Rev and GO

MEMBERS INSTRUCTION BOOKLET TO GAIN ENTRY LEVEL QUALIFICATION FOR INTRODUCTION TO VEHICLE TECHNOLOGY BY

IMIAWARDS

IMI AL Entry Level Award for the Introduction to Vehicle Technology (Entry 3) (QCF) QFQUAL I.D: 501/0549/8

Student Name (please print) ___________________________________________
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3.1 Mandatory Units:
   EL01 Introduction to Motor Vehicle Workshop Safety
   EL02 Introduction to the Retail Automotive Maintenance and Repair Industry
   EL03 Introduction to Workshop Tools and Equipment

3.2 Entry Level 3 Optional Units:
   EL14 Motorcycle Construction
   EL15 Routine Motorcycle Checks

3.3 Level 1 Optional Units:
   L119 Introduction to Spark ignition Fuel Systems

References included in the booklet are to Haynes Motorcycle Techbooks:
“Basics” and “Workshop Practice”. These offer optional additional information

See separate booklet for Work Sheets and Assessment Forms
SECTION 1
1.1 Introduction
These qualifications are designed for 14-19 year olds who are interested in learning about the automotive retail industry. They are aimed at students who prefer and respond to ‘hands-on’ learning.

Award - This Award is ideal for those students who wish to undertake a qualification which provides a stepping stone to the IMIAL Entry Level Certificate for the Introduction to Vehicle Technology (Entry 3).

1.2 Qualification and Credit Framework (QCF)
The QCF is the framework for creating and accrediting qualifications in England, Wales and Northern Ireland. The QCF allows achievements to be recognised and recorded through the award of credits and qualifications.

Units are the building blocks of all QCF qualifications. Each unit has a credit value and level. One credit represents ten notional hours of learning, showing how much time the average student would take to complete the unit or qualification. Levels indicate difficulty and vary from entry (1) to level 8. There are three types of qualification:

- Awards (1 to 12 credits)
- Certificates (13 to 36 credits)
- Diplomas (37 credits or more)

1.3 Entry Requirements
There are no entry requirements for these qualifications.

1.4 Qualification Structures
Each qualification is made up of units that cover specified topics. Many of these topics follow the themes within the Level 1 and 2 Institute of the Motor Industry (IMI) NOS, also included is an overview of the retail automotive industry.

Each unit contains learning outcomes, students must achieve all of their selected units’ learning outcomes.

1.5 Assessment
In order to pass this qualification, students must demonstrate its learning outcomes by following and achieving its 2 assessment components:

a. IMI Awards’ Assessments
b. IMI Awards’ On-line Assessment (Unit EL02 only)

The majority of the tasks within the assessments will be assessed via observation and oral questioning. Some units also contain short Student Task Sheets for students to complete independently. To ensure consistency of approach, the assessments will be sampled by an IMI Awards’ external verifier during their regular monitoring visits to the approved centre.

b. IMI Awards On-line Assessment (Unit EL02 only)
All students registered on these qualifications must successfully complete the on-line test for EL02, set by IMI Awards. This test examines learning outcomes 2 and 3 of EL02.
All EL02 questions contain pictures and are in a drag & drop or multiple-choice format. The student has 1 hour to complete the test.

<table>
<thead>
<tr>
<th>Unit Ref.</th>
<th>QCA Unit I.D No.</th>
<th>Test No</th>
<th>Duration</th>
<th>Pass Mark</th>
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<tr>
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<td>1 hour</td>
<td>60%</td>
</tr>
</tbody>
</table>

Note: To access a test, a student must be logged onto the system by an IMI Awards’ approved assessor/invigilator.

The result of each on-line test is available instantly. Retain a printout of the test results with this booklet.

Re-sits may only be attempted after a minimum of 48 hours.

SECTION 2: Learning and Assessment Strategies

2.1 Introduction
The structure of these qualifications is outlined in Section 3, together with the assessment criteria that must be met to achieve the qualification.

2.2 Assessment Methods
A range of assessment methods will be used. These qualifications support the delivery of ‘theory’, but all opportunities will be taken to support this with practical instruction and/or demonstration.

