>
<tr>
<td>Overhauling unit 1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Overhauling unit 2</td>
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<td></td>
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<tr>
<td>Overhauling unit 3</td>
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<td></td>
<td></td>
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<tr>
<td>Overhauling unit 4</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

**VRQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work
Candidate name:………………………………………..
Candidate enrolment number:…………………………….
Candidate signature:……………………………………..
Date: ………………………

**VRQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
Assessor name: ……………………………………………
Assessor signature: ………………………………………
Date: ………………………
Countersignature: (if relevant) ………………………………..
Date: ………………………

**VRQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:
I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.
Internal verifier name: …………………………………..
Internal verifier signature: …………………………
Date: ………………………
Countersignature: (if relevant) ……………………………..
Date: ………………………

**N/SVQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work
Candidate name:………………………………………..
Candidate enrolment number:…………………………….
Candidate signature:……………………………………..
Date: ………………………

**N/SVQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
Assessor name: ……………………………………………
Assessor signature: ………………………………………
Date: ………………………
Countersignature: (if relevant) ………………………………..
Date: ………………………

**N/SVQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:
I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.
Internal verifier name: …………………………………..
Internal verifier signature: …………………………
Date: ………………………
Countersignature: (if relevant) ……………………………..
Date: ………………………
Performance objectives

To be competent you must:

Wear suitable personal protective equipment throughout all overhauling activities.

Use suitable sources of technical information to support your overhauling activities.

Assess and prepare all the equipment required, following manufacturers’ instructions, prior to use.

Use the tools and equipment required correctly and safely throughout all overhauling activities.

Carry out all overhauling activities following:

- the manufacturer’s instructions
- your workplace procedures
- health and safety requirements.

Work in a way which minimises the risk of:

- damage to other components
- leakages
- contact with hazardous substances.

Ensure your assessment of the dismantled unit identifies accurately its condition and suitability for overhaul.

Inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform.

Use testing methods which comply with the manufacturer’s requirements.

When necessary, adjust the unit’s components correctly to ensure that they operate to meet the vehicle operating requirements.

Ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements.

Ensure your overhaul records are accurate, complete and passed to the relevant person(s) promptly in the format required.

Complete all overhauling activities within the agreed timescale.

Report any anticipated delays in completion to the relevant person(s) promptly.

Scope of this unit

All of the items listed below form part of this National Occupational Standard.

1. Overhaul activities are
   a. dismantling
   b. assessment,
   c. repair
   d. replacement
   e. adjustment of internal components
   f. re-assembly
   g. functional testing

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

Assessor

Date

Candidate

Date
### Essential knowledge

#### You need to understand:

<table>
<thead>
<tr>
<th>PR</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legislative and organisational requirements and procedures</strong></td>
<td></td>
</tr>
<tr>
<td>1. The legal requirements applicable to the units and assemblies overhauled (including road safety requirements).</td>
<td></td>
</tr>
<tr>
<td>2. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection.</td>
<td></td>
</tr>
<tr>
<td>3. Your workplace procedures for - recording overhaul activities - the referral of problems - reporting delays to the completion of work.</td>
<td></td>
</tr>
<tr>
<td>4. The importance of, documenting repair information.</td>
<td></td>
</tr>
<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
<td></td>
</tr>
<tr>
<td>6. The importance of reporting any anticipated delays to the relevant person(s) promptly.</td>
<td></td>
</tr>
</tbody>
</table>

#### Equipment

7. How to prepare, and assess the accuracy and operation of all the overhauling and testing equipment required.

8. How to use all the overhauling and testing equipment required.

#### Mechanical unit overhauling activities

9. How to find, interpret and use sources of information on overhauling procedures and statutory requirements.

10. How vehicle mechanical units and assemblies operate.

11. How mechanical units and assemblies are constructed, dismantled and reassembled.

12. The possible causes of faults in mechanical units and assemblies units.

13. Vehicle operating specification for limits, fits and tolerances and where this information can be sourced.

14. How to assess the condition evident within unit sub-assemblies and components.

15. The cost-benefit relationship between the reconditioning, repair and replacement of components within units.

16. How to carry out overhauling activities for the type(s) of unit worked upon.

17. The relationship between test methodology and the faults repaired – the use of appropriate testing methods

18. How to test and evaluate the performance of overhauled units against the operating specification.

19. How to interpret test results.

20. How to identify the types and causes of mechanical unit and assembly failure.

21. How to make suitable adjustments to components and units.

22. How to work safely avoiding personal injury, damage to components leakage and hazardous substances.

---

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</table>
### Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong> Access 3, Outcomes 2 and 3 Intermediate 1, Outcomes 1</td>
</tr>
<tr>
<td>C1.1; C1.3; C2.2;</td>
<td></td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong> Intermediate 1, Outcomes 1, 2 and 4</td>
</tr>
<tr>
<td>N2.1; N2.2; N2.3?</td>
<td></td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong> Dependent upon systems in use</td>
</tr>
<tr>
<td>Dependent upon systems in use</td>
<td></td>
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<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong> Intermediate 1, Outcomes 1, 2 and 3</td>
</tr>
<tr>
<td>WO1.1; WO1.2; WO1.3?</td>
<td></td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td>No parallel unit.</td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong> Intermediate 2, Outcomes 1, 2 and 3</td>
</tr>
<tr>
<td>PS3.1; PS3.2; PS3.3</td>
<td></td>
</tr>
</tbody>
</table>
Syllabus

Overhaul Mechanical Units
This unit is about the bench based overhaul of mechanical units, involving dismantling, assessment, repair, replacement or adjustment of internal components and re-assembly and testing.

Course Outline
To assist Centres in developing training courses, further guidance is given relating to the essential knowledge in the National Standards. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail. Reference should also be made to the national standards.

Reference should also be made to the National Standards.

Outcomes
On completion of this unit, the student must be able to:

1. Describe the procedures for preparing tools and equipment required for dismantling, assessment, repair, replacement or adjustment of internal components and re-assembly and testing.

2. Describe the procedures for preparing mechanical units for bench based overhaul.

3. Describe the procedures for dismantling, assessment, repair, replacement or adjustment of internal components and re-assembly and testing.

4. Describe the procedures for recording the results of overhaul procedures.
**Outcome 1**
Describe the procedures for preparing tools and equipment required for dismantling, assessment, repair, replacement or adjustment of internal components and re-assembly and testing

**Objectives**
To achieve this outcome a student has to describe the

1) Preparation of the units and equipment used for dismantling, assessment, repair, replacement or adjustment of internal components and re-assembly and testing units
   a) engines
   b) gearboxes (manual and automatic)
   c) final drives
   d) steering units
   e) suspension units
   f) motor cycle chassis assemblies.

2) Equipment
   a) hand tools
   b) pullers
   c) presses
   d) measuring instruments
   e) refurbishment tools
   f) general workshop equipment
   g) special service tools
   h) cylinder compression and leakage testers
   i) clock gauges and degree plates
   j) torque setting equipment
      i. electronic analysers and fault code readers (scanners)
      ii. multimeters
   k) pre-load gauges
   l) belt tension gauges.

3) Procedures used to check the accuracy and operational efficiency of the equipment required for unit overhaul.

4) Procedures for preparing, connecting and testing all the required overhaul equipment prior to use.

5) Systematic collection of sufficient information to enable overhaul.

6) Using the tools and equipment correctly and safely at all times.

7) Procedures used to obtain and check the data required for overhaul.
Outcome 2
Describe the procedures for preparing mechanical units for bench based overhaul

Objectives
To achieve this outcome a student has to describe the:

1) External visual assessments and procedures required for preparing mechanical units for bench overhaul
   a) fluid leakage
   b) wear
   c) damage
   d) alignment
   e) corrosion
   f) balance.

2) How mechanical units
   a) are constructed
   b) operate
   c) are dismantled
   d) are re-assembled.

3) Methods of finding, interpreting and using information prior to overhaul to ensure the units will comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits.

4) Information which will be required prior to overhaul
   a) wear
   b) run out
   c) pressures and compressions
   d) flow
   e) leakage.

5) Electrical measurements
   a) voltage
   b) pulse displays
   c) electronic systems date
   d) fault codes
   e) sensor measurements
   f) control unit outputs/signals.

6) The possible causes of faults in mechanical units and assemblies.

7) Health and safety legislation and employers workshop practices relating to
   a) personal protection
b) vehicle protection  
c) recording fault location and rectification activities  
d) referral of problems  
e) reporting delays to the completion of work  
f) importance of working to agreed timescales and keeping others informed of progress  
g) relationship between time, costs and profitability.

8) Recommendations based upon the inspection procedures
   a) servicing  
   b) repair  
   c) replace
Outcome 3
Describe the procedures for dismantling, assessment, repair, replacement or adjustment of internal components and re-assembly and testing.

Objectives
To achieve this outcome a student has to describe the:

1) Procedures for overhauling mechanical units
   a) dismantling
   b) assessment
   c) repair
   d) replacement
   e) adjustment of internal components
   f) re-assembly
   g) functional testing.

2) Reasons why failure has occurred.

3) How to select the most appropriate methods for the overhaul of units on the bench.

4) Adjustments required to mechanical units
   a) clearances
   b) gaps
   c) settings
   d) pressures
   e) tensions
   f) pre-loads
   g) speeds.

5) Health and safety legislation and workplace procedures relating to the overhaul of mechanical units.

6) Functional testing procedures for overhauled units
   a) balance
   b) performance testing on the bench, dynamometer or dynamic rollers
   c) road testing.

7) How to select the most appropriate methods for the overhaul of units on the bench.
Outcome 4
Describe the procedures for recording the results of overhaul procedures.

Objectives
To achieve this outcome a student has to describe the:

1) Importance of documenting overhaul information.
2) Procedures for recording overhaul activities
   a) computer based
   b) hard copy.
3) Importance of ensuring the records are
   a) accurate
   b) complete
   c) in the format required
   d) passed promptly to the relevant person.
4) Procedures for
   a) disposing of waste material resulting from the overhaul activities
   b) returning defective units and components to storage or for re-cycling, including refrigerant handling requirements.
5) How to make cost effective recommendations for rectification.
6) The relationship between time, costs and profitability.

Assessment
Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
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<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
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<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>


MR12/V27

Remove and Replace Vehicle Transmission and Driveline Units and Components

Evidence requirements
To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).
To complete this unit you must:

1. Produce evidence of removing and replacing three transmission and driveline components.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
**Information for N/SVQs**

**General Requirements**

You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both.
6. Evidence from simulated activities is not acceptable for this unit.

