# VEHICLE SERVICING AND REPAIRING

## NTQF Level II

# Learning Guide 42

**Unit of Competence:** Identify Basic Automotive Faults Using Troubleshooting Processes

**Module Title:** Identifying Basic Automotive Faults Using Troubleshooting Processes

**LG Code:** EIS VSR2 M14 LO2-LG-42

**TTLM Code:** EIS VSR2 TTLM 0919v1

## LO2: Identify fault using trouble shooting processes

| Instruction Sheet | Identify fault using trouble shooting processes |
|---|---|

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Identify Automotive system or components of faults/problems
- Perform Troubleshooting processes
- Forward Report to persons for action

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Identify automotive system or component relating to the fault or the problem.
- Perform Troubleshooting processes and identify the likely cause of the fault or problem of component or system.
- Forward report to persons for action according to workplace procedures

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” in page **-.**
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

| Information Sheet-1 | Identify Automotive system or component |
|---|---|

**Automotive Systems**

System is a word used to describe a collection of related components which interact as a whole. The automobile's systems are made up of parts which are called components. Such systems are; Lighting, steering, suspension, braking, engine, fuel, drive train system etc.

**Lighting System and its components**

Vehicle lighting systems are very important, particularly where road safety is concerned; to illuminate, indicate/ warn the drivers. Those lights are headlights, clearance light, turn signals, fog light, side marker light are often combined on the front. Those taillights, stoplights, reverse lights, indicators, fog light, number plate light are at the rear.

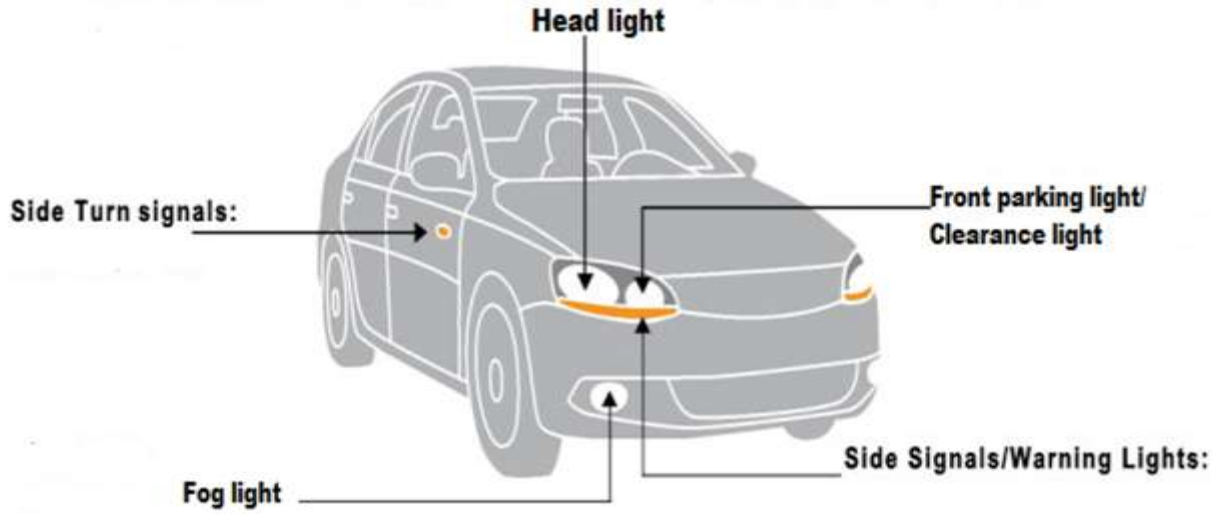
**Head light:** to illuminate the road in front of the vehicle. Generally, high-beam and low-beam lights are provided and can be switched from one to the other by the dimmer switch.


**Fog light (front and rear):**

Fog lights differ from headlight beam and rear tail-lights in that they're normally set lower in the front or rear aprons or bumpers and angled in such a way, as to cut beneath, or be visible, in dense fog.

Many vehicles have fog lights both at the front and rear which are operated independently of the headlights for use in fog, inclement weather, or other times of extremely reduced visibility.

**Clearance lights and Tail Lights**: These are low-intensity lights to indicate the presence and width of a vehicle at night to other vehicles in the front or behind. Those in the front are called clearance-lights and those in the back are called taillights.



