ASA
AUTO SKILLS AUSTRALIA

Servicing Operations

THIS LEARNER WORKBOOK SUPPORTS THE AUTOMOTIVE COMPETENCY UNIT:

AURTTA027
CARRY OUT BASIC VEHICLE SERVICING OPERATIONS

This workbook has been developed to provide an example of how an RTO may approach the development of skills and knowledge related to units of competency. The workbook is an example only and RTOs are reminded they are responsible for ensuring that any learning and assessment strategies used must meet all regulatory requirements relevant to the role of an RTO.

WHS/OHS training

We recommend that learners complete the WHS/OHS unit **AURASA002 Follow safe working practices in an automotive workplace** before undertaking further study in this qualification.

Disclaimer

Auto Skills Australia has used its best endeavours to ensure that this assessment tool is correct and current at the time of publication, but does not give any warranty or accept any liability in relation to the contents. If any law prohibits the exclusion of such liability, Auto Skills Australia limits its liability to the extent permitted by law.

This assessment tool has been developed to provide an example of how an RTO may approach the assessment of skills and knowledge related to units of competency. The tool is an example only and RTOs are reminded they are responsible for ensuring that any learning and assessment strategies used for assessment of an individual meet all regulatory requirements relevant to the role of an RTO.

Safety Disclaimer

Auto Skills Australia does not accept any liability for injury or damage in relation to these learning resources.

This publication has been produced with the assistance of funding provided by the Commonwealth Government through the Australian Government Department of Industry.

Table of Contents

Introduction

Welcome to Servicing based on automotive competency unit **AURTTA008 Participate in basic vehicle servicing operations.**

Study overview

In this study you will learn how to service a vehicle. You will examine the many fluids that are used in servicing operations, the risks involved and how they must be handled. You will look at safely lifting vehicles on a hoist – an essential requirement for safe servicing operations. You will develop your ability to obtain information from a variety of sources and use it for servicing operations.

Purpose

To develop the knowledge and skills required for vehicle serving operations and to apply these in workshop activities.

Content

In this study you will learn about:

- servicing requirements
- hazards associated with servicing
- tools and materials used in servicing
- handling of fluids used in servicing
- servicing operations
- finalising a servicing operation.

You will apply this learning in basic activities that will give you the underpinning skills to work safely in the automotive industry.

Duration

The guideline for this study is 20 hours. For most situations this means eight, two-hour sessions (or the equivalent in school periods) and up to three hours for revision and assessment. Your instructor may change this to suit your needs and past experience.

Study notes

These study notes can be used as evidence for your assessment. Spaces have been left for you to record your work as you progress. Please make every effort to complete the study notes. It will benefit you in the long run.

Assessment

When you undertake this study you will be required to complete the following assessment tasks. If you complete them successfully under the auspices of a registered training organisation (RTO) you may be awarded a statement of attainment for the competency unit AURTTA008 Participate in basic vehicle servicing operations.

Assessment tasks

The assessment tasks you will complete are:

1. Workbook activities

2. A 40-question online test

3. Three servicing operations.

The materials and supervision necessary to complete these tasks will be supplied by your training provider.

Topic 1: Prepare to Service

1.1 Servicing information

You will not always have the servicing details of a service manual available and even the service manual may not give enough information to perform a lot of servicing tasks. External information sources such as Infomedia* publish datasheets for most makes and models of car. How do you access this?

Activity 1: Sourcing information
Search the internet for information on servicing two specific models of car or commercial vehicle. Report what you were able to find and comment on how useful it would be. Is it enough information to undertake a service to the vehicle manufacturer's requirements?

Infomedia* is a global organisation that supplies servicing information along with many other services that are of value to automotive technicians. Find the URL for Infomedia and note the range of services it provides.

***INFOMEDIA –** permission to use is being sought

1.2 Servicing safety – WHS/OHS

In many industries it is common to complete a form called a JSA (Job Safety Analysis) or SWMS (Safe Work Methods Statement) before starting any major work process. You may have seen this in the WHS/OHS unit as a hazard management plan. The table below is an example.

Activity 2: Hazard management plan

Look ahead to Topic 6, which sets out all the tasks to be completed in a full service. Select one set of tasks – cooling, engine, etc. – and complete this table for each of the subtasks, e.g. Check and adjust brake fluid. Share and compare your findings with others in your group.

Servicing task

1. Subtask	2. Hazard	3. Rating	4. Controls	5. Responsible

Topic 2: Servicing Fluids and Lubricants

Motor vehicles use many different fluids and lubricants. There are fluids in the brakes, transmission and clutch, and fuels (petrol, diesel fuel, biodiesel, LPG, natural gas and ethanol) are also fluids. Lubricants include grease and engine oil and transmission oil. While most of these come from oil refining processes, biodiesel and ethanol are produced from plant or animal sources. Natural gas comes directly from the ground.

The following fluids play a role in the operation of vehicles and their servicing.

2.1 Petroleum products

The crude oil from which fuels are produced is known as mineral oil, because it comes from the ground. Oil is believed to have originated from the bodies of marine animals and plants. Wells are drilled to tap the oil and bring it to the surface.

Crude oil undergoes several processes in a refinery. One of the first steps is called fractional distillation. The crude oil is broken down into its various fractions. The fractions are determined by the temperature at which the various particles of oil separate.

The crude oil is heated at the bottom of a tall hollow tower and turns to a vapour. As the vapour rises, it cools and distils to a liquid. At various levels in the tower, fractions are collected. The lighter products are collected towards the top of the tower and the denser ones distil closer to the bottom.

A broad spectrum crude oil will distil into:

- gas – liquefied petroleum gas (LPG)
- solvents – part of paint
- motor spirit – petrol
- kerosene – jet fuel and heating fuel
- diesel fuels – replaces petrol in some vehicles
- furnace oil – used for industrial heating.

Think Stock 481404963

2.2 Petrol and other fuels

Petrol is made up of molecules composed of hydrogen and carbon atoms. When the air–fuel mixture burns, the hydrogen and carbon atoms unite with the oxygen atoms contained in the air to form water (H_2O). This generates a large amount of heat.

2.2.1 Knocking, octane and grades of petrol

During normal fuel combustion in an engine the pressure in the combustion chamber increases evenly, giving smooth running. If fuel burns too rapidly, there is a sudden increase in pressure that causes a 'knock'. Fuel doesn't burn evenly and is wasted. Knocking can damage the engine.