**Specific Performance Evidence for this Unit**

You must:

7. Produce evidence of removing and replacing 4 different units or components in total which must include a gearbox, clutch, hubs and bearings and driveline shafts. Your evidence must include mechanical, electrical and hydraulic/fluid units or components.
8. Your assessor must physically observe you in your normal workplace on at least 1 occasion successfully removing and replacing transmission and driveline units and components.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

| Evidence of removing and replacing 1 |  |
| Evidence of removing and replacing 2 |  |
| Evidence of removing and replacing 3 |  |
| Evidence of removing and replacing 4 |  |

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

| VRQ Candidate declaration: | N/SVQ Candidate declaration: |
| I confirm that the evidence listed for this unit is authentic and a true representation of my own work | I confirm that the evidence listed for this unit is authentic and a true representation of my own work |
| Candidate name:……………………………………………….. | Candidate name:……………………………………………….. |
| Candidate enrolment number:…………………………………… | Candidate enrolment number:…………………………………… |
| Candidate signature:…………………………………………... | Candidate signature:…………………………………………... |
| Date: ……………………… | Date: ……………………… |

| VRQ Assessor declaration: | N/SVQ Assessor declaration: |
| I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. | I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. |
| Assessor name: …………………………………………….. | Assessor name: …………………………………………….. |
| Assessor signature:………………………………………….. | Assessor signature:………………………………………….. |
| Date: ……………………… | Date: ……………………… |

| VRQ Internal verifier Declaration: | N/SVQ Internal verifier Declaration: |
| Leave blank if sampling of this unit did not take place. | Leave blank if sampling of this unit did not take place. |
| I have internally verified the assessment work on this unit in the following ways (please tick): | I have internally verified the assessment work on this unit in the following ways (please tick): |
| sampling candidate and assessment evidence | sampling candidate and assessment evidence |
| observation of assessment practice | observation of assessment practice |
| discussion with candidate | discussion with candidate |
| other – please state: | other – please state: |
| I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification. | I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification. |
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| Countersignature: (if relevant) ……………………………….. Date: …………… | Countersignature: (if relevant) ……………………………….. Date: …………… |
### Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities.</td>
<td></td>
</tr>
<tr>
<td>Support your removal and replacement activities by reviewing</td>
<td></td>
</tr>
<tr>
<td>• vehicle technical data</td>
<td></td>
</tr>
<tr>
<td>• removal and replacement procedures</td>
<td></td>
</tr>
<tr>
<td>• legal requirements.</td>
<td></td>
</tr>
<tr>
<td>Prepare, test and use all the <strong>equipment</strong> required following manufacturers’ instructions.</td>
<td></td>
</tr>
<tr>
<td>Carry out all removal and replacement activities following;</td>
<td></td>
</tr>
<tr>
<td>• manufacturers’ instructions</td>
<td></td>
</tr>
<tr>
<td>• your workplace procedures</td>
<td></td>
</tr>
<tr>
<td>• health and safety requirements.</td>
<td></td>
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<tr>
<td>You work in a way which minimises the risk of:</td>
<td></td>
</tr>
<tr>
<td>• damage to other vehicle systems</td>
<td></td>
</tr>
<tr>
<td>• damage to other vehicle components and units</td>
<td></td>
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<tr>
<td>• contact with leakage</td>
<td></td>
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<tr>
<td>• contact with hazardous substances.</td>
<td></td>
</tr>
<tr>
<td>Ensure replaced transmission and driveline <strong>units and components</strong> conform to the vehicle operating specification and any legal requirements.</td>
<td></td>
</tr>
<tr>
<td>Record and report any additional faults you notice during the course of your work promptly.</td>
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<tr>
<td>Use suitable <strong>testing methods</strong> to evaluate the performance of the reassembled system accurately.</td>
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<tr>
<td>Ensure the reassembled <strong>transmission and driveline system</strong> performs to the vehicle operating specification and meets any legal requirements prior to return to the customer.</td>
<td></td>
</tr>
<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required</td>
<td></td>
</tr>
<tr>
<td>Complete all removal and replacement activities within the agreed timescale.</td>
<td></td>
</tr>
<tr>
<td>Report any expected delays in completion to the relevant person(s) promptly</td>
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</tbody>
</table>
### Scope of this unit

<table>
<thead>
<tr>
<th>All of the items listed below form part of this National Occupational Standard.</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Equipment is:</strong></td>
<td></td>
</tr>
<tr>
<td>a. hand tools</td>
<td></td>
</tr>
<tr>
<td>b. special workshop tools</td>
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<tr>
<td>c. general workshop equipment</td>
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<tr>
<td>d. electrical testing equipment.</td>
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<tr>
<td><strong>2. Testing methods are:</strong></td>
<td></td>
</tr>
<tr>
<td>a. visual</td>
<td></td>
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<tr>
<td>b. aural</td>
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<tr>
<td>c. simulated testing and measuring</td>
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<tr>
<td>d. functional.</td>
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<tr>
<td><strong>3. Units and components are:</strong></td>
<td></td>
</tr>
<tr>
<td>a. mechanical</td>
<td></td>
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<tr>
<td>b. electrical</td>
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<tr>
<td>c. hydraulic.</td>
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<tr>
<td><strong>4. Transmission and driveline systems are:</strong></td>
<td></td>
</tr>
<tr>
<td>a. gearbox</td>
<td></td>
</tr>
<tr>
<td>b. hubs and bearings</td>
<td></td>
</tr>
<tr>
<td>c. driveline shafts</td>
<td></td>
</tr>
<tr>
<td>d. clutch.</td>
<td></td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
Essential knowledge

<table>
<thead>
<tr>
<th>You need to understand:</th>
<th>PRN</th>
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</thead>
<tbody>
<tr>
<td><strong>Legislative and organisational requirements and procedures</strong></td>
<td></td>
</tr>
<tr>
<td>1. The legal requirements relating to the vehicle (including road safety requirements).</td>
<td></td>
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<td>2. The health and safety legislation and workplace procedures relevant to vehicle maintenance activities and personal and vehicle protection.</td>
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<tr>
<td>3. Your workplace procedures for</td>
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<tr>
<td>- recording removal and replacement information</td>
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<tr>
<td>- the referral of problems</td>
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<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
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<tr>
<td>6. The relationship between time and costs.</td>
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</tr>
<tr>
<td>7. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
<td></td>
</tr>
</tbody>
</table>

| **Use of technical information** | |
| 8. How to find, interpret and use sources of information applicable to unit and component removal and replacement within transmission and driveline systems. | |
| 9. The importance of using the correct sources of technical information. | |
| 10. The purpose of and how to use identification codes. | |

| **Electrical and electronic principles** | |
| 11. Vehicle earthing principles and earthing methods. | |
| 12. Electrical and electronic principles associated with transmission and driveline systems, including types of sensors and actuators, their application and operation. | |
| 13. Types of circuit protection and why these are necessary. | |
| 15. Electric symbols, units and terms. | |
| 16. Electrical and electronic control system principles. | |

| **Transmission and driveline system operation and construction** | |
| 17. How transmission and driveline systems and their related units and components are constructed, removed and replaced for the classification of vehicle worked upon. | |
| 18. How transmission and driveline systems and their related units and components operate for the classification of vehicle worked upon. | |

| **Equipment** | |
| 19. How to prepare, test and use all the removal and replacement equipment required. | |

| **Transmission and driveline system unit and component removal and replacement** | |
| 20. How to remove and replace transmission and driveline system mechanical, electrical and hydraulic units and components for the classification of vehicle worked upon. | |
| 21. how to file, fit, tap, thread, cut and drill plastics and metals. | |
| 22. How to select and use gaskets, sealants, seals, fittings and fasteners. | |
| 23. How to test and evaluate the performance of replacement transmission and driveline system units and components and the reassembled system against the vehicle operating specifications and any legal requirements. | |
| 24. The relationship between testing methods and the transmission and driveline system units and components replaced – the use of appropriate test methods. | |
| 25. When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements. | |
| 26. How to work safely avoiding damage to other vehicle systems, components and units and contact with leakage and hazardous substances. | |

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
</tr>
</tbody>
</table>
# Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td></td>
</tr>
<tr>
<td>C1.1; C1.3; C2.2</td>
<td><strong>Communication:</strong></td>
</tr>
<tr>
<td></td>
<td>Access 3, Outcomes 2 and 3</td>
</tr>
<tr>
<td></td>
<td>Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong></td>
</tr>
<tr>
<td>N2.1; N2.2/1.2?? N1.3</td>
<td>Intermediate 1, Outcomes 1, 2 and (4? Or Access 3, Outcome 4)</td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong></td>
</tr>
<tr>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong></td>
</tr>
<tr>
<td>WO2.2?</td>
<td>Intermediate 1, Outcome 2</td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td>No parallel unit.</td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong></td>
</tr>
<tr>
<td>PS2.1</td>
<td>Intermediate 1, Outcome 1</td>
</tr>
</tbody>
</table>
Syllabus

Remove and Replace Transmission and Driveline Units and Components

This unit is about removing and replacing units and components where dismantling and re-assembly of transmission systems is required. It is also about evaluating the performance of replaced units and components. The units and components concerned are those outside those replaced as part of normal routine, vehicle maintenance (servicing) activities.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red italics, that specific to motorcycles is highlighted by blue underlining and that specific to heavy vehicle in green bold. GOLA tests will only cover the general content.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe clutch operating principles, functions and removal, replacements and adjustment procedures.
2. Describe manual gearbox operating principles, functions and removal, replacements and adjustment procedures.
3. Describe automatic gearbox operating principles, functions and removal, replacements and adjustment procedures.
4. Describe driveline operating principles, functions and removal, replacements and adjustment procedures.
5. Describe final drive operating principles, functions and removal, replacements and adjustment procedures.
**Outcome 1**
Describe clutch operating principles, functions and removal, replacements and adjustment procedures.