2.3 Strategy
The assessment of these qualifications is based upon the achievement of learning outcomes. For each learning outcome there is a set of assessment criteria, all of which must be met.
SECTION 3:

- Students must achieve **12 credits**. The options have been chosen as:

**Mandatory Units**

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<tr>
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<tr>
<td>EL01</td>
<td>Introduction to Motor Vehicle Workshop Safety (T/502/4654)</td>
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<td>Introduction to the Retail Automotive Maintenance and Repair Industry (A/502/4655)</td>
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<td>EL03</td>
<td>Introduction to Workshop Tools and Equipment (J/502/4657)</td>
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<table>
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<th>Unit Title</th>
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<tr>
<td>EL14</td>
<td>Motorcycle Construction (J/502/4674)</td>
</tr>
<tr>
<td>EL15</td>
<td>Routine Motorcycle Checks (L/502/4675)</td>
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**Level 1 Units**

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<th>Unit Title</th>
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<tr>
<td>L119</td>
<td>Introduction to Spark Ignition Fuel Systems (Y/602/0008)</td>
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<tr>
<td>UNIT REF: EL01</td>
<td>UNIT TITLE: INTRODUCTION TO MOTOR VEHICLE WORKSHOP SAFETY</td>
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</table>

**Level:** Entry Level 3  
**Credit value:** 2  
**Guided Learning Hours:** 20  
**Rationale:** To develop an awareness of health & safety requirements when working in a motor vehicle workshop. To be able to demonstrate safe working practices for all automotive sectors.

### Content to include:

1.1.1 The use and storage of:
   a. lifting equipment (jacks, ramps and axle stands) - Inc visit to RTR for ramp safety  
   b. air lines and attachments  
   c. electrical apparatus  
   d. general hand tools  
   e. special equipment (tracking gauges; tyre changing equipment, pressure testing equipment etc) - See Workshop Practice Chapter 5

2.1.1  
   a. protective clothing e.g overalls, smocks, two piece work wear  
   b. gloves (rubber, leather, latex, cotton)  
   c. protective footwear e.g safety boots or shoes, wellington - safety style  
   d. wet working equipment  
   e. protective eyewear e.g goggles, face shields (clear and UV protective)  
   f. face masks (simple and filtered)

3.1.1
   a. trip hazards  
   b. fire hazards  
   c. noise hazards  
   d. dust hazards  
   e. working at height  
   f. inappropriate working hazards  
   g. hazards associated with fooling around  
   h. running hazards  
   i. smoking hazards  
   j. eating and drinking in a workshop hazard  
   k. use of drugs (illegal and prescribed)

4.1.1
   a. mentor  
   b. supervisor  
   c. senior personnel  
   d. employer  
   e. manager

4.2.1
   a. company procedure  
   b. raise alarm  
   c. notify senior person  
   d. follow instructions as directed
### 4.3.1
- a. basic first aid box
- b. responsible person in charge of first aid at workplace
- c. contents of first aid box
- d. responsibilities ensure it is visible at all times
- e. responsibilities of notifying senior personnel of problems with first aid box
- f. accident/incident book and duties of safe keeping and responsibilities of completing accurately

### 4.4.1
- a. types of fire extinguisher
- b. classes of fire
- c. importance of signage
- d. importance of annual maintenance
- e. who may or may not use fire fighting equipment (training)
- f. consequences of incorrect fire extinguisher being used
- g. most common extinguisher used in workshop and reason

### 5.1.1
- a. fuel (diesel and petrol)
- b. oils
- c. paints
- d. cleaning solutions
- e. aerosols
- f. flammable materials (rags, paper etc)
- g. gas cylinders (oxy/acetylene/propane)

### 5.2.1
- a. fuel (diesel and petrol)
- b. oils
- c. paints
- d. cleaning solutions
- e. pressurised cylinders
- f. flammable materials (rags; paper etc)
Fire Extinguishers

Fire risks are now classified by the type of materials that may be involved. Extinguishers should be chosen for a situation by their suitability for these classes of fire. The classification is as below:

Class A: SOLIDS such as paper, wood, plastic etc

Class B: FLAMMABLE LIQUIDS such as paraffin, petrol, oil etc

Class C: FLAMMABLE GASES such as propane, butane, methane etc

Class D: METALS such as aluminium, magnesium, titanium etc

Class E: Fires involving ELECTRICAL APPARATUS

Class F: Cooking OIL & FAT etc

Colour Coding

Prior to 1st Jan 1997, the code of practice for fire extinguishers in the UK was BS 5423, which advised the colour coding of extinguishers as follows:

Water - Red
Foam - Cream
Powder - Blue
CO₂ - Black
Halon - Green
New fire extinguishers should conform to BS EN 3, which requires that the entire body of the extinguisher be coloured red. A zone of colour of up to 5% of the external area can be used to identify the contents using the old colour coding shown above. BS EN 3 identification labels are shown below.