Meanwhile, on YouTube:

The Story of Gasoline – 1950s educational documentary

20 minutes

http://www.youtube.com/watch?v=EyTSrEsnFf4

Some engines have knock sensors fitted as part of the engine management system. These detect the early stages of knocking. The engine management system makes adjustments to the ignition and fuel systems to stop the knock. This causes a loss of engine power, but prevents harmful knocking.

Fuels are tested for their resistance to knocking and given a research octane number (RON). A high-octane fuel resists knocking, while a low-octane fuel knocks easily. A mixture of the two fuels can be used to produce a fuel of any octane number.

Until the 1980s petrol that was marketed as super or leaded petrol contained a small quantity of tetraethyl lead that was used to give it a high octane number. Lead produces harmful emissions from the engine's exhaust. Leaded petrol was phased out nationally by 1 January 2002.

Petrol is now available several grades:

- ULP – 91 RON
- Premium – 95 RON (or 98 RON)
- Premium extra – 100 RON.

As well as reducing harmful emissions, unleaded petrol enabled catalytic converters to be used in exhaust systems and these are fitted to all new vehicles. Catalytic converters remove other emissions, but cannot be used with leaded fuel.

2.2.2 Other fuels

Ethanol is a type of alcohol (C_2H_5OH) that is produced by fermenting and distilling sugars. It is classified as a biofuel. The main advantages of blending ethanol and petrol are that ethanol burns very cleanly with low emissions and it has a higher RON of 129. The ethanol boosts the octane rating of the fuel blend.

The main disadvantages of ethanol are that it is not suitable for older carburetted vehicles and is more expensive to produce. It hardens older rubber components such as fuel pump diaphragms and hoses and can cause failure. The ethanol will also clean old fuel deposits in the tank and fuel lines and quickly block fuel filters when first used. Ethanol is more volatile and can cause driveability problems, such as stalling and flat spots created by vapour locks.

Gas fuels

The two gas fuels that are used for motor vehicles are liquefied petroleum gas (LPG) and natural gas for vehicles (NGV). Both gases are hydrocarbons, as is petrol, but LPG and NGV have different chemical compositions.

Liquid petroleum gas

LPG is one of the products of crude oil refining. It consists mainly of propane and butane.

Because LPG is colourless, odourless and tasteless, it has a chemical added to give it a strong smell. This means LPG can be detected if there is a gas leak. LPG is twice as dense as air so leaking gas will flow downward. It will concentrate in low areas, such as pits and drains.

Natural gas for vehicles

NGV is a natural gas that consists mainly of methane. It comes from the ground, where it was formed by decomposing vegetable and other matter. Some NGV is also obtained during the processing of crude oil.

Diesel fuels

Diesel fuels are the denser parts of refined crude oil. These chemicals must be fine enough to be atomised in the cylinder, but heavy enough to adhere to the engine parts as a lubricant. Diesel fuels are given a rating like the octane rating. It is called the cetane rating. Diesel fuels are mixed to optimise performance and cetane rating.

Biodiesel is made from vegetable oil and animal fats. It is a clean burning fuel with no sulphur.

2.3 Petroleum-based lubricants

2.3.1 Lubricant functions

In 1999, it was estimated that approximately 40 billion litres of lubricants were consumed worldwide. One of the largest single uses for lubricants is protecting the internal combustion engines in motor vehicles. Lubricants reduce friction between moving surfaces. They also remove foreign particles, among other things. The most common petroleum-based lubricant used in engines is engine oil.

Lubricants also perform the following key functions. They:

- reduce friction between moving parts
- remove heat
- transmit power – hydraulics
- reduce wear
- limit corrosion
- act as a seal for gases – seal the piston/cylinder space
- reduce rust.

A good lubricant has the following characteristics:

- high boiling temperature
- low freezing temperature
- high viscosity
- thermally stable
- hydraulically stable
- high resistance to oxidation.

Typically, lubricants contain 90% base oil (most often petroleum fractions, called mineral oils) and less than 10% additives. Additives deliver reduced friction and wear and increased viscosity. Additives can be:

- antioxidants
- detergents
- metal deactivators
- corrosion inhibitors
- friction modifiers
- anti-foaming agents
- viscosity index improvers
- demulsifying/emulsifying.

Activity 3: Additive hazards
Use the internet to determine the safety risk associated with three of these additives. Explain your findings.

Lubricants are typically used to separate moving parts in a system by forming a physical barrier, i.e., a thin layer of lubricant separates the moving parts. This is similar to hydroplaning in a car when the car's tyres are separated from the road surface by moving through standing water.

2.3.2 Grease

Grease is a lubricant that is used in bearings, ball joints and many other places where oil is not suitable. It is a semi-solid consisting of two parts:

- a lubricant, which is an oil
- a base that carries the oil.

The base is made of animal or vegetable fat mixed with a metal compound – sodium, calcium, lithium, aluminium or zinc are common.

Grease is categorised with a rating called the NLGI number (National Lubricating Grease Institute). Values range from NLGI 000 for the thinnest grease to NLGI 6 for the thickest.

2.3.3 Transmission oils

An automatic transmission has bands and clutches that require lubrication like other engine parts, but they also need friction to grip moving parts. These are two opposing requirements for which automatic transmission fluids have to cater.

2.4 Hydraulic fluid and brakes

The hydraulic fluid used in braking systems is usually glycol ether – a derivative of oil refining.

Brake fluids are classified using a DOT rating. DOT stands for Department of Transport (an American term).

- DOT 3 is suitable for most common cars
- DOT 4 is similar to DOT 3 with a higher boiling point
- DOT 5 meets higher standards of performance and has a high boiling point.

DOT 5 can be used in common cars but DOT 3 must not be used in high-performance cars.

Brake fluid is easily contaminated by mineral oil, kerosene and other mineral oil products. Rubber seals will swell and deteriorate in the presence of these contaminants.

If brake fluid is contaminated it should be replaced along with all associated seals and hoses.

Topic 3: Disposal and the Environment

There are strict regulations about the disposal of lubricants in landfill or discharge into water systems. Lubricants will contaminate water and land even in small amounts.

Item number: 86534146

Burning lubricants generates airborne pollutants that are full of toxic materials, mainly heavy metal compounds. Lubricant burning is only allowed in specialised facilities that have equipment to scrub airborne pollutants before they reach the atmosphere. Some landfill sites may have permits to deal with toxic wastes.