**Objectives**
To achieve this outcome a student has to:

1. a) Describe the functions of the clutch system
   - i) provides a medium for transmitting torque
   - ii) provides a method of gradual drive take-up
   - iii) assists in gear changing
   - iv) provides a temporary neutral

   b) state, for clutch systems the
   - i) working principles
   - ii) factors upon which friction depends
   - iii) factors upon which torque transmitted by a clutch depends

2. Describe how to remove, replace and adjust clutch assemblies, clutch operating systems and components
   a) mechanically operated release mechanisms
   b) hydraulically operated release mechanisms
   c) cables and automatic adjusting mechanisms
   d) master and slave cylinders and associated pipes
   e) electrical/electronic release system components
   f) centre plates, pressure plates and release bearings

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) measuring equipment
      - i) feeler gauges
      - ii) dial test indicators
      - iii) internal and external micrometers
      - iv) Vernier and depth gauges
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) impact wrenches
   g) power tools
   h) brushes, solvents and other cleaning equipment
   i) lubricants, easing oils, and specialist fluids
   j) locking and joining devices and materials

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
i) workshop procedures
ii) road testing procedures
iii) manufacturers requirements
iv) legal requirements
v) dynamometers / rollers

b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 2
Describe manual gearbox operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:
1. a) Describe the functions of the manual gearbox system
   i) utilises engine torque characteristics effectively
   ii) provides reverse
   iii) provides a permanent neutral
   iv) improves traction and handling
   v) reduces fuel consumption and engine wear
b) state, for front wheel drive and rear wheel drive, manual gearbox systems, the
   i) working principles for four, five and six speed gearboxes
   ii) method of torque multiplication using gears
   iii) power flow for each ratio
   iv) layout of shafts and bearings
   v) layout of selector mechanisms
2. Describe how to remove, replace and adjust manual gearbox systems in two and three shaft layouts
   a) overdrive arrangements
   b) transaxles
   c) types of gear, thrust washers and bearings
   d) primary shaft, layshaft, mainshaft and reverse idler shafts
   e) synchromesh arrangements
   f) oil seals and gaskets
   g) speedometer drive arrangements
   h) mountings
   i) selector forks, rails, location, retention and interlock devices
   j) gear change mechanisms (direct/indirect) and linkages
   k) reversing light arrangements
3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) lifting and supporting equipment
   c) measuring equipment
      i) feeler gauges
      ii) dial test indicators
      iii) internal and external micrometers
      iv) Vernier and depth gauges
   c) special purpose wrenches and stud removers
d) vehicle and unit lifting devices and supports  
e) torque wrenches  
f) draining equipment  
g) brushes, solvents and other cleaning equipment  
h) lubricants, easing oils, and specialist fluids  
i) locking and joining devices and materials  

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement  
   i) workshop procedures  
   ii) road testing procedures  
   iii) manufacturers requirements  
   iv) legal requirements  
   v) dynamometers / rollers  

b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement  

5. Understand how records of workplace activities are completed as computer or paper based systems.  

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 3
Describe automatic gearbox operating principles, functions and removal, replacements and adjustment procedures. This is an emerging technology for motor cycles so has not been highlighted as light vehicle only.

Objectives
To achieve this outcome a student has to:
1. a) Describe the functions of the automatic gearbox system
   i) multiplies engine torque to suit engine load and speed
   ii) provides reverse
   iii) provides a permanent neutral
   iv) provides automatic gear changing
b) state, for automatic gearbox systems, the purpose of the
   i) drivers control systems
   ii) gear changing control systems
2. Describe how to remove, replace and adjust automatic gearbox systems (external adjustments only)
   a) fluid level
   b) drivers control arrangements
   c) bands
   d) inhibitor switch
   e) oil coolers
3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) measuring equipment
      i) feeler gauges
      ii) dial test indicators
      iii) internal and external micrometers
      iv) Vernier and depth gauges
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) power tools
   g) draining equipment
   h) brushes, solvents and other cleaning equipment
   i) lubricants, easing oils, and specialist fluids
   j) locking and joining devices and materials
4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   i) workshop procedures
ii) road testing procedures
iii) manufacturers requirements
iv) legal requirements
v) stall testing
vi) dynamometers / rollers

b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
   i) code readers / scanners
   ii) measuring equipment

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 4
Describe driveline operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to
1. a) Describe the functions of the driveline
   i) transmits the drive
   ii) accommodates angular shaft deflection
   iii) allows for changes in distance between components

b) state, for the driveline the
   i) working principles
   ii) action of universal joints, constant velocity joints and plunge joints
   iii) reasons for using tubular/solid shafts and slip joints
   iv) typical applications for semi-floating, three-quarter floating and fully floating final drive hubs
   v) chain drives

2. Describe how to remove, replace and adjust driveline components
   a) shafts, joints and centre bearings
   b) drive shafts, bearings and joints
   c) torque tubes, housings and casings
   d) hub arrangements including bearings, seals and adjustment methods
      i) semi-floating
      ii) three-quarter floating
      iii) fully floating

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) balancing equipment
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   m) brushes, solvents and other cleaning equipment
   n) lubricants, easing oils, and specialist fluids
   o) locking and joining devices and materials

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
      i) workshop procedures
      ii) road testing procedures
      iii) manufacturers requirements
      iv) legal requirements
v) dynamometer / rollers

b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
   i) balance testers
   ii) run out checking / measuring equipment

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 5
Describe final drive operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. a) Describe the functions of the final drive systems
   i) provides a permanent reduction in transmission
   ii) permits different wheel speeds on corners by using conventional differentials

b) state, for the final drive systems, the
   i) working principles
   ii) operation of final drive gears and chain drives
   iii) operation of conventional differentials
   iv) limited slip differentials

2. Describe how to remove, replace and adjust final drive system components

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) measuring equipment
      i) feeler gauges
      ii) dial test indicators
      iii) internal and external micrometers
      iv) Vernier and depth gauges
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) power tools
   g) belt tension gauges
   h) draining equipment
   i) brushes, solvents and other cleaning equipment
   j) lubricants, easing oils, and specialist fluids
   k) locking and joining devices and materials

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
      i) workshop procedures
      ii) road testing procedures
      iii) manufacturers requirements
      iv) legal requirements
      v) dynamometers / rollers

b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
i) torque setting equipment
ii) measuring equipment

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.

Assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>5</td>
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<td>2.</td>
<td>5</td>
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<td>3.</td>
<td>5</td>
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<tr>
<td>4.</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>5</td>
</tr>
<tr>
<td>Test duration 35mins</td>
<td>Total 25</td>
</tr>
</tbody>
</table>
MR12HV/V28

Remove and Replace Commercial Vehicle Transmission and Driveline Units and Components

| Further guidance available | Observation of your task/work | Evidence recording | Computer based testing | ? Verbal Questioning |

Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).

To complete this unit you must:

1. Produce evidence of removing and replacing three transmission and driveline components

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:
1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit
You must:
7. Produce evidence of removing and replacing 4 different units or components in total which must include a gearbox and/or power take off, clutch, hubs and bearings and driveline shafts. Your evidence must include mechanical, electrical and hydraulic/fluid or pneumatic units or components.
8. Your assessor must physically observe you in your normal workplace on at least 1 occasion successfully removing and replacing transmission and driveline units and components.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
### Evidence reference summary

<table>
<thead>
<tr>
<th>Portfolio reference number (PRN)</th>
<th>VRQ</th>
<th>N/SVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed assessment</td>
<td>Approved centre or workplace</td>
</tr>
</tbody>
</table>

- evidence of removing and replacing 1
- evidence of removing and replacing 2
- evidence of removing and replacing 3
- evidence of removing and replacing 4

### Supplementary evidence (if used) PRN

### On line test reference for this unit PRN

### Unit assessment and verification declaration

#### VRQ Candidate declaration:
- I confirm that the evidence listed for this unit is authentic and a true representation of my own work.
- Candidate name: …………………………………………………
- Candidate enrolment number: …………………………………..
- Candidate signature: ………………………………………………
- Date: ………………………

#### VRQ Assessor declaration:
- I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
- Assessor name: …………………………………………………
- Assessor signature: ………………………………………………
- Date: ………………………
- Countersignature: (if relevant). ……………………………
- Date: ………………………

#### VRQ Internal verifier Declaration:
- I have internally verified the assessment work on this unit in the following ways (please tick):
  - sampling candidate and assessment evidence
  - observation of assessment practice
  - discussion with candidate
  - other – please state:
- I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.
- Internal verifier name: …………………………………..
- Internal verifier signature: ……………………………….. Date: ………..
- Countersignature: (if relevant) ……………………………….. Date: ………..

#### N/SVQ Candidate declaration:
- I confirm that the evidence listed for this unit is authentic and a true representation of my own work.
- Candidate name: …………………………………………………
- Candidate enrolment number: …………………………………..
- Candidate signature: ………………………………………………
- Date: ………………………

#### N/SVQ Assessor declaration:
- I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.
- Assessor name: …………………………………………………
- Assessor signature: ………………………………………………
- Date: ………………………
- Countersignature: (if relevant). ……………………………
- Date: ………………………

#### N/SVQ Internal verifier Declaration:
- (Leave blank if sampling of this unit did not take place.)
- I have internally verified the assessment work on this unit in the following ways (please tick):
  - sampling candidate and assessment evidence
  - observation of assessment practice
  - discussion with candidate
  - other – please state:
- I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.
- Internal verifier name: …………………………………..
- Internal verifier signature: ……………………………….. Date: ………..
- Countersignature: (if relevant) ……………………………….. Date: ………..
## Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
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<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities.</td>
<td></td>
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<tr>
<td>Support your removal and replacement activities by reviewing</td>
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<tr>
<td>• vehicle technical data</td>
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<tr>
<td>• removal and replacement procedures</td>
<td></td>
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<tr>
<td>• legal requirements.</td>
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<tr>
<td>Prepare, test and use all the <strong>equipment</strong> required following manufacturers’ instructions.</td>
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<tr>
<td>Carry out all removal and replacement activities following;</td>
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<tr>
<td>• manufacturers’ instructions</td>
<td></td>
</tr>
<tr>
<td>• your workplace procedures</td>
<td></td>
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<tr>
<td>• health and safety requirements.</td>
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<tr>
<td>You work in a way which minimises the risk of:</td>
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<tr>
<td>• damage to other vehicle systems</td>
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<tr>
<td>• damage to other vehicle components and units</td>
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<td>• contact with leakage</td>
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<tr>
<td>• contact with hazardous substances</td>
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<tr>
<td>Ensure replaced transmission and driveline <strong>units and components</strong> conform to the vehicle operating specification and any legal requirements.</td>
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<tr>
<td>Record and report any additional faults you notice during the course of your work promptly.</td>
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<tr>
<td>Use suitable <strong>testing methods</strong> to evaluate the performance of the reassembled system accurately.</td>
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<tr>
<td>Ensure the reassembled <strong>transmission and driveline system</strong> performs to the vehicle operating specification and meets any legal requirements prior to return to the customer.</td>
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<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required</td>
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<tr>
<td>Complete all removal and replacement activities within the agreed timescale.</td>
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<tr>
<td>You report any expected delays in completion to the relevant person(s) promptly</td>
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</tbody>
</table>
# Scope of this unit

All of the items listed below form part of this National Occupational Standard.