Halon -
Although effective on some types of fire, Halon has been found to be damaging to the environment, so the old green Halon extinguishers will become 'illegal' after December 2003, and should be removed and disposed of in an environmentally friendly way by a responsible company.

Siting of Fire Extinguishers

Normally, extinguishers should be permanently mounted on brackets or stands in conspicuous positions where persons following an escape route can easily see them, e.g. close to exits.

The intention is to encourage people to move towards the exit, rather than go further into danger. It is usual to locate extinguishers adjacent to fire alarm call points, so people can actuate the fire alarm before picking up an extinguisher.

Extinguishers should be sited so that it is not necessary to travel more than 30m to reach one. Extinguishers provided for special fire risks should be sited near to the risk, but not so near as to be inaccessible or place the operator in undue danger from fire. e.g. In a kitchen, next to the door rather than next to the cooker.

Mounting Fire Extinguishers

Small extinguishers weighing up to 4 kg should be mounted with the carrying handle about 1.5m from the floor, whilst larger, heavier extinguishers should be mounted with their handles at about 1m. Care should be taken to ensure that injury is not caused by extinguishers being dislodged and falling onto people.

Signs

The Health & Safety (Safety Signs & Signals) regulations 1996 requires that where extinguishers are placed in positions hidden from direct view, their location should be indicated by signs and, where appropriate, directional arrows.
The diagram opposite shows basic precautions you should take when working under a lift. Here are three extra precautions:

- Do not exceed the lift's safe working load (SWL).
- Before raising a car, check that the radio aerial, bonnet and boot lid are down. They could hit lights, beams or the roof.
- Before lowering, make sure that all tools and old parts have been removed.

Compressed-air equipment

Compressed air is dangerous if misused. Before you use flexible pipe extensions, make sure that the quick-release couplings are fully engaged.

When working with compressed air:

- never direct it onto any part of your body
- never use it to blow away brake dust (or any other type of dust)
- never use it to clear dirt or filings off benches
- never use it to clean ball and roller bearings (by spinning them).

Hand tools

Hand tools are spanners, sockets, screwdrivers, pliers, hammers, chisels and files. To work safely with them use your common sense, know which tool to use, and follow safe procedures.

In a workshop the most common small injuries are cut fingers or skinned knuckles and fingers. Usually these are due to the misuse of a hand tool. The diagrams opposite show situations where this can occur.

Rotating machinery

All high-speed rotating machinery, such as wheel balancers, drills and grindstones, should have guards fitted.

Handling harmful substances

Workshops often store dangerous chemicals. Some could catch fire; some could even explode when handled. Others are corrosive or caustic, and could damage your skin.

There are regulations about the Control of Substances Hazardous to Health (COSHH). These state that every hazardous substance must be described on a health and safety data sheet. The sheet gives details of safe handling, and says whether protective equipment should be worn.

HEALTH & SAFETY

Motor vehicle repair work is dirty. Cuts, however minor, should always be cleaned and treated straight away.
**UNIT REF: EL02**
**UNIT TITLE:  INTRODUCTION TO THE RETAIL AUTOMOTIVE MAINTENANCE AND REPAIR INDUSTRY**

**Level:** Entry Level 3  
**Credit value:** 2  
**Guided Learning Hours:** 20

**Rationale:** This unit provides students with an understanding of the various organisations that make up the maintenance and repair sector of the retail motor industry and the various vehicles that the organisations cater for. The unit also introduces students to the types of job roles available within the sector.