The common use of vehicles leads to some release of lubricant directly into the environment. It gets into drains and landfills. Another direct source of contamination is runoff from roads, spills, natural disasters and pipeline leakages.

Activity 4: Environmental hazards

It is estimated that 40% of all lubricants are released into the environment. What hazards might come from that? List at least three problems.

1.

2.

3.

3.1 Lubricant disposal

Improving technologies have made lubricant recycling a viable option. Filtration systems can remove particulates, additives and oxidation products and recover the base oil. This base oil is then treated much the same as virgin base oil, but there is considerable reluctance to use recycled oil as it is generally considered to be inferior.

Used lubricant may also be used as refinery feedstock to become part of crude oil. Cost prohibits treating used lubricants with both filtration and re-refining. The primary problem with recycling still remains the collection of fluids. Refineries need continuous supply in amounts measured in thousands of litres, which generally comes from oil wells.

When used lubricant requires disposal the best option is to return it to the retailer where it can be reprocessed. Local councils often have oil recycling programs and in some areas recyclers will pick up used oil.

Activity 5: Waste disposal

Where is your nearest lubricant retailer if you need to dispose of waste lubricant?

Activity 6: First aid alert

You are disposing of brake fluid when you accidently get some in your mouth. Use the Material Safety Data Sheet to determine what actions and treatment you should use to control the situation. You will need to select a product on the internet and download the MSDS. List your first aid actions.

Topic 4: Measurement

Feet and inches are units in the old 'imperial' measurement system that was replaced by the metric system in Australia between 1970 and 1988. In industry generally, most measurements are made in metric units, such as metres, millimetres and kilometres. In the automotive industry you will find some parts are described in inches or feet. The reason this still occurs is that some countries, such as the United States, use imperial measurement and they are a supplier of parts used in cars in Australia.

Two Feet?
Item number:153699443

4.1 Servicing measurements

A micrometer is a tool that can measure small distances of less than a millimetre or larger distances with an accuracy of 1/100th of a millimetre. Unless measurements taken from pistons and other internal components are this accurate a vehicle engine may run rough or not run at all.

When you are servicing a vehicle you will need to make several measurements, from the amount of water in the windscreen washers (not very accurate) to the thickness of the lining on brakes (very accurate and possibly a very small distance).

We can break measurement into several parts:

- the commodity (the thing) being measured – steel, cheese, wind, light
- the unit of measurement – length, weight, speed, lumens
- the measuring device – measuring tape, scales, anemometer, lux meter.

How many measurements are involved in servicing a car? We are going to explore this and develop our knowledge of measurement as a crucial skill for all mechanics and service technicians.

Activity 7: Measurement

Complete the table as fully as you can. An example has been provided.

There is no one right answer. Try to get as many measurements as possible.

Servicing measurements

The commodity	***Unit of measurement***	***Measuring device***
Brake lining thickness	*Millimetres*	*Micrometer*

Topic 5: Lifting Vehicles

Many of the tasks required to service a vehicle involve lifting the vehicle on a hoist or a hydraulic floor jack.

5.1 Lifting onto jack stands with a hydraulic floor jack

Vehicles being serviced will usually be lifted on a hydraulic jack and placed on jack stands or safety stands. This allows wheels to be changed and for limited work to be performed under the vehicle.

- Make the first lift at the rear of the vehicle.
- Align the lifting point on the hydraulic floor jack with the strongest part of the under door sill or a specified lifting point under the vehicle – see vehicle manual or servicing database.
- Lift the vehicle to the required height then place jack stands under the wheel axles or other designated strength point.
- Lower the floor jack but leave it in position as an additional safety device.

5.2 Lifting with a hoist

Activity 8: Lifting

When a vehicle is lifted above head height a full range of under-vehicle tasks can be performed. List six tasks.

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....

The hoist in your workshop has been chosen to meet the needs of the business or school. The skills you develop can be applied to the wide variety of hoists you will encounter in your automotive career.

We have looked at hoists earlier in the course and this time we will look at hoists with a strong emphasis on safety. A hoist has the capacity to cause serious injury and could kill an operator if not used safely.

5.3 Safety checks

Before a hoist can be used all the following conditions must be met.

- A vehicle hoist must not be operated unless it has a current certificate of inspection.
- Ensure the vehicle hoist has operating and maintenance instructions permanently located and clearly visible.
- The hoist must be used in accordance with the manufacturer's instructions.
- Check the capacity of the hoist compared to the weight of the vehicle. If the vehicle is too heavy, do not proceed.
- Ensure the area is clean and clear of grease, oil, and objects that may be a slip/trip hazard.
- Familiarise yourself with and check all machine operations and controls.
- Check that all safety devices are in good condition.
- Ensure support arms are capable of being locked in position.
- Ensure rubber pads are in good condition on all load points.
- Faulty equipment must be reported immediately it is discovered.

5.4 Operating guidelines

In addition to the safety checks specific to the hoist in your workshop, the following factors should always be considered.

- Centre the vehicle on the hoist, ensuring that the weight is evenly distributed to the front and rear.
- Identify the correct jacking points and place the lifting pads under the vehicle at the front and rear on the jacking points, ensuring contact.
- Only one person operates the hoist at a time.
- Ensure hoist area is clear of people and equipment before operating.
- Never leave the hoist running unattended.
- Check vehicle stability by looking at the jacking points.
- Engage the manual lock when the required height is reached.
- At the completion of work, lower the vehicle hoist and ensure all equipment is left in a safe position.
- Switch off equipment.
- Leave the equipment and work area in a safe, clean and tidy state.

5.5 Safety signs

The following safety signs should be visible when working on the hoist.

Safety glasses must be worn at all times in work areas.

Long and loose hair must be contained.

Safety footwear must be worn at all times in work areas.

Close fitting/protective clothing must be worn.

Rings and jewellery must not be worn.

Do not stand on hoist while hoist is in operation.

Material in 5.3 to 5.5 adapted from *Safety Operating Procedures – Vehicle Hoists,* published by Department for Education and Childhood Development, South Australia.

Topic 6: Servicing Tools and Materials Operational Guidelines

Activity 9: Servicing tools – selection and maintenance

Your instructor will demonstrate a standard service. You will observe and you may be asked to help from time to time. You will be performing services on several cars as part of your assessment. The notes you make here will help you complete your assessment successfully.