<table>
<thead>
<tr>
<th>1. Equipment is</th>
<th>PRN</th>
</tr>
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<tbody>
<tr>
<td>a. hand tools</td>
<td></td>
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<tr>
<td>b. special workshop tools</td>
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<tr>
<td>c. general workshop equipment</td>
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<tr>
<td>d. electrical testing equipment</td>
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<table>
<thead>
<tr>
<th>2. Testing methods are:</th>
<th>PRN</th>
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<tbody>
<tr>
<td>a. visual</td>
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<td>b. aural</td>
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<tr>
<td>c. simulated testing and measuring</td>
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<tr>
<td>d. functional</td>
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<table>
<thead>
<tr>
<th>3. Units and components are:</th>
<th>PRN</th>
</tr>
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<tbody>
<tr>
<td>a. mechanical</td>
<td></td>
</tr>
<tr>
<td>b. electrical</td>
<td></td>
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<tr>
<td>c. hydraulic</td>
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<table>
<thead>
<tr>
<th>4. Transmission and driveline systems are</th>
<th>PRN</th>
</tr>
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<tbody>
<tr>
<td>a. gearbox</td>
<td></td>
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<tr>
<td>b. hubs and bearings</td>
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<tr>
<td>c. driveline shafts</td>
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<tr>
<td>d. clutch</td>
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</table>

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<table>
<thead>
<tr>
<th>Candidate</th>
<th>Date</th>
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</table>
## Essential knowledge

### You need to understand:

<table>
<thead>
<tr>
<th>Legislative and organisational requirements and procedures</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The legal requirements relating to the vehicle (including road safety requirements).</td>
<td></td>
</tr>
<tr>
<td>2. The health and safety legislation and workplace procedures relevant to vehicle maintenance activities and personal and vehicle protection.</td>
<td></td>
</tr>
<tr>
<td>3. Your workplace procedures for recording removal and replacement information</td>
<td></td>
</tr>
<tr>
<td>4. The importance of documenting removal and replacement information</td>
<td></td>
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<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
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</tr>
<tr>
<td>6. The relationship between time and costs.</td>
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<tr>
<td>7. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
<td></td>
</tr>
</tbody>
</table>

### Use of technical information

| Use of technical information | |
|------------------------------||
| 8. How to find, interpret and use sources of information applicable to unit and component removal and replacement within transmission and driveline systems. | |
| 9. The importance of using the correct sources of technical information | |
| 10. The purpose of and how to use identification codes. | |

### Electrical and electronic principles

| Electrical and electronic principles | |
|------------------------------------||
| 11. Vehicle earthing principles and earthing methods. | |
| 12. Electrical and electronic principles associated with transmission and driveline systems, including types of sensors and actuators, their application and operation. | |
| 13. Types of circuit protection and why these are necessary. | |
| 15. Electric symbols, units and terms. | |
| 16. Electrical and electronic control system principles. | |

### Transmission and driveline system operation and construction

| Transmission and driveline system operation and construction | |
|-------------------------------------------------------------||
| 17. How commercial vehicle transmission and driveline systems and their related units and components are constructed, removed and replaced for the classification of vehicle worked upon. | |
| 18. How commercial vehicle transmission and driveline systems and their related units and components operate for the classification of vehicle worked upon. | |

### Equipment

| Equipment | |
|-----------||
| 19. How to prepare, test and use all the removal and replacement equipment required. | |

### Transmission and driveline system unit and component removal and replacement

| Transmission and driveline system unit and component removal and replacement | |
|---------------------------------------------------------------------------||
| 20. How to remove and replace commercial vehicle transmission and driveline system mechanical, electrical and hydraulic units and components for the classification of vehicle worked upon. | |
| 21. How to file, fit, tap, thread, cut and drill plastics and metals. | |
| 22. How to select and use gaskets, sealants, seals, fittings and fasteners. | |
| 23. How to test and evaluate the performance of replacement transmission and driveline system units and components and the reassembled system against the vehicle operating specifications and any legal requirements. | |
| 24. The relationship between testing methods and the transmission and driveline system units and components replaced – the use of appropriate test methods. | |
| 25. When replacement units and components must meet the original equipment specification (OES) for warranty or other requirements. | |
| 26. How to work safely avoiding damage to other vehicle systems, components and units and contact with leakage and hazardous substances. | |

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In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</table>
## Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication:</strong></td>
<td><strong>Communication:</strong> Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td>C1.1; C1.3; C2.2</td>
<td></td>
</tr>
<tr>
<td><strong>Application of Number:</strong></td>
<td><strong>Numeracy:</strong> Intermediate 1, Outcomes 1, 2 and 4? Or Access 3, Outcome 4</td>
</tr>
<tr>
<td>N2.1; N2.2/1.2?? N1.3</td>
<td></td>
</tr>
<tr>
<td><strong>Information Technology:</strong></td>
<td><strong>Information Technology:</strong> Not applicable</td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Working with Others:</strong></td>
<td><strong>Working with Others:</strong> Intermediate 1, Outcome 2</td>
</tr>
<tr>
<td>WO2.2?</td>
<td></td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong></td>
<td><em>No parallel unit.</em></td>
</tr>
<tr>
<td>Not applicable</td>
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</tr>
<tr>
<td><strong>Problem Solving:</strong></td>
<td><strong>Problem Solving:</strong> Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td>PS2.1</td>
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</tbody>
</table>
Syllabus

Remove and Replace Commercial Vehicle Transmission and Driveline Units and Components

This unit is about removing and replacing units and components where dismantling and re-assembly of commercial vehicle transmission systems is required. It is also about evaluating the performance of replaced units and components. The units and components concerned are those outside those replaced as part of normal routine, vehicle maintenance (servicing) activities.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe clutch operating principles, functions and removal, replacements and adjustment procedures.
2. Describe manual gearbox operating principles, functions and removal, replacements and adjustment procedures.
3. Describe automatic gearbox operating principles, functions and removal, replacements and adjustment procedures.
4. Describe driveline operating principles, functions and removal, replacements and adjustment procedures.
5. Describe final drive operating principles, functions and removal, replacements and adjustment procedures.
Outcome 1
Describe clutch operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. a) Describe the functions of the clutch system
   i) provides a medium for transmitting torque
   ii) provides a method of gradual drive take-up
   iii) assists in gear changing
   iv) provides a temporary neutral
   b) state, for clutch systems the
      i) working principles
      ii) factors upon which friction depends
      iii) factors upon which torque transmitted by a clutch depends

2. Describe how to remove, replace and adjust clutch assemblies, clutch operating systems and components
   a) mechanically, hydraulically, and pneumatically operated release mechanisms
   b) cables and automatic adjusting mechanisms
   c) control (master) and operating (slave) cylinders, servo units and associated pipes
   d) electrical/electronic release systems
   e) centre plates, clutch cover assemblies and release bearings

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) impact wrenches
   b) power tools and hand tools
   c) measuring equipment
   d) feeler gauges
      i) dial test indicators
      ii) internal and external micrometers
      iii) vernier and depth gauges
   e) special purpose wrenches and stud removers
   f) vehicle and unit lifting devices and supports
   g) torque wrenches
   h) brushes, solvents and other cleaning equipment
   i) lubricants, easing oils, and specialist fluids
   j) locking and joining devices and materials

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   i) workshop procedures
   ii) road testing procedures
iii) manufacturers requirements

iv) legal requirements

v) dynamometers / rollers

b) Describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 2
Describe manual gearbox operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. a) Describe the functions of the manual gearbox system
   i) utilises engine torque characteristics effectively
   ii) provides reverse
   iii) provides a permanent neutral
   iv) improves traction and handling
   v) reduces fuel consumption and engine wear

b) State, for manual gearboxes, the
   i) working principles for multi ratio gearboxes
   ii) method of torque multiplication using gears
   iii) power flow for each ratio
   iv) layout of shafts and bearings
   v) layout of selector mechanisms

2. Describe how to remove, replace and adjust manual (synchromesh) gearbox and associated systems in two/ and three shaft layouts
   a) types of gear, thrust washers and bearings
   b) primary shaft, layshaft, mainshaft and reverse idler shafts
   c) splitter and range change arrangements
   d) synchromesh arrangements
   e) oil seals and gaskets
   f) speedometer drive arrangements
   g) mountings
   h) selector forks, rails, location, retention and interlock devices
   i) gear change mechanisms (mechanical, air and electrical)
   j) automated-shift systems
   k) reversing light arrangements

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) lifting and supporting equipment
   c) measuring equipment
      i) feeler gauges
      ii) dial test indicators
      iii) internal and external micrometers
      iv) vernier and depth gauges
   c) special purpose wrenches and stud removers
d) vehicle and unit lifting devices and supports

e) torque wrenches

f) draining equipment

g) brushes, solvents and other cleaning equipment

h) lubricants, easing oils, and specialist fluids

i) locking and joining devices and materials

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement

   i) workshop procedures

   ii) road testing procedures

   iii) manufacturers requirements

   iv) legal requirements

   v) dynamometers / rollers

b) Describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 3
Describe fully-automatic gearbox operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:
1. a) Describe the functions of the automatic gearbox system {Standard wording here}
   i) multiplies engine torque to suit engine load and speed
   ii) provides reverse
   iii) provides a permanent neutral
   iv) provides automatic gear changing
b) state, for automatic gearbox systems, the purpose of the
   i) drivers control systems
   ii) gear changing control systems
2. Describe how to remove, replace and adjust automatic gearbox systems (external adjustments only)
   a) fluid level
   b) drivers control arrangements
   c) brake bands
   d) inhibitor switch
   e) oil coolers
3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) measuring equipment
      i) feeler gauges
      ii) dial test indicators
      iii) internal and external micrometers
      iv) Vernier and depth gauges
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) power tools
   g) draining equipment
   h) brushes, solvents and other cleaning equipment
   i) lubricants, easing oils, and specialist fluids
   j) locking and joining devices and materials
4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   i) workshop procedures
   ii) road testing procedures
iii) manufacturers requirements
iv) legal requirements
v) stall testing
v) dynamometers / rollers

b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
i) code readers / scanners

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 4
Describe driveline operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to
1. a) Describe the functions of the driveline
   i) transmits the drive
   ii) accommodates angular shaft deflection
   iii) allows for changes in distance between components

   b) state, for the driveline the
   i) working principles
   ii) action of universal joints,
   iii) reasons for using tubular shafts and slip joints
   iv) typical applications of three-quarter floating and fully floating final drive hubs

2. Describe how to remove, replace and adjust driveline components
   a) propeller shafts, universal joints and centre bearings
   b) drive shafts
   c) hub arrangements including bearings, seals and adjustment methods
      i) three-quarter floating
      ii) fully floating

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) balancing equipment
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   m) brushes, solvents and other cleaning equipment
   n) lubricants, easing oils, and specialist fluids
   o) locking and joining devices and materials

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   i) workshop procedures
   ii) road testing procedures
   iii) manufacturers requirements
   iv) legal requirements
   v) dynamometer / rollers

b) Describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
   i) balance testers
ii) run out checking / measuring equipment

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
Outcome 5
Describe final drive operating principles, functions and removal, replacements and adjustment procedures.