### Content to include:

1.1.1 The types of organisations that make up the maintenance and repair structure of the retail automotive sector could include:
   - a. retail operations
   - b. vehicle sales (new and used)
   - c. franchised dealer service, repair and parts
   - d. independent repairers
   - e. fast fit operations
   - f. body repair / refinishing
   - g. parts supply

2.1.1 The different types of vehicle within the retail automotive sector could include:
   - a. cars (to include saloon, hatchback, coupe, estate, convertible)
   - b. vans (car derived and specialist)
   - c. trucks (rigid)
   - d. tractor units (and trailer types)
   - e. motorcycles (and mopeds)

3.1.1 The technical and non-technical job roles available within the sector could include:
   - a. vehicle technician
   - b. vehicle examiner
   - c. workshop controller
   - d. body repair technician
   - e. vehicle refinisher technician
   - f. parts advisor
   - g. vehicle sales person
   - h. customer service advisor
   - i. valetor
   - j. autoglazing technician
   - k. apprentice

3.2.1 One example of the type of work carried out for each of the job roles could include:
   - a. vehicle technician-maintenance and repair of vehicles
   - b. vehicle examiner- safety inspections
   - c. workshop controller- supervision of technicians
   - d. body repair technician- panel repair and replacement
   - e. vehicle refinisher technician- preparation and painting
f. parts advisor - supply of parts to public and trade  
g. vehicle sales person - new and used vehicle sales  
h. customer service advisor - liaises with customers and workshop staff  
i. valetor - preparation and cleaning of vehicles  
j. autoglazing technician - glass repair and replacement  

3.3.1 The opportunities for career progression and development within the automotive sector could include:  
a. supervisor and manager  
b. technical engineer  
c. vehicle damage assessor  
d. technical trainer and assessor  
e. warranty personnel
MOT TESTING PROCEDURE

START

Sit on machine check
* All controls
* Switches
* Horn
* Front suspension

Move to front

At front check
* Front lights
* Indicators
* Front brake master cylinder (if fitted)

On right side check
* Frame
* Footrest
* Seat
* Exhaust system
* Final drive
* Rear tyne wall
* Rear wheel brake
Remove machine from stand and test rear suspension

Go to rear

Place machine on stand
Raise front wheel check
* Steering
* Head bearings
* Front forks
* Wheel
* Tyre condition
* Wheel bearings
* Floor plate
Lower front wheel & go to right side

Check for any loose items such as:
* Stands
* Fairings
* Fairing or bodywork
* Mirrors etc.

END OF TEST

At front check
* Wheel alignment
* Headlamp aim
* Brake performance

At rear check
* Rear lamp
* Stop lamp
* Reflector
* Indicators

Go to left side

On left side check
* Frame
* Footrest
* Rear suspension
* Final drive
* Exhaust system
* Rear tyne
* Rear wheel & brake

Go to front

NOTE: Final drive may be fitted to either left or right of rear wheel.
EL02: INTRODUCTION TO THE RETAIL AUTOMOTIVE MAINTENANCE AND REPAIR INDUSTRY

1. AUTOCITY Task
Do the following:
   - Go to www.motor.org.uk
   - Scroll down to Careers section
   - Click on Careers
   - Click on Autocity - Careers IAG
   - Click on World at Work
   - Identify the organisations

Using the diagram below and Autocity, identify the 9 main types of organisation that make up the Retail Motor Industry. Then work through the web site to review the contents shown above for this module.
## UNIT REF: EL03  INTRODUCTION TO WORKSHOP TOOLS AND EQUIPMENT

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<tbody>
<tr>
<td>Credit value: 2</td>
</tr>
<tr>
<td>Guided Learning Hours: 20</td>
</tr>
</tbody>
</table>

**Rationale:** This unit introduces students to motor vehicle workshop tools and equipment. It includes general workshop tools that would be used in light vehicle, heavy vehicle or motor cycle workshops. It encompasses the identification of the tools and their specific use. It is only concerned with tools and equipment that do not require detailed training to operate.

The aim of this unit is to develop the students understanding of fundamental use of workshop tools and equipment, their identification and their safe use and handling. Students can then apply their understanding to all aspects of working within a motor vehicle workshop.