While observing this demonstration, in the pages that follow you will:

- list all the tools and materials needed to complete the servicing checks, adjustments and replacement for each system covered by the service
- note the time taken to perform each task
- note whether the task is under bonnet (UB) or under car (UC) – some tasks may be neither (NA) or both (UB/UC)
- note when each task is performed – i.e. every 5,000 km, 10,000 km, six months, etc. Refer to May and Simpson, volume 1, page 635 for guidance.
- make any other notes that will be useful to your study and learning.

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
Preliminary check						
1. WHS / OHS checks	• Examine the work area and identify any potential hazards • Report hazards requiring management action • Resolve all other issues locally with appropriate controls					
Steering and suspension						
2. Steering linkage	• Check steering wheel rotational free play • Check linkage ball joints for looseness and wear • Lubricate the ball joints where possible					
3. Wheel alignment	• Check the steering and suspension as scheduled • Check and adjust front-end alignment					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
4. Steering box or housing	• Check 'worm' steering box for operation and oil level and possible leaks • Check the condition of the boots on rack-and-pinion steering • Check power steering operation and fluid levels					
5. Front suspension	• Check for wear on the suspension ball joints • Check ball joint boots for damage • Lubricate suspension ball joints, where possible • Check shock absorbers or strut for leaks • Check the condition of the shock absorber boots • Inspect the suspension generally for wear and damage					
6. Wheel bearings	Where required: • Clean front wheel bearings and repack with grease • Clean and repack rear wheel bearings on some front-wheel-drive vehicles					
7. Rear suspension	• Check the bushes and mountings • Check shock absorber operation • Check for oil leaks around shock absorbers • Replace faulty shock absorbers					
8. Body and chassis	• Check bolts and nuts on body, chassis or sub-frames • Use a torque wrench where a torque is specified					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
Drive line						
9. Drive line	• Check the drive line components for wear or damage • Check drive line universal joints for wear • Check the condition of the boots and seals on constant-velocity joints • Lubricate universal joints where required					
10. Final drive	• Check oil level of the rear axle • Check for gasket and seal leaks • Check that the vent on the rear axle housing or differential housing is clear					
Braking						
11. Brake fluid	• Check the brake fluid level • Replace the fluid at the specified service period					
12. Brake lines and hoses	• Check brake fittings for leaks. • Check for other forms of damage or wear					
13. Brake linings and pads	• Check disc brake pads for wear • Replace worn pads • Check brake discs for scoring • Have scored discs ground					
14. Brake pedal	• Check the pedal free play and pedal travel • Check the operation of the brake booster • Check and adjust drum brakes					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
15. Parking brake	❖ Check and adjust parking brake if the travel is excessive					
Wheels and tyres						
16. Tyres and wheels	❖ Inspect the tyres and rims for damage ❖ Check tyre inflation ❖ Rotate the tyres to even up the wear ❖ Check wheel nuts for tightness					
Transmission						
17. Clutch	❖ Check and adjust the clutch pedal free play ❖ For a hydraulic clutch: o Check and adjust the fluid level in the master cylinder o Check for hydraulic leaks o Change the fluid where specified					
18. Manual transmission	❖ Check and adjust the oil level of the oil in the transmission or transaxle ❖ Check for oil leaks ❖ Change the fluid where specified					
19. Automatic transmission	❖ Check the automatic transmission fluid level with the transmission hot ❖ Check for leaks					
Engine system						
20. Engine	❖ Inspect engine assembly for fuel, oil, coolant and other leaks; determine necessary action					
21. Valve clearance	❖ Inspect valve clearances in warm engine and adjusted to specifications					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
22. Manifold bolts	• Inspect bolts or nuts connecting the manifolds to the cylinder head • Adjust bolts and nuts for tightness to eliminate leaks • Inspect and adjust nuts and bolts for the exhaust pipe at the manifold flange					
23. Drive belts	• Inspect camshaft drive belts • Replace at correct service interval or when damaged or excessively worn • Check and adjust belts for the fan, alternator, air-conditioner and power steering • Replace belts with wear • Adjust the belt tension to the required deflection					
24. Engine oil	• Replace engine oil at scheduled intervals • Change oil filter with change of oil • Check and replace the drain plug washer if worn • Check for oil leaks					
Battery and electrical						
25. Battery	• Clean the battery • Inspect for damage to the battery case and for looseness and corrosion in the terminals • Top up the cells with deionised water • Check the level of the electrolyte in the battery and measure its density with a hydrometer • Test the battery for electrical load performance level and confirm it is sufficient for the vehicle type • Apply a coating of grease to the battery terminals					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
26. Lighting	❦ Check the operation of indicator lights, hazard warning and stop lights ❦ Replace faulty globe or identify other causes for not operating					
27. Instruments	❦ Check all indicator, warning and instruments lights to ensure that they are all operating					
28. Power windows and mirrors	❦ Check the operation of the power windows, mirrors and door locks					
Fuel system						
29. Petrol engine – idle speed	❦ Obtain idle information from service manual ❦ Check and adjust the engine idle speed to the prescribed rate ❦ Adjust the idle speed in accordance with the emission-control information					
30. Petrol engine – air cleaner	❦ Inspect the air cleaner ❦ Clean the air cleaner with compressed air ❦ Replace the air cleaner, if damaged or due, according to the schedule					
31. Petrol engine – choke	❦ Check and adjust the cable of a manual choke on a carburettor engine ❦ Check choke valve position for automatic choke					
32. Petrol engine – fuel filter	❦ Check and replace line filter if fitted according to schedule ❦ Check for fuel leaks					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
33. Petrol engine – fuel lines	• Check the condition of fuel system hoses, pipes and connections					
34. Petrol engine – fuel tank cap	• Check the fuel cap is in good condition and the correct type • Check that the washer seals on the filler neck of the tank • Replace the fuel cap with the correct type of cap					
35. Diesel engine – fuel lines	• Check connections to the filter, fuel pump and injection pump • Check injector pipes for tightness and leaks					
36. Diesel engine – fuel filters	• Clean filters or replace as required and drain water from the sedimentor • Prime and bleed the system • Check for leaks					
37. Diesel engine – air cleaner	• Clean or replace the air cleaner • Check air hoses and ducts for leaks					
38. Diesel engine – injectors	• Check that injectors are operational					
39. Diesel engine – injection timing	• Check as required					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
40. Petrol engine – spark plugs	• Clean and check spark plugs • Adjust spark plug gap • Replace spark plugs when specified or when faulty					
41. Petrol engine – distributor and cables	• Clean the distributor cap • Check the HT cables • Clean distributor rotor • Inspect the cap for cracks or damage • Check and adjust the contact points for wear and pitting. Renew if necessary • Check dwell time and reset the ignition timing • Check and adjust ignition timing • Check the ignition advance					
Cooling system						
42. Cooling system	• Check coolant level is above the minimum mark in the reservoir and adjust as required • Check cooling system hose connections • Check all heater hoses for leaks • Clean radiator core by blowing air through it from the rear • Check the water pump for leaks • Check fan condition					
43. Coolant	• Drain and flush cooling system according to schedule • Drain coolant from heater core • Refill cooling system with coolant including water and correct additives for vehicle and environment					