Objectives
To achieve this outcome a student has to:

1. a) Describe the functions of the final drive systems
   i) provides a permanent reduction in transmission
   ii) permits different wheel speeds on corners by using conventional differentials

b) state, for the final drive systems, the
   i) working principles
   ii) operation of final drive gears
   iii) operation of conventional differentials
   iv) operation of differential locks
   v) operation of limited slip differentials

2. Describe how to remove, replace and adjust final drive system components

3. Demonstrate an understanding of the appropriate tools, equipment and consumables needed to remove and refit system components
   a) basic hand tools
   b) measuring equipment
      i) feeler gauges
      ii) dial test indicators
      iii) internal and external micrometers
      iv) Vernier and depth gauges
   c) special purpose wrenches and stud removers
   d) vehicle and unit lifting devices and supports
   e) torque wrenches
   f) power tools
   g) belt tension gauges
   h) draining equipment
   i) brushes, solvents and other cleaning equipment
   j) lubricants, easing oils, and specialist fluids
   k) locking and joining devices and materials

4. a) Describe how vehicle systems are evaluated for operational efficiency following component replacement
   i) workshop procedures
   ii) road testing procedures
   iii) manufacturers requirements
   iv) legal requirements
   v) dynamometers / rollers
b) describe the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement

   i) torque setting equipment

5. Understand how records of workplace activities are completed as computer or paper based systems.

6. State the currently acceptable and legal procedures for disposing of waste materials resulting from the above activities.
## Assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
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<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
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<td>4.</td>
<td>5</td>
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<tr>
<td>5.</td>
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</table>

Test duration 35mins  
Total 25
Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.
Information for VRQs (Technical Certificates).

To complete this unit you must:
Produce evidence of diagnosing and rectifying at least 1 fault in each of the following systems:

1. Gearbox
2. Hubs and bearings
3. Driveline shafts

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
Information for N/SVQs

General Requirements
You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both.
6. Simulated activities will be acceptable to assess candidates’ diagnosis and rectification of faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be diagnosed and rectified to ensure that all the evidence requirements can be met.

Specific Performance Evidence for this Unit
You must:

7. Produce evidence of diagnosing and rectifying at least 1 fault in each of the following systems:
   - gearbox
   - hubs and bearings
   - driveline shafts
   - clutch.
8. Your identification of faults must have involved a 2 or more step diagnostic activity using a prescribed process or format.
9. Of the 4 pieces of evidence above, 3 must come from work carried out in your normal workplace.

Your assessor must physically observe you on at least 1 occasion undertaking a transmission and driveline related diagnostic and rectification activity.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
**Evidence reference summary**

| Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit. |
| Portfolio reference number (PRN) |
| VRQ | N/SVQ | N/SVQ |
| Observed assessment | Approved centre or workplace | Observed assessment |

- Diagnose fault in gearbox
- Diagnose fault in hubs and bearings
- Diagnose fault in driveline shafts
- Diagnose fault in clutch

*Observation of any one system required

**Supplementary evidence (if used) PRN**

**On line test reference for this unit PRN**

**Unit assessment and verification declaration**

**VRQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work

Candidate name: ……………………………………………………
Candidate enrolment number: ………………………………………
Candidate signature: ………………………………………………
Date: ……………………………

**VRQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: …………………………………………………
Assessor signature: ………………………………………………
Date: ……………………………
Countersignature: ………………………………………………
Date: ……………………………

**VRQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ………………………………………
Internal verifier signature: ……………………………………
Countersignature: (if relevant) ……………………………
Date: ……………………………

**N/SVQ Candidate declaration:**
I confirm that the evidence listed for this unit is authentic and a true representation of my own work

Candidate name: …………………………………………………
Candidate enrolment number: ………………………………………
Candidate signature: ………………………………………………
Date: ……………………………

**N/SVQ Assessor declaration:**
I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.

Assessor name: …………………………………………………
Assessor signature: ………………………………………………
Date: ……………………………
Countersignature: (if relevant) ……………………………
Date: ……………………………

**N/SVQ Internal verifier Declaration:**
(Leave blank if sampling of this unit did not take place.)
I have internally verified the assessment work on this unit in the following ways (please tick):
- sampling candidate and assessment evidence
- observation of assessment practice
- discussion with candidate
- other – please state:

I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.

Internal verifier name: ………………………………………
Internal verifier signature: ……………………………………
Countersignature: (if relevant) ……………………………
Date: ……………………………
**Performance objective checklist**

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
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<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings when using <strong>diagnostic methods</strong> and carrying out <strong>rectification activities</strong>.</td>
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<tr>
<td>Support the identification of <strong>faults</strong>, by reviewing vehicle:</td>
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<tr>
<td>- technical data</td>
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<tr>
<td>- diagnostic test procedures.</td>
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<tr>
<td>Prepare, connect and test all the required <strong>equipment</strong> following manufacturers’ instructions prior to use.</td>
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<tr>
<td>Use <strong>diagnostic methods</strong> which are relevant to the symptoms presented.</td>
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<tr>
<td>Collect diagnostic information in a systematic way relevant to the diagnostic methods used.</td>
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<tr>
<td>Collect sufficient diagnostic information to enable an accurate diagnosis of transmission and driveline system faults.</td>
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<td>Identify and record any system deviation from acceptable limits accurately.</td>
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<td>Ensure your assessment of dismantled sub-assemblies, components and units identifies their condition and suitability for repair or replacement, accurately.</td>
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<td>Inform the relevant person(s) promptly where repairs are uneconomic or unsatisfactory to perform.</td>
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<tr>
<td>Use the <strong>equipment</strong> required, correctly and safely throughout all <strong>rectification activities</strong>.</td>
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<tr>
<td>Carry out all <strong>rectification activities</strong> following:</td>
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<td>- manufacturers’ instructions</td>
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<td>- your workplace procedures</td>
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<td>- health and safety requirements.</td>
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<td>Work in a way which minimises the risk of:</td>
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<td>- damage to other vehicle systems</td>
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<td>- damage to other components and units</td>
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<td>- contact with leakages</td>
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<td>- contact with hazardous substances.</td>
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<td>Ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements.</td>
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<td>When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.</td>
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<td>Record and report any additional faults you notice during the course of work promptly.</td>
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<tr>
<td>Use testing methods which are suitable for assessing the performance of the system rectified.</td>
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<tr>
<td>Ensure the transmission and driveline system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.</td>
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<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
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<td>Complete all system diagnostic activities within the agreed timescale.</td>
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<tr>
<td>Report any anticipated delays in completion to the relevant person(s) promptly.</td>
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</tbody>
</table>
### Scope of this unit

All of the items listed below form part of this National Occupational Standard. PRN

1. **Transmission and driveline systems are:**
   - a. gearbox
   - b. hubs and bearings
   - c. driveline shafts
   - d. clutch.

2. **Diagnostic methods are:**
   - a. measurement
   - b. functional testing
   - c. electrical and electronic systems testing.

3. **Equipment is:**
   - a. diagnostic and rectification equipment for transmission mechanical systems
   - b. diagnostic and rectification equipment for transmission electrical systems
   - c. diagnostic and rectification equipment for transmission hydraulic and fluid systems
   - d. specialist repair tools
   - e. general workshop equipment.

4. **Faults are:**
   - a. mechanical
   - b. electrical and electronic
   - c. hydraulic and fluid

5. **Rectification activities are:**
   - a. dismantling
   - b. replacement of units and components
   - c. adjustment of units and components
   - d. repairs to wiring and connectors
   - e. re-programming vehicle systems
   - f. reassembly
   - g. functional testing.

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</table>
### Essential knowledge

#### You need to understand:

<table>
<thead>
<tr>
<th>PRN</th>
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<tbody>
<tr>
<td><strong>Legislative and organisational requirements and procedures</strong></td>
</tr>
<tr>
<td>1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying transmission and driveline faults.</td>
</tr>
<tr>
<td>2. Legal requirements relating to the vehicle (including road safety requirements).</td>
</tr>
<tr>
<td>3. Your workplace procedures for</td>
</tr>
<tr>
<td>recording diagnostic and rectification activities</td>
</tr>
<tr>
<td>the referral of problems</td>
</tr>
<tr>
<td>reporting delays to the completion of work.</td>
</tr>
<tr>
<td>4. The importance of, documenting diagnostic and rectification information.</td>
</tr>
<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
</tr>
<tr>
<td>6. The relationship between time, costs and profitability.</td>
</tr>
<tr>
<td>7. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
</tr>
<tr>
<td><strong>Electrical and electronic principles</strong></td>
</tr>
<tr>
<td>8. Electrical and electronic principles associated with transmission and driveline systems, including types of sensors and actuators, their application and operation.</td>
</tr>
<tr>
<td>9. How electrical and electronic transmission and driveline systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles.</td>
</tr>
<tr>
<td>10. The interaction between electrical, electronic and mechanical components within vehicle transmission and driveline systems.</td>
</tr>
<tr>
<td>11. Electrical symbols, units and terms.</td>
</tr>
<tr>
<td>12. Electrical safety procedures.</td>
</tr>
<tr>
<td><strong>Use of diagnostic and rectification equipment</strong></td>
</tr>
<tr>
<td>13. How to prepare and test the accuracy of diagnostic testing equipment.</td>
</tr>
<tr>
<td>14. How to use diagnostic and rectification equipment for transmission and driveline mechanical, electrical, hydraulic and fluid systems, specialist repair tools and general workshop equipment.</td>
</tr>
<tr>
<td><strong>Transmission and driveline faults, their diagnosis and correction</strong></td>
</tr>
<tr>
<td>15. How transmission and driveline mechanical, electrical, and hydraulic systems are constructed, dismantled, reassembled and operate.</td>
</tr>
<tr>
<td>16. The types and causes of transmission and driveline mechanical, electrical, and hydraulic systems, component and unit faults and failures.</td>
</tr>
<tr>
<td>17. Transmission and driveline mechanical, electrical and hydraulic fluid component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action.</td>
</tr>
<tr>
<td>18. How to find, interpret and use sources of information on transmission and driveline electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements.</td>
</tr>
<tr>
<td>19. Vehicle operating specifications for limits, fits and tolerances relating to transmission and driveline mechanical, electrical, electronic and hydraulic systems for the vehicle(s) on which you work.</td>
</tr>
<tr>
<td>20. How to select the most appropriate diagnostic testing method for the symptoms presented.</td>
</tr>
<tr>
<td>21. How to carry out systematic diagnostic testing of transmission and driveline mechanical, electrical and electronic, hydraulic and fluid systems using a prescribed process or format.</td>
</tr>
<tr>
<td>22. How to assess the condition evident within transmission and driveline mechanical, electrical, electronic, hydraulic and fluid components and units.</td>
</tr>
<tr>
<td>23. How to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults.</td>
</tr>
<tr>
<td>24. How to carry out the rectification activities listed in the Scoping Statement for this unit in order to correct faults in the transmission and driveline mechanical, electrical, electronic and hydraulic fluid systems.</td>
</tr>
<tr>
<td>25. The relationship between test methodology and the faults repaired – the use of appropriate testing methods.</td>
</tr>
<tr>
<td>26. How to make cost effective recommendations for rectification.</td>
</tr>
</tbody>
</table>