### Content to include:

1.1.1  
- a. spanners (open end, ring, combination, speed and ratchet types)
- b. screwdrivers (blade, Phillips, pozidrive) show various versions of these for specialist use
- c. hammers (ball pein, lump, copper/hide, rubber, neoprene)
- d. Allen keys
- e. vice grips
- f. socket sets (different drive sizes for specific equipment to cover range of vehicles)
- g. pliers (long nose, engineers, side snips/cutters)
- h. torque wrench

1.1.2  
- a. lifting equipment e.g jacks, ramps and axle stands
- b. air lines and attachments e.g wrenches, blow guns, tyre inflator/gauge
- c. mains electrical apparatus e.g drills; extension leads; parts cleaner
- d. task specific specialist tools e.g tracking gauges (simple optical), filter straps, waste oil drainers

2.1  
- 1. Demonstrate the safe use of common hand tools found in a motor vehicle workshop
  - a. spanners (open end; ring; combination; speed and ratchet types)
  - b. screwdrivers (blade, Phillips, pozidrive) show various versions of these for specialist use
  - c. hammers (ball pein, lump, copper/hide, rubber, neoprene)
  - d. Allen keys
  - e. vice grips
  - f. socket sets (different drive sizes for specific equipment to cover range of vehicles)
  - g. pliers (long nose, engineers, side snips/cutters)
  - h. torque wrench
2.2 1. Demonstrate the safe use of common equipment found in a motor vehicle workshop
   a. lifting equipment e.g jacks, ramps and axle stands
   b. air lines and attachments e.g wrenches, blow guns, tyre inflator/gauge
   c. mains electrical apparatus e.g drills, extension leads, parts cleaner
   d. task specific specialist tools e.g tracking gauges (simple optical), filter straps, waste oil drainers

3.1.1
   a. tape measure
   b. steel rule
   c. feeler blades
   d. steel rules
   e. micrometers
   f. tread depth gauges

4.1.1 Describe what each item is and does. Use Google (e.g. “motor vehicle locking nuts”) to obtain more information about:
   a. castellated nut with split pins
   b. lock tabs
   c. self locking nuts
   d. locking nuts (2 nut method)
   e. chemical lock

4.2. 1 Show how and when to use each item:
   a. castellated nut with split pins
   b. lock tabs
   c. self locking nuts
   d. locking nuts (2 nut method)
   e. chemical lock (e.g. Blue and Red Locktite)

See Workshop Practice Chapters 2 and 6 for further information
UNIT REF: EL14  UNIT TITLE: MOTORCYCLE CONSTRUCTION

Level: Entry Level 3
Credit Value: 2
Guided Learning Hours: 20
Rationale: In this unit the student will learn about motorcycle construction

Content to include:

1.1.1 The engine range of motorcycle types to include:
   a. scooter
   b. moped
   c. sports
   d. tourer
   e. naked
   f. faired
   g. moto cross
   h. super moto
   i. trials

2.1.1 The names of the main parts found on naked motorcycles to include:
   a. front suspension and forks
   b. rear suspension and swing arm
   c. frame
   d. braking components
   e. chain and sprockets
   f. engine and gearbox
   g. seat unit
   h. tank unit

2.2.1 The names of the main panels found on faired motorcycles to include:
   a. top fairing
   b. lower fairing
   c. belly pan
   d. screen
   e. tail unit

3.1.1 The position of the various controls found on a range of motorcycles to include:
   a. front brake lever
   b. rear brake lever
   c. gear change lever
   d. clutch
   e. throttle
   f. side/headlight switch
   g. dip switch
   h. indicator switch
   i. engine kill switch
   j. ignition switch (and positions)

See Basics chapter 1 and use Google for part 1
Level: Entry Level 3
Credit Value: 2
Guided Learning Hours: 20

Rationale: In this unit students will learn how to carry out weekly and monthly motorcycle maintenance checks to maintain road worthiness including: frame assembly, power units, transmission / drive line, brakes, wheels and tyres.