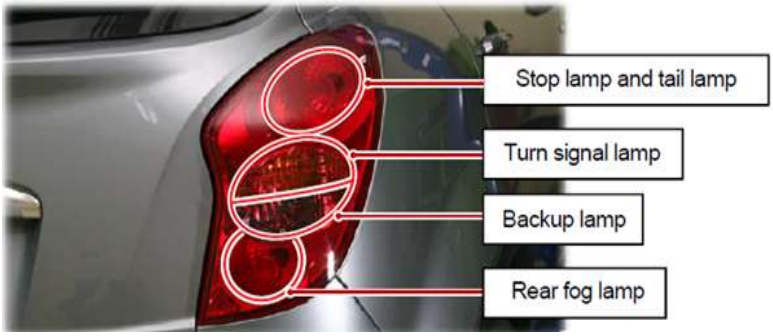

**Turn signal lights:** Turn signal lights are used to let other drivers know that you are about to make a turn.

Side marker lights: this light indicates directional or side, when vehicles are parallel moves in lane.

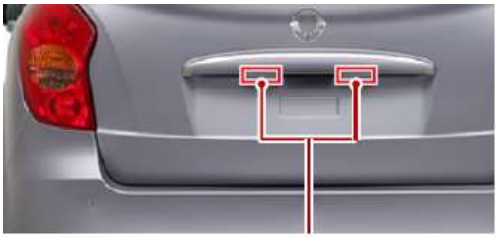
**Hazard Warning Lights:** In the event of an emergency, such as a roadside breakdown, all the lamps should be capable of working simultaneously, when they are called "hazard warning lights". The hazard warning lights indicate the existence of the vehicle to the front, rear and both sides during emergency stopping or parking. The emergency warning lights are turned on with a separate switch that causes all four turn signals to flash at once.

**Backup (Reverse) light**: warn other drivers or pedestrians that you are reversing, or intend to reverse. When the switch is operated, selecting the shift lever to reverse, the supply is sent to the rear lamps through wire.

Brake lights (Stop lights): are used to warn drivers behind that you are slowing down or stopping. Brake lights come on. When the switch is operated; when the driver presses the brake pedal, the supply is sent to the rear lamps through the wire which connects to the center high mounted stoplight.



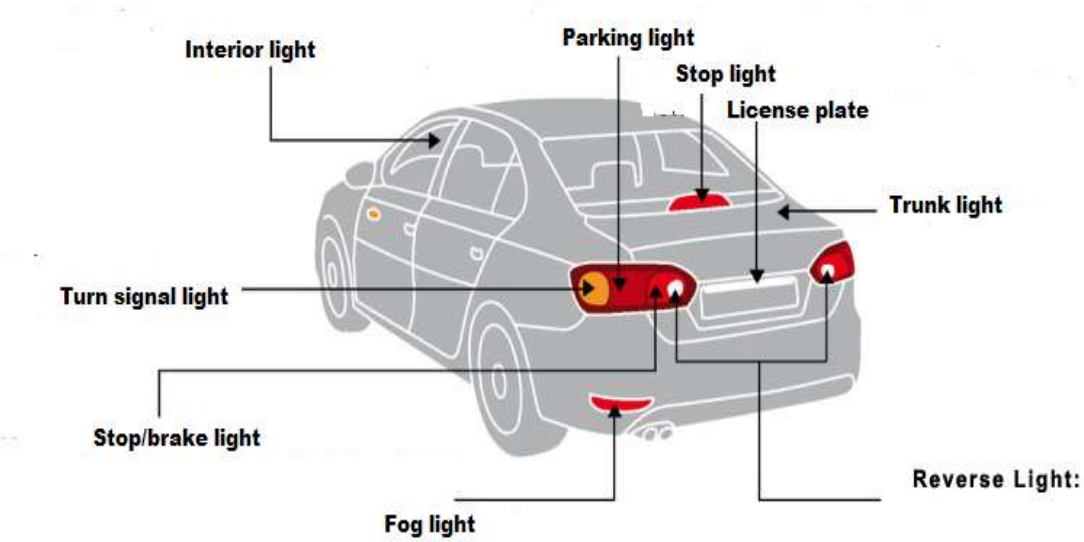

**License plate lights:** These lights illuminate the rear license plate. The license plate lights go on when the taillights go on.