System or component	Action items	UB/UC	Tools	Materials	Time taken	Notes
Emission system						
44. Emission hoses	• Check emission control components for condition and leaks • Check and replace charcoal canister according to vehicle schedule and canister condition • Check for correct operation of the positive crankcase ventilation (PCV) valve • Clean or replace as necessary • There are many variations in emission controls. Information is available in the relevant workshop manual					
45. Exhaust system	• Check the exhaust system for condition and leaks at the pipe joints • Check the exhaust mountings for condition and for clearance with the body or suspension					
Back-up checks						
46. Fluid checks	• Check and adjust engine oil level • Check and adjust engine coolant level • Check and adjust power steering fluid level • Check and adjust brake fluid level • Check and adjust windshield washer fluid level • Check and replace wiper blades • Check and adjust differential/transfer case fluid level • Check and adjust transmission fluid level					

Adapted from:

AURTTA008 Participate in basic vehicle servicing operations – Knowledge Evidence; May, E. and Simpson, L., *Automotive Mechanics,* Volume 1, 8th edition, published by McGraw Hill. *ASE Program Certification Standards For General Service Technician Programs,*
http://www.schools.utah.gov/cte/documents/sts/standards/GeneralServiceTechnician.pdf

Topic 7: Servicing Tools and Materials

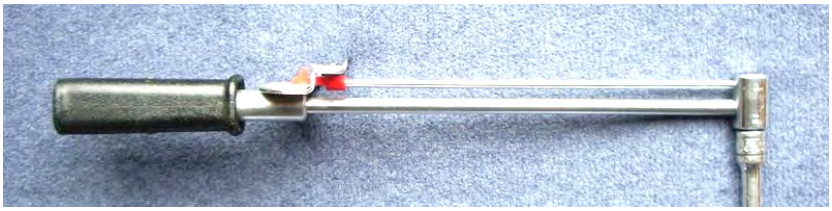
The list below can be used to help you identify the tools and materials (fluids, etc.) required to perform each task in the servicing process. You may, and probably should, identify other tools and materials beyond this list.

1. Spanners

2. Socket spanners

3. Adjusting or shifting spanners

4. Torque wrenches

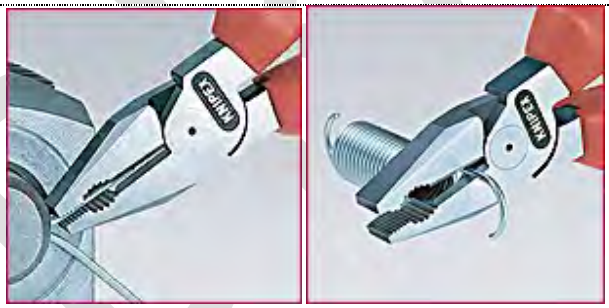


5. Hex/Allen key

6. Screwdrivers

7. Oil filter remover

8. Pliers



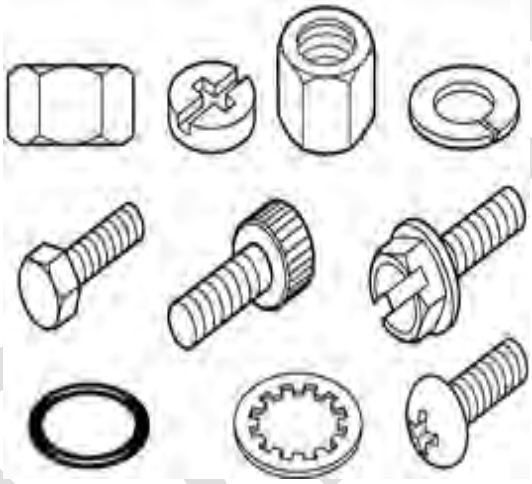
9. Files

10. Hacksaws

11. Engineer's hand hammers

12. Cold chisel and punch

13. Fastening hardware



14. Drills

15. Drill bits

16. Electric power wrenches

17. Grinders

18. Air or pneumatic tools

19. Lifting equipment – jacks and supports

ThinkStock 465216769

20. Lifting equipment – hoists

21. Fluids

The following fluids are used in most servicing processes. List any others you use or see your instructor using.

Petrol	Grease
Gas fuel	Transmission oil
Lubricants	Hydraulic fluids
.	.
.	.
.	.

Activity 10: Adopt a tool

Select a tool you are not familiar with and ask your instructor to demonstrate its use. Practise using the tool until you are able to use it without concern. Note the tool and its function below.

Topic 8: Variations to Servicing Schedule

A typical cycle for servicing modern vehicles is every 15,000 kilometres or every 12 months – whichever comes first. Most servicing tasks are repeated at each service, but some are not required as frequently

The table below gives a summary of these less frequent tasks.

Servicing task	**Variation to servicing schedule**
Valve clearance	Adjust at 2,000, 30,000 and 60,000 km
Manifold bolts	Tighten at 2,000, 30,000 and 60,000 km
Engine coolant	Replace at 30,000 and 60,000 km
Air cleaner	Replace at 30,000 and 60,000 km
Choke operation	Inspect at 30,000 and 60,000 km
Fuel filter – diesel or petrol	Replace at 30,000 and 60,000 km
Injection timing – diesel	Check at 30,000 and 60,000 km
Spark plugs	Replace at 30,000 and 60,000 km
Ignition timing – petrol	Adjust at 2,000, 30,000 and 60,000 km
Charcoal canister	Replace at 30,000 and 60,000 km
Brake fluid	Replace at 30,000 and 60,000 km
Wheel alignment	Adjust at 30,000 and 60,000 km
Steering box	Check at 2,000, 30,000 and 60,000 km
Front/rear wheel bearings – to suit vehicle	Lubricate Replace at 30,000

This information is generic and does not apply to any specific vehicle. Detailed, vehicle-specific information can be obtained from manufacturers or dealers and from sources such as Infomedia, which publishes data on most makes and models of cars.