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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## Key and core skills signposting

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<tr>
<th>Key Skills</th>
<th>Core Skills</th>
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<tbody>
<tr>
<td><strong>Communication:</strong> C1.1; C1.3; C2.2</td>
<td><strong>Communication:</strong> Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong> N2.1; N2.2/1.2?? N1.3</td>
<td><strong>Numeracy:</strong> Intermediate 1, Outcomes 1, 2 and (4? Or Access 3, Outcome 4)</td>
</tr>
<tr>
<td><strong>Information Technology:</strong> Not applicable</td>
<td><strong>Information Technology:</strong> Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong> WO2.2?</td>
<td><strong>Working with Others:</strong> Intermediate 1, Outcome 2</td>
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<tr>
<td><strong>Improving Own Learning and Performance:</strong> Not applicable</td>
<td>No parallel unit.</td>
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<tr>
<td><strong>Problem Solving:</strong> PS2.1</td>
<td><strong>Problem Solving:</strong> Intermediate 1, Outcome 1</td>
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Syllabus

Diagnose and Rectify Vehicle Transmission and Driveline System Faults

This unit is about diagnosing and rectifying faults occurring in the vehicle clutches, gearboxes, driveline, shafts and hubs and bearings.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Important note: This unit includes technology from different types of vehicle. Content that is general to all vehicle types is in normal print (the majority of the syllabus). Material specific to light vehicles is highlighted in red *italics*, that specific to motorcycles is highlighted by blue *underlining* and that specific to heavy vehicle in green **bold**. GOLA tests will only cover the general content.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1) Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings

2) Describe the procedures for preparing vehicle clutches, gearboxes, driveline, shafts and hubs and bearings for diagnostic activities

3) Describe the procedures for carrying out diagnostic inspections and tests and interpreting the results of these inspections

4) Describe the procedures for rectification of defects identified by diagnostic procedures

5) Describe the procedures for recording the results of rectification procedures
**Outcome 1**
Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings

**Objectives**
To achieve this outcome a student has to describe the

1) a) Preparation of diagnostic equipment used for diagnosis analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings
   i. diagnostic and rectification equipment for transmission chassis electrical systems
   ii. diagnostic and rectification equipment for transmission chassis
   iii. mechanical systems
   iv. diagnostic and rectification equipment for transmission hydraulic and fluid systems
   v. specialist repair tools
   vi. general workshop equipment
   vii. pressure and flow gauges
   viii. clock gauges and degree plates
   ix. torque setting equipment
   x. belt tension gauges

   b) electrical systems
      i. electronic analysers and fault code readers (scanners)
      ii. multimeters

   c) specialist repair tools for hydraulic and fluid systems

   d) pre-load gauges

2) Procedures used to check the accuracy of the diagnostic and testing equipment

3) Methods of finding, interpreting and using information on analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings to check they comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits

4) How to select the most appropriate diagnostic testing methods for the symptoms presented

5) Health and safety legislation and workplace procedures relating to diagnosing system faults

6) Legal and road safety requirements relating to the vehicle

7) Procedures for
   a) preparing, connecting and testing all the required diagnostic and testing equipment prior to use
   b) systematic collection of sufficient diagnostic information to enable precise identification of the fault
   c) using the tools and equipment correctly and safely at all times

8) Procedures used to obtain and check the data required for diagnosis

9) Procedures for using the tools and equipment needed for diagnosis
Outcome 2
Describe the procedures for preparing vehicle clutches, gearboxes, driveline, shafts and hubs and bearings for diagnostic activities

Objectives
To achieve this outcome a student has to describe the
1) Methods of preparing analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings for diagnosis
2) Way in which vehicle clutches, gearboxes, driveline, shafts and hubs and bearings
   a) are constructed
   b) operate
   c) are dismantled
   d) are re-assembled
3) Diagnostic information which is required
   a) wear
   b) run out
   c) pressures
   d) flow
   e) leakage
   f) electrical measurements
      i. voltage
      ii. pulse displays
      iii. electronic systems data
      iv. fault codes
   v. sensor measurements
   vi. control unit outputs/signals
4) Systems which are to be diagnosed
   a) transmission components
   b) clutch and manual gearboxes
   c) **torque converters and automatic gearboxes**
   d) oil coolers
   e) drive shafts, associated joints, couplings and inertia dampers
   f) **final drive assemblies**
      i. crown wheel and pinions
      ii. conventional differentials
      iii. **limited slip differentials including viscous couplings, torsen and electronically controlled**
      iv. semi and three quarter floating rear hubs
      v. half shafts
5) Drive systems
   a) **front wheel drive**
b) rear wheel drive
c) *four wheel drive*
d) traction control

6) Hydraulic and fluid systems
   a) oils and lubrication
   b) cooling systems

7) Electrical and electronic principles associated with analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings including types of sensors and actuators, application and operation

8) How electrical and electronic analysis of vehicle clutches, gearboxes, driveline, shafts and hubs and bearings operate
   a) electrical component function
   b) inputs
   c) outputs
   d) voltages
   e) oscilloscope patterns
   f) *digital and fibre optics principles (multiplexing)*

9) The interaction between electrical, electronic and mechanical components

10) Electrical symbols and terms and electrical safety procedures

11) Methods of finding, interpreting and using information prior to diagnosis to ensure the systems and units will comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits

12) Health and safety legislation and employers workshop practices relating to
   a) personal protection
   b) vehicle protection
   c) recording fault location and rectification activities
   d) referral of problems
   e) reporting delays to the completion of work
   f) importance of working to agreed timescales and keeping others informed of progress
   g) relationship between time, costs and profitability
   h) importance of reporting anticipated delays promptly

13) Reasons why failure has occurred

14) Recommendations based upon the inspection procedures
   a) servicing
   b) repair
Outcome 3
Describe the procedures for carrying out diagnostic inspections and tests on vehicle clutches, gearboxes, driveline, shafts and hubs and bearings and interpreting the results of these inspections

Objectives
To achieve this outcome a student has to describe the:

1) Fault types where
   a) multiple failures occur within an individual system and involves a two or more stage diagnostic facility
   b) a cross system fault where an individual failure can affect several vehicle systems and involves a two or more stage diagnostic facility

2) 2 Recommendations based upon the diagnostic procedures
   a) servicing
   b) dismantling for further inspection and testing
   c) repair
   d) replacement

3) Diagnosis procedures covering
   a) single system faults using a prescribed process or format
   b) multi and cross system faults using a prescribed process or format

4) Diagnostic methods
   a) measurement
   b) functional testing
   c) electrical and electronic systems testing

5) How to carry out systematic diagnostic testing of mechanical, electrical and electronic, hydraulic and fluid systems.

6) How to assess the condition of transmission mechanical, electrical, electronic, hydraulic and fluid components and units

7) How to interpret test results and vehicle data to identify location and cause of faults.

8) how to select the most appropriate methods of diagnosis

9) Rectifications within the transmission and chassis areas
   a) electronic clutch control
   b) electronic gearbox control system
   c) electronic automatic gearbox control system

10) Interaction between electrical, electronic and mechanical components

11) Transmission and chassis electrical systems interlink, interact (including multiplexing)

12) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer
Outcome 4
Describe the procedures for rectification of defects identified by diagnostic procedures

Objectives
To achieve this outcome a student has to describe the:

1) Rectification activities for vehicle clutches, gearboxes, driveline, shafts and hubs and bearings diagnosis
   a) dismantling
   b) replacement of units and components
   c) adjustment of units and components
   d) repairs to wiring and connectors
   e) re-programming vehicle systems
   f) reassembly
   g) functional testing

2) Types and causes of vehicle clutches, gearboxes, driveline, shafts and hubs and bearings, component and unit faults and failures

3) Vehicle clutches, gearboxes, driveline, shafts and hubs and bearings mechanical, electrical, electronic and hydraulic and fluid system component replacement procedures, the circumstances which will necessitate replacement and other causes of action

4) How to carry out rectification activities on transmission, mechanical, electrical electronic and hydraulic and fluid systems.

5) How to make cost effective recommendations for rectification

6) The relationship between time, costs and profitability
Outcome 5
Describe the procedures for recording the results of rectification procedures

Objectives
To achieve this outcome a student has to describe the:
1) Importance of documenting diagnostic and rectification information
2) Procedures for recording diagnostic and rectification activities
   a) computer based
   b) hard copy
3) Importance of ensuring the records are
   a) accurate
   b) complete
   c) in the format required
   d) passed promptly to the relevant person
4) Procedures for
   a) disposing of waste material resulting from the diagnostic and rectification activities
   b) returning defective units and components to storage or for re-cycling, including refrigerant handling requirements
## Assessment

*Essential knowledge assessment*

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
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<tbody>
<tr>
<td>1</td>
<td>3</td>
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<td>2</td>
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<td>3</td>
<td>10</td>
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<td>4</td>
<td>5</td>
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<tr>
<td>5</td>
<td>2</td>
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<tr>
<td><strong>Test duration 35mins</strong></td>
<td><strong>Total 25</strong></td>
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</tbody>
</table>
MR13HV/V30

Diagnose and Rectify Commercial Vehicle Transmission and Driveline System Faults

<table>
<thead>
<tr>
<th>Evidence requirements</th>
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</thead>
<tbody>
<tr>
<td>To complete this unit you will be required to undertake knowledge and practical tests.</td>
</tr>
<tr>
<td>For the knowledge test you must pass the City &amp; Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.</td>
</tr>
<tr>
<td>If you are completing an apprenticeship which includes both N/SVQ &amp; VRQ (Technical Certificate) you will only take this test once.</td>
</tr>
<tr>
<td>The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.</td>
</tr>
<tr>
<td>You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.</td>
</tr>
<tr>
<td>If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.</td>
</tr>
<tr>
<td>Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.</td>
</tr>
</tbody>
</table>
Information for VRQs (Technical Certificates).