License plate lamp

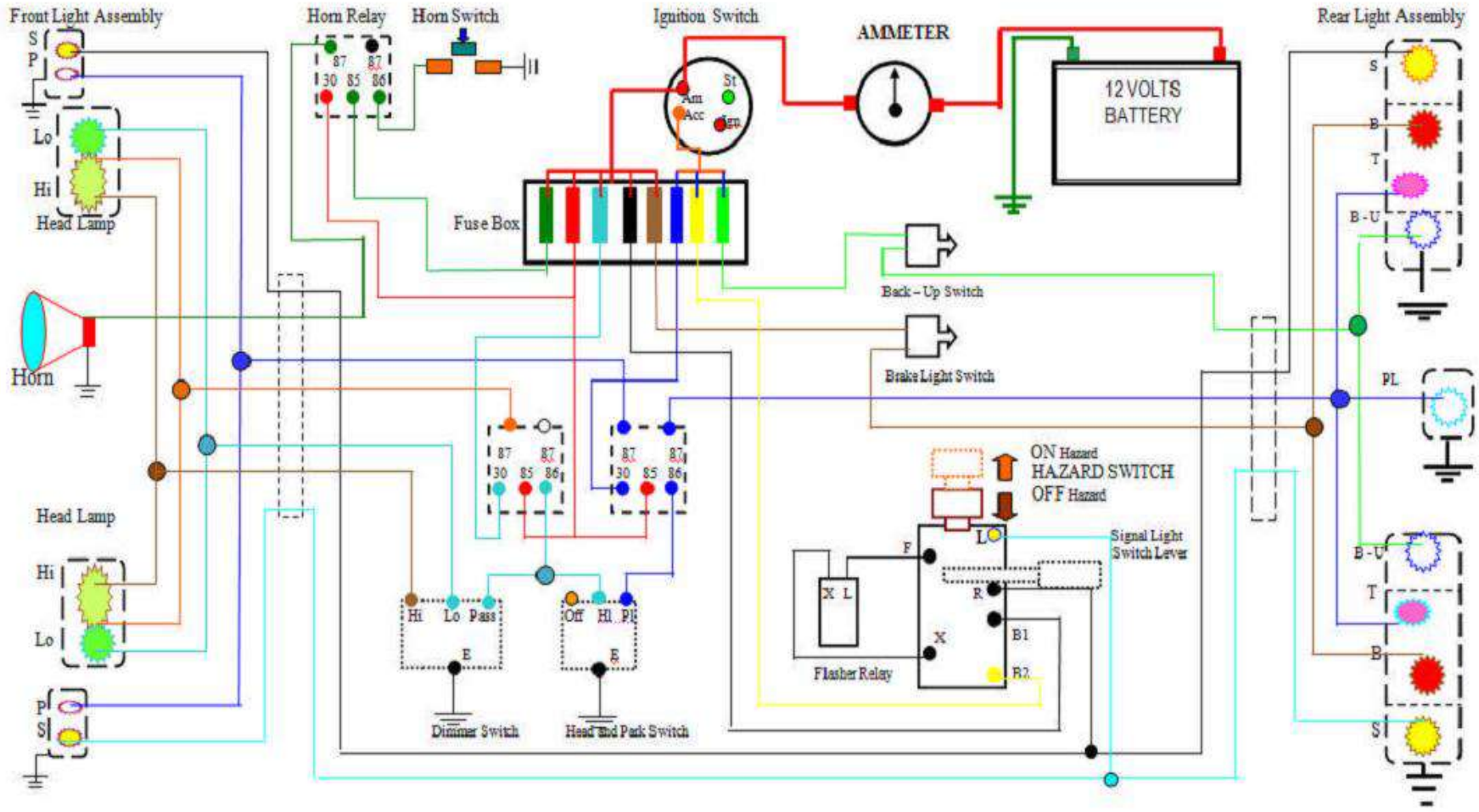
**Courtesy lights:** which turn on when the car door is opened. Most cars have one central interior light above the rear-view mirror, or two lights, on the sides above the driver's and passenger's shoulders. Door switches are simple spring-loaded contacts that are made as the door opens. The contacts are broken again as the door closes.

**Panel and instrument lights:** are illuminated when the vehicle sidelights are switched on. Most cars also incorporate a dimmer switch so the level of illumination can be set.