Content to include:

1.1.1 Vehicle systems and components that require routine maintenance to include:
   a. battery, engine oil, engine coolant, fluid levels
   b. wheels and tyres
   c. lighting system - See Basics Techbook chapter 10
   d. horn, instruments, warning lamps
   e. external components; mirrors, bodywork, paintwork
   f. chain tension and lubrication
   g. stand
   h. controls, throttle, brake levers, footbrake, handlebars

1.2.1 The maintenance requirements for vehicle systems to include:
   a. check engine oil condition and level
   b. check engine oil filter condition and for leakage
   c. checking and top-up fluid levels; battery, clutch and brake fluid
   d. checking and adjusting drive belts (if fitted)
   e. tyre condition, pressures and tread depth
   f. operation of vehicle lamps and indicators
   g. operation of instruments, horn and warning lamps
   h. operation and condition of door mirrors
   i. condition of bodywork and paintwork
   j. chain tension and lubrication
   k. stand lubrication

2.1.1 The information required for vehicle maintenance to include:
   a. vehicle make, model and VIN number
   b. correct engine oil specifications
   c. engine coolant specifications
   d. brake and clutch fluid specifications
   e. tyre pressures
   f. specifications for new components or fluids, bulbs, transmission lubricants

2.2.1 The tools and equipment required for vehicle maintenance to include:
   a. tyre tread gauge
   b. tyre inflator
   c. tyre pressure gauge
   d. disposable cloths
### 3.1.1 Safe working practices and correct methods of working to include:
  a. personal safety – appropriate use of PPE
  b. awareness and safety of others
  c. safety of vehicle – engine immobilised, ignition key removed
  d. selection and use of tools and equipment
  e. accessing appropriate information relevant to vehicle
  f. systematic working procedures, following checklists

### 3.2.1 The personal protection equipment (PPE) required for vehicle maintenance to include:
  a. overalls
  b. safety footwear
  c. protective gloves

### 3.3.1 The correct sequence and procedure for vehicle maintenance to include:
  a. using vehicle protection (where required)
  b. correct use of tools and equipment
  c. using correct information for vehicle
  d. using vehicle manufacturer’s data and information
  e. using logical working sequence
  f. using correct working procedures
  g. correct disposal of waste materials
  h. reinstatement of vehicle, components and property
  i. removal of grease marks from paintwork and controls
  j. completion of vehicle records and work records
  k. correct storage of tools and equipment

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Read the tyres section that follows - there are extracts from different sources of material

Read Haynes Basics Techbook Manual Chapter 6 - Wheels and Tyres Sections

Questions will be asked - take note of:
- **Weave and Wobble causes**
- **Tyre removal and fitting instructions**
- **Tyre sidewall markings** -
  - Aspect Ration / Width - Wheel Size Load Index Speed Rating in various orders
  - e.g 120/70 ZR17 69W
TYRE SIDEWALL MARKINGS

Apart from the make & model, tyre sidewalls have a number of different markings that give the various specifications for that tyre. Many of these are irrelevant for the UK market, but the following are important:

Nominal Tread Width - usually in millimetres (mm), although some may use old Imperial measurements, with decimals used for fractions of an inch (eg 3.25)

Aspect Ratio - This refers to the height of the tyre, expressed as a percentage of the nominal width. If there is no aspect ratio specified, it will generally be 80% in the case of Metric sizes, 100% for Imperial sizes.

Speed Rating - This is a code letter that specifies the maximum speed recommended for that tyre. The most common codes are given in the table opposite. Note that a second letter, ‘R’ in the speed rating specifies that the tyre is of radial construction.

Nominal Wheel Diameter (usually in inches)

Most new designs of motorcycle tyre are now being marked with a Service Description, which appears after the size marking (eg 120/90 - 18 65H). The Service Description is made up of two parts - the Load Index and the speed rating. The load index indicates the maximum load the tyre can carry at the speed indicated by the rating code. Load index codes are given below:

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<th>Kg</th>
<th>L. Index</th>
<th>Kg</th>
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*Tyre Markings. DOC & Steve Worthington 2001*
## Speed ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Speed (km/h) (min)</th>
<th>Load capacity reduction</th>
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<th>Capacity</th>
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<tbody>
<tr>
<td>A1</td>
<td>5 (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>10 (6)</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Z</td>
<td>300 (187)</td>
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<td>240 (150)</td>
<td>91% of Load Index</td>
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Where a second letter used as part of the speed rating symbol, the second letter identifies the type of tyre construction. If there is no second letter, the tyre is of diagonal (cross) ply construction.

- **R** - Radial ply construction
- **B** - Bias-belt construction

\[
\text{Load capacity reduction} = \frac{\text{Load Index}}{100}
\]
Tyre fitting procedure

Check tyre is correct fitment
Examine sidewall markings on tyre & check that it is correct construction, size, speed rating & load index for the machine and that it is suitable for fitting to that wheel. Note direction of rotation markings (arrows) and note position of valve alignment marker (usually a coloured spot).