To complete this unit you must:
Produce evidence of diagnosing and rectifying at least 1 fault in each of the following systems:

1. gearbox
2. hubs and bearings
3. driveline shafts
4. clutch

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an apprenticeship workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.
**Information for N/SVQs**

**General Requirements**

You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
   - your normal workplace
   - and approved centre, or
   - a combination of both
6. Simulated activities will be acceptable to assess candidates' diagnosis and rectification of faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be diagnosed and rectified to ensure that all the evidence requirements can be met.

**Specific Performance Evidence for this Unit**

You must:

7. Produce evidence of diagnosing and rectifying at least 1 fault in each of the following systems:
   a. gearbox and may include power take off
   b. hubs and bearings
   c. driveline shafts/final drive assembly
   d. clutch
8. Your identification of faults must have involved a 2 or more step diagnostic activity using a prescribed process or format.
9. Of the 4 pieces of evidence above, 3 must come from work carried out in your normal workplace.

Your assessor must physically observe you on at least 1 occasion undertaking a transmission and driveline related diagnostic and rectification activity.

With your assessor you must complete a suitable City & Guilds evidence recording form for each task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an apprenticeship workplace observation will also provide VRQ evidence.
Evidence reference summary

<table>
<thead>
<tr>
<th>Portfolio reference number (PRN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRQ</td>
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<tr>
<td>N/SVQ</td>
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<tr>
<td>N/SVQ</td>
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<tr>
<td>Observed assessment</td>
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<tr>
<td>Approved centre or workplace</td>
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<tr>
<td>Observed assessment</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Evidence reference summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnose fault in gearbox</td>
</tr>
<tr>
<td>*</td>
</tr>
<tr>
<td>Diagnose fault in hubs and bearings</td>
</tr>
<tr>
<td>*</td>
</tr>
<tr>
<td>Diagnose fault in driveline shafts</td>
</tr>
<tr>
<td>*</td>
</tr>
<tr>
<td>Diagnose fault in clutch</td>
</tr>
<tr>
<td>*</td>
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</tbody>
</table>

*Observation of any one system required

Supplementary evidence (if used) PRN

On line test reference for this unit PRN

Unit assessment and verification declaration

<table>
<thead>
<tr>
<th>VRQ Candidate declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that the evidence listed for this unit is authentic and a true representation of my own work</td>
</tr>
<tr>
<td>Candidate name:…………………</td>
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<tr>
<td>Candidate enrolment number:………………………………..</td>
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<tr>
<td>Candidate signature:………………………………..</td>
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<tr>
<td>Date:………………………</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>VRQ Assessor declaration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient.</td>
</tr>
<tr>
<td>Assessor name:…………………</td>
</tr>
<tr>
<td>Assessor signature:…………………</td>
</tr>
<tr>
<td>Date:………………………</td>
</tr>
<tr>
<td>Countersignature: (if relevant)…………………</td>
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<table>
<thead>
<tr>
<th>VRQ Internal verifier Declaration:</th>
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<tbody>
<tr>
<td>(Leave blank if sampling of this unit did not take place.)</td>
</tr>
<tr>
<td>I have internally verified the assessment work on this unit in the following ways (please tick):</td>
</tr>
<tr>
<td>sampling candidate and assessment evidence</td>
</tr>
<tr>
<td>observation of assessment practice</td>
</tr>
<tr>
<td>discussion with candidate</td>
</tr>
<tr>
<td>other – please state:</td>
</tr>
<tr>
<td>I confirm that the candidate’s work meets the standards specified for this unit and may be presented for external verification and/or certification.</td>
</tr>
<tr>
<td>Internal verifier name: ………………..</td>
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<tr>
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<th>N/SVQ Candidate declaration:</th>
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<tr>
<td>Countersignature: (if relevant)…………………</td>
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<tr>
<td>Date: ………………..</td>
</tr>
<tr>
<td>Countersignature: (if relevant) ………………..</td>
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### Performance objective checklist

<table>
<thead>
<tr>
<th>To be competent you must ensure that:</th>
<th>PRN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear suitable personal protective equipment and use vehicle coverings when using <strong>diagnostic methods</strong> and carrying out <strong>rectification activities</strong>.</td>
<td></td>
</tr>
<tr>
<td>Support the identification of <strong>faults</strong>, by reviewing vehicle:</td>
<td></td>
</tr>
<tr>
<td>• Technical data</td>
<td></td>
</tr>
<tr>
<td>• Diagnostic test procedures.</td>
<td></td>
</tr>
<tr>
<td>Prepare, connect and test all the required <strong>equipment</strong> following manufacturers' instructions prior to use.</td>
<td></td>
</tr>
<tr>
<td><strong>Use diagnostic methods</strong> which are relevant to the symptoms presented.</td>
<td></td>
</tr>
<tr>
<td>Collect diagnostic information in a systematic way relevant to the diagnostic methods used.</td>
<td></td>
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<tr>
<td>Collect sufficient diagnostic information to enable an accurate diagnosis of transmission and driveline system faults.</td>
<td></td>
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<tr>
<td>Identify and record any system deviation from acceptable limits accurately.</td>
<td></td>
</tr>
<tr>
<td>Ensure your assessment of dismantled sub-assemblies, components and units identifies their condition and suitability for repair or replacement, accurately.</td>
<td></td>
</tr>
<tr>
<td>Inform the relevant person(s) promptly where repairs are uneconomic or unsatisfactory to perform.</td>
<td></td>
</tr>
<tr>
<td><strong>Use the equipment required, correctly and safely throughout all rectification activities.</strong></td>
<td></td>
</tr>
<tr>
<td>Carry out all <strong>rectification activities</strong> following:</td>
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<tr>
<td>• Manufacturers' instructions</td>
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<tr>
<td>• Your workplace procedures</td>
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<tr>
<td>• Health and safety requirements.</td>
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<tr>
<td>Work in a way which minimises the risk of:</td>
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<tr>
<td>• Damage to other vehicle systems</td>
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<tr>
<td>• Damage to other components and units</td>
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<tr>
<td>• Contact with leakages</td>
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<tr>
<td>• Contact with hazardous substances.</td>
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<tr>
<td>Ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements.</td>
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<tr>
<td>When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.</td>
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<tr>
<td>Record and report any additional faults you notice during the course of work promptly.</td>
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<tr>
<td>Use testing methods which are suitable for assessing the performance of the system rectified.</td>
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<tr>
<td>Ensure the transmission and driveline system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.</td>
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<tr>
<td>Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.</td>
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<tr>
<td>Complete all system diagnostic activities within the agreed timescale.</td>
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<tr>
<td>Report any anticipated delays in completion to the relevant person(s) promptly.</td>
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</tbody>
</table>
Scope of this unit

All of the items listed below form part of this National Occupational Standard. PRN

1. **Transmission and driveline systems** are
   a. gearbox
   b. hubs and bearings
   c. driveline shafts
   d. clutch

2. **Diagnostic methods** are
   a. measurement
   b. functional testing
   c. electrical and electronic systems testing

3. **Equipment** is
   a. diagnostic and rectification equipment for transmission mechanical systems
   b. diagnostic and rectification equipment for transmission electrical systems
   c. diagnostic and rectification equipment for transmission hydraulic and fluid systems
   d. specialist repair tools
   e. general workshop equipment

4. **Faults** are
   a. mechanical
   b. electrical and electronic
   c. hydraulic and fluid

5. **Rectification activities** are:
   a. dismantling
   b. replacement of units and components
   c. adjustment of units and components
   d. repairs to wiring and connectors
   e. re-programming vehicle systems
   f. reassembly
   g. functional testing

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Date</th>
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<tbody>
<tr>
<td>Candidate</td>
<td>Date</td>
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</table>
### Essential knowledge

#### Legislative and organisational requirements and procedures

<table>
<thead>
<tr>
<th>PRN</th>
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<tbody>
<tr>
<td>1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying transmission and driveline faults.</td>
</tr>
<tr>
<td>2. Legal requirements relating to the vehicle (including road safety requirements).</td>
</tr>
<tr>
<td>3. Your workplace procedures for recording diagnostic and rectification activities, the referral of problems, reporting delays to the completion of work.</td>
</tr>
<tr>
<td>4. The importance of documenting diagnostic and rectification information.</td>
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<tr>
<td>5. The importance of working to agreed timescales and keeping others informed of progress.</td>
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<tr>
<td>6. The relationship between time, costs and profitability.</td>
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<tr>
<td>7. The importance of reporting anticipated delays to the relevant person(s) promptly.</td>
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</table>

#### Electrical and electronic principles

<table>
<thead>
<tr>
<th>PRN</th>
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<tbody>
<tr>
<td>8. Electrical and electronic principles associated with transmission and driveline systems, including types of sensors and actuators, their application and operation.</td>
</tr>
<tr>
<td>9. How electrical and electronic transmission and driveline systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles.</td>
</tr>
<tr>
<td>10. The interaction between electrical, electronic and mechanical components within vehicle transmission and driveline systems.</td>
</tr>
<tr>
<td>11. Electrical symbols, units and terms.</td>
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<tr>
<td>12. Electrical safety procedures.</td>
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</table>

#### Use of diagnostic and rectification equipment

<table>
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<tr>
<th>PRN</th>
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<tbody>
<tr>
<td>13. How to prepare and test the accuracy of diagnostic testing equipment.</td>
</tr>
<tr>
<td>14. How to use diagnostic and rectification equipment for transmission and driveline mechanical, electrical, hydraulic and fluid systems, specialist repair tools and general workshop equipment.</td>
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</table>