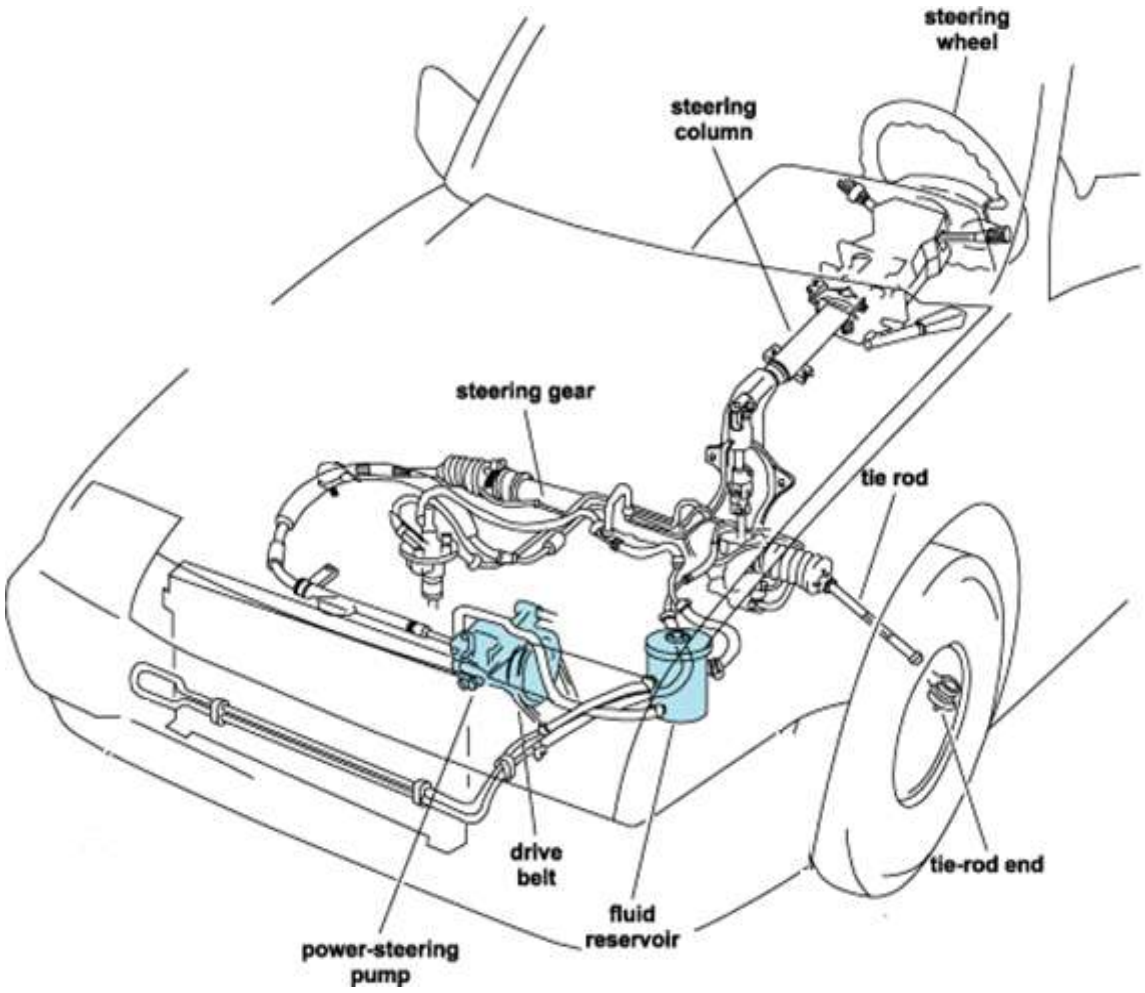
**Lighting circuits diagram:**

TOYOTA COMMON CIRCUIT (BLOCK DIAGRAM)



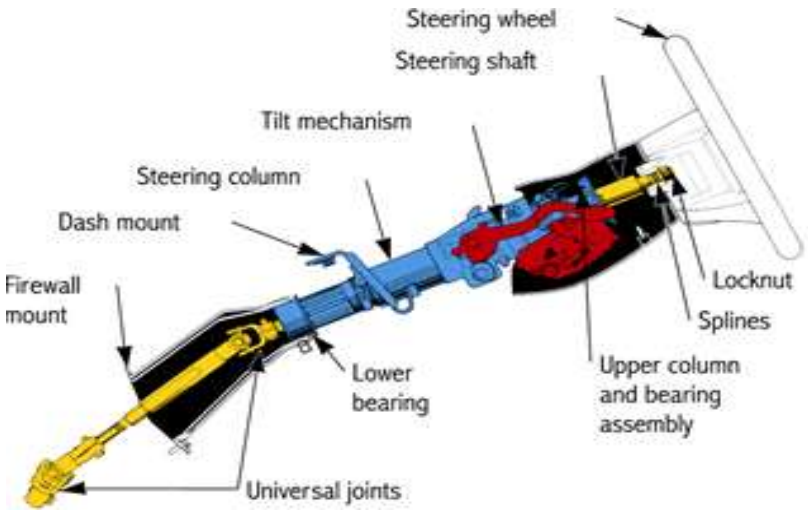
## Steering System

The purpose of the steering system is to provide precise control of the wheel direction i.e. to turn the front wheels. In some cases, it also turns the rear wheels. Consists of the steering wheel, steering shaft, column, flexible coupling and universal joint, gear box, pitman arm, idler arm, center link, drag link, tie rod