If the tyre is a tubed type, check that the tube is suitable for the tyre.

Replace valve - tubeless rims
The valve core is often removed from the new valve before fitting it into the rim. This is not essential but is believed to reduce restriction to air rushing into the tyre, allowing quicker build-up of pressure when seating.

Lubricate bead and rim
Use tyre soap to lubricate both the edge of the tyre bead and the edge of the rim.

Position tyre on wheel, checking alignment
Ensure direction of rotation arrows are in correct direction and align marker spot with valve position.

Work first bead over rim
The first bead will often push on by hand. Start on the opposite side of the wheel from the valve. Ensure that the bead is right down the well of the rim to allow slot on the other side of the wheel. Use tyre levers to push final part over rim, if necessary.

Insert tube and locate valve - tubed tyres
The tube should be pushed well into the tyre carcass, away from the bead, to avoid the risk of trapping between levers & rim. Ensure that the tube is at straight as possible, avoiding any kinking, folding or twisting. The tube should be in a relaxed state, with no localised stretching or tension.

Locate the valve by pushing it through the hole in the rim and threading the valve collar on loosely. This will prevent the valve from pulling back into the rim when fitting the second bead.

Work second bead over rim using levers
Again, start on the opposite side of the wheel from the valve and ensure that the bead sits right down the well of the rim to allow slot on the other side of the wheel. Tyre levers should be used to gradually work the bead over the rim by 'teasing' around the rim. On tubed tyres, take the same care not to 'pinch' the tube between lever and rim, as when removing, and ensure that the valve is fitted squarely through the hole in the rim.

Manually adjust tyre to get initial seating on rim
The tyre needs to be correctly seated on the rim. With tubed tyres, this can largely be done manually whilst the tyre is deflated. Tubeless tyres are a much tighter fit to the rim and so more difficult to seat, particularly with MT-H2 (humped) type rims. With tubeless tyres, we generally settle for positioning the tyre so that it provides an approximate seal, enough to allow some internal pressure to build up.
Inflatable tyre until bead is correctly seated on rim

Tubed tyres should be inflated gradually, checking correct seating of the bead on the rim. Small adjustments may be possible while the tyre is at low pressure. Firm seating can be helped by over-inflating of the tyre so that the internal pressure pushes it outwards against the rim.

Tubeless tyres fit quite tightly onto the rim and will require a certain amount of internal pressure to push the bead over the humps on the rim. When the beads slip over the humps and locate firmly, this usually happens quite suddenly, with a fairly loud 'pop'. It is important to ensure that there is nothing between the bead and the rim flange when this happens, particularly fingers! Again, firm seating is achieved by over-inflation.

Valve cores should be replaced at this point, if they were left out earlier.

Over-inflating the tyre ensures that the bead is tightly located against the rim flange. Advice from tyre manufacturers states that seating pressure should not exceed 40 psi under normal circumstances. In exceptionally difficult cases, seating pressure may be taken as high as 65 psi, but great care must be taken when working with such high pressure.

Safety valves should be used when inflating tyres above 40 psi, and should be used whenever inflating tyres on split-rim wheels.

Valve collars (tubed tyres) should be tightened at this point.

Accuracy of the seating between the tyre and rim can be judged by checking the small rib that usually runs in a band around the circumference of the tyre just above the bead. This band should be the same distance from the rim all the way around the tyre. Check alignment on both sides of the tyre.

Adjust tyre pressure

Pressure should be adjusted to manufacturers' recommendations.

Replace dust cap

Check balance

Any change to the wheel & tyre assembly can cause changes in wheel balance. This should be corrected before refitting the wheel to the machine.

Replace wheel

Refit the wheel assembly to the motorcycle.
Tyre removal procedure

Remove wheel

Deflate tyre, remove valve core

Break bead from wheel rim
This can be extremely difficult with some tubeless tyres, especially if fitted to MT 112 rims. Use a bead breaker.

Lubricate bead and rim
Applying tyre soap to lubricate the bead and the rim will help make removal easier.