You can feed this information back into your servicing guidelines, above.

Topic 9: Service and Report

9.1 Servicing activities and assessment

You will work through four main steps to learn, practise and be assessed in vehicle servicing. The four steps are:

1. Demonstration. Your instructor will perform a demonstration service, explaining the tools and materials used. Record this on the pages below.

2. Practise. Your group – two or three fellow students – will complete a service on selected systems (brakes, fuel etc.) and your peers will time you and record these times in the table below. You will complete the Service Record 1 as you proceed.

3. Assessment. Your group will service another vehicle observed by your instructor or another assessor. You may be called on by your instructor to only service some aspects of a vehicle. You will follow all the required procedures, but not for every system. You will complete the Service Record 2 as you proceed.

9.2 Inspection

Your work on the Task 3 assessment will include a detailed inspection of your work, including criticism. You will correct any errors to produce a completely satisfactory outcome.

Service Record 1*

Customer:

Vehicle make and model:

Odometer:

Date of service:

Date of last service:

Technician comments:

Next service due: Odometer or Date

/ /

Service technician number:

* Your instructor or assessor will tell you which systems to service.

System or component	Action items	U/B:U/C	Notes
Preliminary check			
1 WHS/OHS checks	• Examine the work area and identify any potential hazards • Report hazards requiring management action • Resolve all other issues locally with appropriate controls		
Steering and suspension system			
2 Steering linkage	• Check steering wheel rotational free play • Check linkage ball joints for looseness and wear • Lubricate the ball joints where possible		
3 Wheel alignment	• Check the steering and suspension as scheduled • Check and adjust front-end alignment		
4 Steering box or housing	• Check 'worm' steering box for operation and oil level and possible leaks • Check the condition of the boots on rack-and-pinion steering • Check power steering operation and fluid levels		
5 Front suspension	• Check for wear on the suspension ball joints • Check ball joint boots for damage • Lubricate suspension ball joints, where possible • Check shock absorbers or strut for leaks • Check the condition of the shock absorber boots • Inspect the suspension generally for wear and damage		
6 Wheel bearings	Where required: • Clean front-wheel bearings and repack with grease • Clean and repack rear-wheel bearings on some front-wheel-drive vehicles		
7 Rear suspension	• Check the bushes and mountings • Check shock absorber operation • Check for oil leaks around shock absorbers • Replace faulty shock absorbers		
8 Body and chassis	• Check bolts and nuts on body, chassis or subframes • Use a torque wrench where a torque is specified		

System or component	Action items	U/B:U/C	Notes
Drive line system			
9 Drive line	• Check the drive line components for wear or damage • Check drive line universal joints for wear • Check the condition of the boots and seals on constant-velocity joints • Lubricate universal joints where required		
10 Final drive	• Check oil level of the rear axle • Check for gasket and seal leaks • Check that the vent on the rear axle housing or differential housing is clear		
Braking system			
11 Brake fluid	• Check the brake fluid level • Replace the fluid at the specified service period		
12 Brake lines and hoses	• Check brake fittings for leaks • Check for other forms of damage or wear		
13 Brake linings and pads	• Check disc brake pads for wear • Replace worn pads • Check brake discs for scoring • Have scored discs ground		
14 Brake pedal	• Check the pedal free play and pedal travel • Check the operation of the brake booster • Check and adjust drum brakes		
15 Parking brake	• Check and adjust parking brake if the travel is excessive		
Wheels and tyres			
16 Tyres and wheels	• Inspect the tyres and rims for damage • Check tyre inflation • Rotate the tyres to even up the wear • Check wheel nuts for tightness		
Transmission system			

17 Clutch	• Check and adjust the clutch pedal free play
	• For a hydraulic clutch:
	  o Check and adjust the fluid level in the master cylinder
	  o Check for hydraulic leaks
	  o Change the fluid where specified		

18 Manual transmission	• Check and adjust the oil level of the oil in the transmission or transaxle • Check for oil leaks		

System or component	Action items	U/B:U/C	Notes
	✓ Change the fluid where specified		
19 Automatic transmission	✓ Check the automatic transmission fluid level with the transmission hot ✓ Check for leaks		
Engine system			
20 Engine	✓ Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action		
21 Valve clearance	✓ Inspect valve clearances in warm engine and adjust to specifications		
22 Manifold bolts	✓ Inspect bolts or nuts connecting the manifolds to the cylinder head ✓ Adjust bolts and nuts for tightness to eliminate leaks ✓ Inspect and adjust nuts and bolts for the exhaust pipe at the manifold flange		
23 Drive belts	✓ Inspect camshaft drive belts ✓ Replace at correct service interval or when damaged or excessively worn ✓ Check and adjust belts for the fan, alternator, air-conditioner and power steering ✓ Replace belts with wear ✓ Adjust the belt tension to the required deflection		
24 Engine oil	✓ Replace engine oil at scheduled intervals ✓ Change oil filter with change of oil ✓ Check and replace the drain plug washer if worn ✓ Check for oil leaks		
Battery and electrical system			
25 Battery	✓ Clean the battery ✓ Inspect for damage to the battery case and for looseness and corrosion in the terminals ✓ Top up the cells with deionised water ✓ Check the level of the electrolyte in the battery and measure its density with a hydrometer ✓ Test the battery for electrical load performance level and confirm it is sufficient for the vehicle type ✓ Apply a coating of grease to the battery terminals		
26 Lighting	✓ Check the operation of indicator lights, hazard warning and stop lights ✓ Replace faulty globe or identify other causes for not operating		
27 Instruments	✓ Check all indicator, warning and instrument lights to ensure that they are all operating		