#### Transmission and driveline faults, their diagnosis and correction

<table>
<thead>
<tr>
<th>PRN</th>
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<tbody>
<tr>
<td>15. How transmission and driveline mechanical, electrical, electronic and hydraulic and fluid systems are constructed, dismantled, reassembled and operate.</td>
</tr>
<tr>
<td>16. The types and causes of transmission and driveline mechanical, electrical, electronic and hydraulic and fluid system, component and unit faults and failures.</td>
</tr>
<tr>
<td>17. Transmission and driveline mechanical, electrical and hydraulic and fluid component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action.</td>
</tr>
<tr>
<td>18. How to find, interpret and use sources of information on transmission and driveline electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements.</td>
</tr>
<tr>
<td>19. Vehicle operating specifications for limits, fits and tolerances relating to transmission and driveline mechanical, electrical, electronic and hydraulic and fluid systems for the vehicle(s) on which you work.</td>
</tr>
<tr>
<td>20. How to select the most appropriate diagnostic testing method for the symptoms presented.</td>
</tr>
<tr>
<td>21. How to carry out systematic diagnostic testing of transmission and driveline mechanical, electrical and electronic, hydraulic and fluid systems using a prescribed process or format.</td>
</tr>
<tr>
<td>22. How to assess the condition evident within transmission and driveline mechanical, electrical, electronic, hydraulic and fluid components and units.</td>
</tr>
<tr>
<td>23. How to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults.</td>
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<tr>
<td>24. How to carry out the rectification activities listed in the Scoping Statement for this unit in order to correct faults in the transmission and driveline mechanical, electrical, electronic and hydraulic and fluid systems.</td>
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<tr>
<td>25. The relationship between test methodology and the faults repaired – the use of appropriate testing methods.</td>
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<tr>
<td>26. How to make cost effective recommendations for rectification.</td>
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In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.

<table>
<thead>
<tr>
<th>PRN</th>
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<th>Date</th>
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<tbody>
<tr>
<td></td>
<td>Candidate</td>
<td>Date</td>
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</table>
## Key and core skills signposting

<table>
<thead>
<tr>
<th>Key Skills</th>
<th>Core Skills</th>
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<tbody>
<tr>
<td><strong>Communication:</strong> C1.1; C1.3; C2.2</td>
<td><strong>Communication:</strong> Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1</td>
</tr>
<tr>
<td><strong>Application of Number:</strong> N2.1; N2.2/1.2?? N1.3</td>
<td><strong>Numeracy:</strong> Intermediate 1, Outcomes 1, 2 and (4? Or Access 3, Outcome 4)</td>
</tr>
<tr>
<td><strong>Information Technology:</strong> Not applicable</td>
<td><strong>Information Technology:</strong> Not applicable</td>
</tr>
<tr>
<td><strong>Working with Others:</strong> WO2.2?</td>
<td><strong>Working with Others:</strong> Intermediate 1, Outcome 2</td>
</tr>
<tr>
<td><strong>Improving Own Learning and Performance:</strong> Not applicable</td>
<td><em>No parallel unit.</em></td>
</tr>
<tr>
<td><strong>Problem Solving:</strong> PS2.1</td>
<td><strong>Problem Solving:</strong> Intermediate 1, Outcome 1</td>
</tr>
</tbody>
</table>
Syllabus

**MR13HV Diagnose and Rectify Commercial Vehicle Transmission and Driveline System Faults**

This unit is about diagnosing and rectifying faults occurring in the vehicle clutches, gearboxes, driveline, shafts and hubs and bearings.

**Course Outline**

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

**Outcomes**

On completion of this unit, the student must be able to:

1) Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings

2) Describe the procedures for preparing vehicle clutches, gearboxes, driveline, shafts and hubs and bearings for diagnostic activities

3) Describe the procedures for carrying out diagnostic inspections and tests and interpreting the results of these inspections

4) Describe the procedures for rectification of defects identified by diagnostic procedures

5) Describe the procedures for recording the results of rectification procedures
Outcome 1
Describe the procedures for preparing tools and equipment required to carry out diagnostic analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings

Objectives
To achieve this outcome a student has to describe the
1) Preparation of diagnostic equipment used for diagnosis analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings
   i. diagnostic and rectification equipment for transmission chassis electrical systems
   ii. diagnostic and rectification equipment for transmission chassis
   iii. mechanical systems
   iv. diagnostic and rectification equipment for transmission hydraulic and fluid systems
   v. specialist repair tools
   vi. general workshop equipment
   vii. pressure and flow gauges
   viii. clock gauges and degree plates
   ix. torque setting equipment
   x. belt tension gauges
b) electrical systems
   i. electronic analysers and fault code readers (scanners)
   ii. multimeters
c) specialist repair tools for hydraulic and fluid systems
d) pre-load gauges
2) Procedures used to check the accuracy of the diagnostic and testing equipment
3) Methods of finding, interpreting and using information on analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings to check they comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits
4) How to select the most appropriate diagnostic testing methods for the symptoms presented
5) Health and safety legislation and workplace procedures relating to diagnosing system faults
6) Legal and road safety requirements relating to the vehicle
7) Procedures for
   a) preparing, connecting and testing all the required diagnostic and testing equipment prior to use
   b) systematic collection of sufficient diagnostic information to enable precise identification of the fault
   c) using the tools and equipment correctly and safely at all times
8) Procedures used to obtain and check the data required for diagnosis
9) Procedures for using the tools and equipment needed for diagnosis
Outcome 2
Describe the procedures for preparing vehicle clutches, gearboxes, driveline, shafts and hubs and bearings for diagnostic activities

Objectives
To achieve this outcome a student has to describe the

1) Methods of preparing analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings for diagnosis

2) Way in which vehicle clutches, gearboxes, driveline, shafts and hubs and bearings
   a) are constructed
   b) operate
   c) are dismantled
   d) are re-assembled

3) Diagnostic information which is required
   a) wear
   b) run out
   c) pressures
   d) flow
   e) leakage
   f) electrical measurements
      i. voltage
      ii. pulse displays
      iii. electronic systems date
      iv. fault codes
      v. sensor measurements
      vi. control unit outputs/signals

4) Systems which are to be diagnosed
   a) transmission components
   b) clutch and manual gearboxes
   c) torque converters and automatic gearboxes
   d) oil coolers
   e) drive shafts
   f) final drive assemblies
      i. crown wheel and pinions
      ii. conventional differentials
      iii. differential locks
      iv. limited slip differentials including viscous couplings, torsen and electronically controlled
      v. three quarter floating and fully floating rear hubs
      vi. half shafts

5) Drive systems
a) rear wheel drive
b) multi-axle, rear wheel drive axle systems
c) all wheel drive systems
d) traction control

6) Hydraulic and fluid systems
   a) oils and lubrication
   b) cooling systems

7) Electrical and electronic principles associated with analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings including types of sensors and actuators, application and operation

8) How electrical and electronic analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings operate
   a) electrical component function
   b) inputs
   c) outputs
   d) voltages
   e) oscilloscope patterns
   f) digital and fibre optics principles (multiplexing)

9) The interaction between electrical, electronic and mechanical components

10) Electrical symbols and terms and electrical safety procedures

11) Methods of finding, interpreting and using information prior to diagnosis to ensure the systems and units will comply with
   a) legal requirements
   b) manufacturers specifications for
      i. repair procedures
      ii. limits, tolerances and fits

12) Health and safety legislation and employers workshop practices relating to
   a) personal protection
   b) vehicle protection
   c) recording fault location and rectification activities
   d) referral of problems
   e) reporting delays to the completion of work
   f) importance of working to agreed timescales and keeping others informed of progress
   g) relationship between time, costs and profitability
   h) importance of reporting anticipated delays promptly

13) Reasons why failure has occurred

14) Recommendations based upon the inspection procedures
   a) servicing
   b) repair
Outcome 3
Describe the procedures for carrying out diagnostic inspections and tests on vehicle clutches, gearboxes, driveline, shafts and hubs and bearings and interpreting the results of these inspections

Objectives
To achieve this outcome a student has to describe the:

1) Fault types where
   a) multiple failures occur within an individual system and involves a two or more stage diagnostic facility
   b) a cross system fault where an individual failure can affect several vehicle systems and involves a two or more stage diagnostic facility

2) Recommendations based upon the diagnostic procedures
   a) servicing
   b) dismantling for further inspection and testing
   c) repair
   d) replacement

3) Diagnosis procedures covering
   a) single system faults using a prescribed process or format
   b) multi and cross system faults using a prescribed process or format

4) Diagnostic methods
   a) measurement
   b) functional testing
   c) electrical and electronic systems testing

5) How to carry out systematic diagnostic testing of mechanical, electrical and electronic, hydraulic and fluid systems.

6) How to assess the condition of transmission mechanical, electrical, electronic, hydraulic and fluid components and units

7) How to interpret test results and vehicle data to identify location and cause of faults.

8) How to select the most appropriate methods of diagnosis

9) Rectifications within the transmission and chassis areas
   a) electronic clutch control
   b) electronic gearbox control system
   c) electronic automatic gearbox control system

10) Interaction between electrical, electronic and mechanical components

11) Transmission and chassis electrical systems interlink, interact (including multiplexing)

12) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer
Outcome 4
Describe the procedures for rectification of defects identified by diagnostic procedures

Objectives
To achieve this outcome a student has to describe the:

1) Rectification activities for analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings diagnosis
   a) dismantling
   b) replacement of units and components
   c) adjustment of units and components
   d) repairs to wiring and connectors
   e) re-programming vehicle systems
   f) reassembly
   g) functional testing

2) Types and causes of analysis vehicle clutches, gearboxes, driveline, shafts and hubs and bearings, component and unit faults and failures

3) Vehicle clutches, gearboxes, driveline, shafts and hubs and bearings mechanical, electrical, electronic and hydraulic and fluid system component replacement procedures, the circumstances which will necessitate replacement and other causes of action

4) How to carry out rectification activities on transmission, mechanical, electrical electronic and hydraulic and fluid systems.

5) How to make cost effective recommendations for rectification

6) The relationship between time, costs and profitability
Outcome 5
Describe the procedures for recording the results of rectification procedures

Objectives
To achieve this outcome a student has to describe the:
1) Importance of documenting diagnostic and rectification information
2) Procedures for recording diagnostic and rectification activities
   a) computer based
   b) hard copy
3) Importance of ensuring the records are
   a) accurate
   b) complete
   c) in the format required
   d) passed promptly to the relevant person
4) Procedures for
   a) disposing of waste material resulting from the diagnostic and rectification activities
   b) returning defective units and components to storage or for re-cycling, including refrigerant handling requirements
Assessment

**Essential knowledge assessment**

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
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Test duration 35mins  
Total 25