Use tyre levers and rim protectors to lever first bead over rim
Levering the tyre over the rim should begin close to the valve position. Push the bead right down into the well of the wheel on the side opposite the valve, this will help create more slack & make it easier to get the first part of the bead over the rim. On tubeless tyres, be careful not to ‘pinch’ the tube between lever and rim.

Remove tube
(tubes only)

Work other bead over rim, using levers if necessary

Tyre removal procedure.doc © NCN 2003
1 Unsuitable Tyre Inflation Pressure
2 Tyre Size/Type Suitability
3 Tyres Worn too Far
4 Excessive Irregular Wear
5 Wheels Require Balancing
6 Alignment of Road Wheels Incorrect
7 Excessive Play in Swinging Arm Axle or Wheel Axle
8 Load and Load Distribution
9 Eccentric Fitting
Technical

1 Eccentric Fitting
2 'Run Out' in Tyre/Wheel
3 Wheels Require Balancing
4 Axles/Hub-Play
5 Excessive Play in Steering Head or Forks
6 Considerable Play in Swinging Arm at Rear Axle
7 Unequal Fork Pressure

Wobble
**UNIT REF: L119**

**UNIT TITLE: INTRODUCTION TO SPARK IGNITION FUEL SYSTEMS**

<table>
<thead>
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<th>Level: 1</th>
<th>Route: Foundation Learning</th>
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**Rationale:** In this unit the student will find out about the main components and the operating principles of vehicle fuel systems including routine maintenance procedures required for effective engine operation.

### Content to include:

1.1.1 Safe working practices to include (some will apply to cars and some to motorcycles):
   - a. overalls
   - b. gloves
   - c. protective footwear
   - d. goggles
   - e. removal and storage of property from vehicle
   - f. immobilising vehicle - removal of ignition key
   - g. ensuring parking brake is applied
   - h. precautions when working with flammable systems
   - i. precautions when using electrical equipment
   - j. disposal of waste materials

2.1.1 The major parts of the fuel system of spark ignition engines to include (some will apply to cars and some to motorcycles):
   - a. fuel tank
   - b. fuel line
   - c. fuel filter
   - d. fuel pressurising system
   - e. fuel metering system
   - f. fuel delivery system
   - g. air intake and filtration

2.2.1 The safety factors to be considered when working with fuel systems to include:
   - a. fire precautions
   - b. exhaust fumes when running an engine in a workshop
   - c. handling and disposing of materials
   - d. preventing ingress of dirt, moisture and foreign matter

3.1.1 Appropriate ways to dispose of waste products in accordance with environmental guidance to include (Google for this information):
   - a. disposal of used air filters
   - b. disposal of contaminated or spilt fuel
   - c. clearing up spillages and disposal of absorbent materials
See Basics Techbook Chapter 3

Spark Plug Conditions - See Workshop Practice Inside Rear Cover

Combustion
Combustion is a chemical process which when occurs creates large amounts of heat, expansion and pressure rise. In an engine combustion is occurring in a closed chamber (combustion chamber) and the only component designed to react to this is the piston. The rapid heat build up and rise in pressure force the piston down the bore.

This is how Chemical Energy is converted into Mechanical Energy.

The heat energy released by the combustion process can be greatly increased by bringing the molecules of air and fuel closer together. This is achieved by compressing the mixture prior to ignition.

The approximate composition of air is 22% Oxygen and 78% Nitrogen.

By products of combustion include the formation of Water which is a result of too much air combining with too little fuel. O₂ Oxygen from the air and H Hydrogen from the fuel creating H₂O Water. CO₂ Carbon Dioxide is produced in large quantities when the mixture is burning at the correct ratio of 14.7: 1 and is a result of all the C Carbon from the fuel combining with all the O₂ Oxygen from the air. When the mixture has too much fuel and not enough air, CO Carbon Monoxide is formed.

The reason water issues from the exhaust, particularly when starting from cold is that only a small proportion of the fuel reaches the combustion chamber in an atomised state due to it condensing on the cold walls of the inlet manifold. This results in a weak mixture and is the principle reason Choke or Starter systems are used.

Although 14.7: 1 is the ideal air fuel ratio, certain conditions dictate that this must be altered to offset or enhance certain situations.

• Air / Fuel Ratios
1. Cold Starting  4:1 down to 1:1
2. Power  12:1
3. Correct Combustion 14.7:1
4. Economical Running 17: 1