System or component	Action items	U/B:U/C	Notes
28 Power windows and mirrors	• Check the operation of the power windows, mirrors and door locks		
Fuel System			
29 Petrol engine – idle speed	• Obtain idle information from service manual • Check and adjust the engine idle speed to the prescribed rate • Adjust the idle speed in accordance with the emission-control information		
30 Petrol engine – air cleaner	• Inspect the air cleaner • Clean the air cleaner with compressed air • Replace the air cleaner, if damaged or due, according to the schedule		
31 Petrol engine – choke	• Check and adjust the cable of a manual choke on a carburettor engine • Check choke valve position for automatic choke		
32 Petrol engine – fuel filter	• Check and replace line filter if fitted according to schedule • Check for fuel leaks		
33 Petrol engine – fuel lines	• Check the condition of fuel system hoses, pipes and connections		
34 Petrol engine – fuel tank cap	• Check the fuel cap is in good condition and the correct type • Check that the washer seals on the filler neck of the tank • Replace the fuel cap with the correct type of cap		
35 Diesel engine – fuel lines	• Check connections to the filter, fuel pump and injection pump • Check injector pipes for tightness and leaks		
36 Diesel engine – fuel filters	• Clean filters or replace as required and drain water from the sedimentor • Prime and bleed the system • Check for leaks		
37 Diesel engine – air cleaner	• Clean or replace the air cleaner • Check air hoses and ducts for leaks		
38 Diesel engine – injectors	• Check that injectors are operational		
39 Diesel engine –	• Check as required		

System or component	Action items	U/B:U/C	Notes
injection timing			
40 Petrol engine – spark plugs	• Clean and check spark plugs • Adjust spark plug gap • Replace spark plugs when specified or when faulty		
41 Petrol engine – distributor and cables	• Clean the distributor cap • Check the HT cables • Clean distributor rotor • Inspect the cap for cracks or damage • Check and adjust the contact points for wear and pitting. Renew if necessary • Check dwell time and reset the ignition timing • Check and adjust ignition timing • Check the ignition advance		
Cooling system			
42 Cooling system	• Check coolant level is above the minimum mark in the reservoir and adjust as required • Check cooling system hose connections • Check all heater hoses for leaks • Clean radiator core by blowing air through it from the rear • Check the water pump for leaks • Check fan condition		
43 Coolant	• Drain and flush cooling system according to schedule • Drain coolant from heater core • Refill cooling system with coolant including water and correct additives for vehicle and environment		
Emission system			
44 Emission hoses	• Check emission control components for condition and leaks • Check and replace charcoal canister according to vehicle schedule and canister condition • Check for correct operation of the positive crankcase ventilation (PCV) valve • Clean or replace as necessary • There are many variations in emission controls. Information is available in the relevant workshop manual		
45 Exhaust system	• Check the exhaust system for condition and leaks at the pipe joints • Check the exhaust mountings for condition and for clearance with the body or suspension		
Back-up checks			
46 Fluid checks	• Check and adjust engine oil level • Check and adjust engine coolant level • Check and adjust power steering fluid level • Check and adjust brake fluid level		

System or component	Action items	U/B:U/C	Notes
	Check and adjust windshield washer fluid level Check and replace wiper blades Check and adjust differential/transfer case fluid level Check and adjust transmission fluid level		

Customer report

Write a short report to the customer outlining additional tasks performed and recommending work required in the near future.

Service Task 1: Customer recommendations

Service Record 2*

Customer:

Vehicle make and model:

Odometer:

Date of service:

Date of last service:

Technician comments:

Next service due: Odometer or Date

/ /

Service technician number:

* Your instructor or assessor will tell you which systems to service.

System or component	Action items	U/B:U/C	Notes
Preliminary check			
1 WHS / OHS checks	▪ Examine the work area and identify any potential hazards ▪ Report hazards requiring management action ▪ Resolve all other issues locally with appropriate controls		
Steering and suspension system			
2 Steering linkage	▪ Check steering wheel rotational free play ▪ Check linkage ball joints for looseness and wear ▪ Lubricate the ball joints where possible		
3 Wheel alignment	▪ Check the steering and suspension as scheduled ▪ Check and adjust front-end alignment		
4 Steering box or housing	▪ Check 'worm' steering box for operation and oil level and possible leaks ▪ Check the condition of the boots on rack-and-pinion steering ▪ Check power steering operation and fluid levels		
5 Front suspension	▪ Check for wear on the suspension ball joints ▪ Check ball joint boots for damage ▪ Lubricate suspension ball joints, where possible ▪ Check shock absorbers or strut for leaks ▪ Check the condition of the shock absorber boots ▪ Inspect the suspension generally for wear and damage		
6 Wheel bearings	Where required: ▪ Clean front wheel bearings and repack with grease ▪ Clean and repack rear wheel bearings on some front-wheel-drive vehicles		
7 Rear suspension	▪ Check the bushes and mountings ▪ Check shock absorber operation ▪ Check for oil leaks around shock absorbers ▪ Replace faulty shock absorbers		
8 Body and chassis	▪ Check bolts and nuts on body, chassis or subframes ▪ Use a torque wrench where a torque is specified		
Drive line system			
9 Drive line	▪ Check the drive line components for wear or damage ▪ Check drive line universal joints for wear ▪ Check the condition of the boots and seals on		

System or component	Action items	U/B:U/C	Notes
	constant-velocity joints • Lubricate universal joints where required		
10 Final drive	• Check oil level of the rear axle • Check for gasket and seal leaks • Check that the vent on the rear axle housing or differential housing is clear		
Braking system			
11 Brake fluid	• Check the brake fluid level • Replace the fluid at the specified service period		
12 Brake lines and hoses	• Check brake fittings for leaks • Check for other forms of damage or wear		
13 Brake linings and pads	• Check disc brake pads for wear • Replace worn pads • Check brake discs for scoring • Have scored discs ground		
14 Brake pedal	• Check the pedal free play and pedal travel • Check the operation of the brake booster • Check and adjust drum brakes		
15 Parking brake	• Check and adjust parking brake if the travel is excessive		
Wheels and tyres			
16 Tyres and wheels	• Inspect the tyres and rims for damage • Check tyre inflation • Rotate the tyres to even up the wear • Check wheel nuts for tightness		
Transmission system			
17 Clutch	• Check and adjust the clutch pedal free play • For a hydraulic clutch: o Check and adjust the fluid level in the master cylinder o Check for hydraulic leaks o Change the fluid where specified		
18 Manual transmission	• Check and adjust the oil level of the oil in the transmission or transaxle • Check for oil leaks • Change the fluid where specified		
19 Automatic transmission	• Check the automatic transmission fluid level with the transmission hot • Check for leaks		

System or component	Action items	U/B:U/C	Notes
Engine system			
20 Engine	• Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action		
21 Valve clearance	• Inspect valve clearances in warm engine and adjust to specifications		
22 Manifold bolts	• Inspect bolts or nuts connecting the manifolds to the cylinder head • Adjust bolts and nuts for tightness to eliminate leaks • Inspect and adjust nuts and bolts for the exhaust pipe at the manifold flange		
23 Drive belts	• Inspect camshaft drive belts • Replace at correct service interval or when damaged or excessively worn • Check and adjust belts for the fan, alternator, air-conditioner and power steering • Replace belts with wear • Adjust the belt tension to the required deflection		
24 Engine oil	• Replace engine oil at scheduled intervals • Change oil filter with change of oil • Check and replace the drain plug washer if worn • Check for oil leaks		
Battery and electrical system			
25 Battery	• Clean the battery • Inspect for damage to the battery case and for looseness and corrosion in the terminals • Top up the cells with deionised water • Check the level of the electrolyte in the battery and measure its density with a hydrometer • Test the battery for electrical load performance level and confirm it is sufficient for the vehicle type • Apply a coating of grease to the battery terminals		
26 Lighting	• Check the operation of indicator lights, hazard warning and stop lights • Replace faulty globe or identify other causes for not operating		
27 Instruments	• Check all indicator, warning and instrument lights to ensure that they are all operating		
28 Power windows and mirrors	• Check the operation of the power windows, mirrors and door locks		
Fuel system			
29 Petrol engine – idle	• Obtain idle information from service manual		

System or component	Action items	U/B:U/C	Notes
speed	• Check and adjust the engine idle speed to the prescribed rate • Adjust the idle speed in accordance with the emission-control information		
30 Petrol engine – air cleaner	• Inspect the air cleaner • Clean the air cleaner with compressed air • Replace the air cleaner, if damaged or due, according to the schedule		
31 Petrol engine – choke	• Check and adjust the cable of a manual choke on a carburettor engine • Check choke valve position for automatic choke		
32 Petrol engine – fuel filter	• Check and replace line filter if fitted according to schedule • Check for fuel leaks		
33 Petrol engine – fuel lines	• Check the condition of fuel system hoses, pipes and connections		
34 Petrol engine – fuel tank cap	• Check the fuel cap is in good condition and the correct type • Check that the washer seals on the filler neck of the tank • Replace the fuel cap with the correct type of cap		
35 Diesel engine – fuel lines	• Check connections to the filter, fuel pump and injection pump • Check injector pipes for tightness and leaks		
36 Diesel engine – fuel filters	• Clean filters or replace as required and drain water from the sedimentor • Prime and bleed the system • Check for leaks		
37 Diesel engine – air cleaner	• Clean or replace the air cleaner • Check air hoses and ducts for leaks		
38 Diesel engine – injectors	• Check that injectors are operational		
39 Diesel engine – injection timing	• Check as required		
40 Petrol engine – spark plugs	• Clean and check spark plugs • Adjust spark plug gap • Replace spark plugs when specified or when faulty		

System or component	Action items	U/B:U/C	Notes
41 Petrol engine – distributor and cables	• Clean the distributor cap • Check the HT cables • Clean distributor rotor • Inspect the cap for cracks or damage • Check and adjust the contact points for wear and pitting. Renew if necessary • Check dwell time and reset the ignition timing • Check and adjust ignition timing • Check the ignition advance		
Cooling system			
42 Cooling system	• Check coolant level is above the minimum mark in the reservoir and adjust as required • Check cooling system hose connections • Check all heater hoses for leaks • Clean radiator core by blowing air through it from the rear • Check the water pump for leaks • Check fan condition		
43 Coolant	• Drain and flush cooling system according to schedule • Drain coolant from heater core • Refill cooling system with coolant including water and correct additives for vehicle and environment		
Emission system			
44 Emission hoses	• Check emission control components for condition and leaks • Check and replace charcoal canister according to vehicle schedule and canister condition • Check for correct operation of the positive crankcase ventilation (PCV) valve • Clean or replace as necessary • There are many variations in emission controls. Information is available in the relevant workshop manual		
45 Exhaust system	• Check the exhaust system for condition and leaks at the pipe joints • Check the exhaust mountings for condition and for clearance with the body or suspension		
Back-up checks			
46 Fluid checks	• Check and adjust engine oil level • Check and adjust engine coolant level • Check and adjust power steering fluid level • Check and adjust brake fluid level • Check and adjust windshield washer fluid level • Check and replace wiper blades • Check and adjust differential/transfer case fluid level • Check and adjust transmission fluid level		

Customer report
Write a short report to the customer outlining additional tasks performed and recommending work required in the near future.

Service Task 2: Customer recommendations

Topic 10: Completing the Work

There are some important tasks that must be done to complete the servicing process.

10.1 Inspection

Your servicing work will be inspected. It will be examined to ensure that you have made all the required checks and any required adjustments or changes of parts or fluids. This checking will occur whether you are a student in training or a qualified service technician in an automotive workshop.

As a result of this checking, you may be asked to repeat some checks or adjustments or replace parts that you missed. The aim of this inspection is to ensure that the customer receives a quality service and drives away satisfied with your work. In this sense, having your work inspected is a benefit to you.

10.2 Cleaning up and storing tools

A visual inspection should tell you when a tool needs cleaning – build-ups of oil, dust and metal shards are easily seen.

Hand tools

- Clean hand tools at the end of each service to the extent needed – use your judgement.
- For daily use and cleaning a quick wipe with a dry cloth should be sufficient.
- If any of your tools have rust on them, use steel wool to rub it off.

Power tools

- Wipe with a cloth to remove surface oil and dust.
- Use a vacuum to remove dust build-up.
- Disassemble and clean individual parts if a tool is not functioning properly.
- Always use the manufacturer's guidelines.

10.3 Recording and reporting to the customer

Most car servicing workshops will have some degree of automatic reporting process – usually based on a computer system. This reporting process will generate lists of tasks to be performed for the specific service you are performing. You will use this list to guide your work then record the completion of your work on the computer system. The computer will:

- keep a record of the service for future reference
- record any additional information such as wear on brakes, tyres needing replacement, etc.
- generate a customer copy of the service report to be discussed then handed to the customer.

Many cars are supplied with a service book. There is a tab or page for each service – 5,000 km, 15,000 km, etc. – to be ticked off. You may also place a sticker above the driver's line of sight on the front windscreen as a reminder when the next service is due.

10.4 Customer handover

In larger workshops a senior service technician may hand over your work to the customer. It's always more satisfying if you can do it yourself – assuming you don't have to wait until 6.30pm to do it. If you are handing over the vehicle remember to:

- explain each major item on the bill/service schedule
- recommend work for the next service – new discs, timing belt replacement, etc.

Treat the customer as someone you are pleased to be talking to. They are paying your wages!