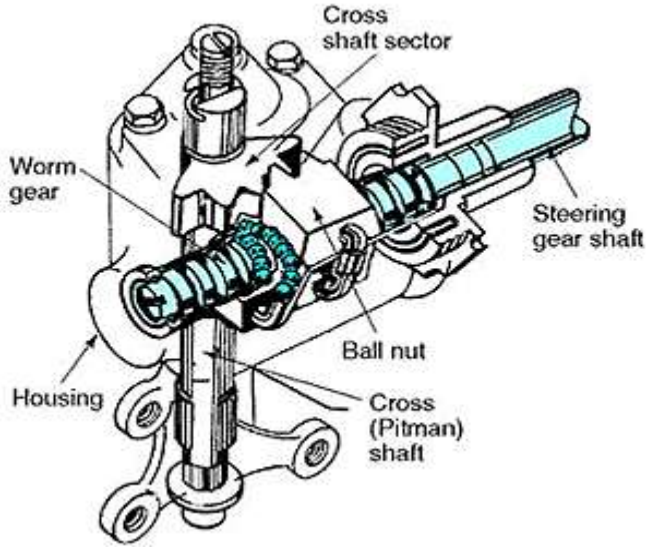



As the steering wheel is turned by the driver, the steering gear transfers this motion to the steering linkage. The steering linkage turns the wheels to control the vehicle's direction.

**Steering Wheel and Column:** is to produce rotational motion and transfers the necessary force to turn the steering gear.




**Steering gear box:** The steering gear translates (reduces) the steering force applied by the driver. It also converts the rotational movement of the steering wheel into push or pulls movements of the track rods. The converted movement is transmitted to the linkage, which in turn moves the wheels in the desired steering direction. Track rods are required to transmit the steering movement from the steering gear to the front wheels.




The **steering linkage** transfers the motion of the steering gear output shaft to the steering arms, turning the wheels to maneuver the vehicle.

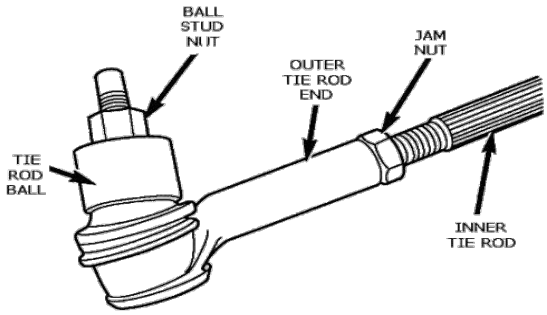
**Pitman Arm** The pitman arm connects the linkage to the steering column through a steering gear located at the base of the column.

**Idler Arm:** is normally attached, on the opposite side of the center link, from the pitman arm and to the car frame, supporting the center link at the correct height. A pivot built into the arm or assembly permits sideways movement of the linkage.

**Center links or steering links** used to control sideways linkage movement, which changes the wheel's direction.

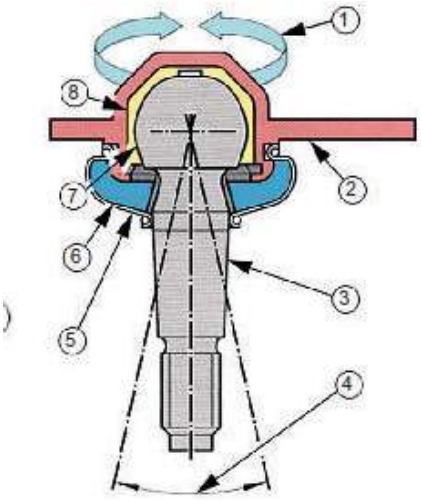
**Tie-Rods** are actually assemblies that make the final connections between the steering linkage and steering knuckles. They consist of inner tie-rod ends, which are connected to the opposite sides of the center link; outer tie-rod ends, which connect to the steering

knuckles; and adjusting sleeves or bolts, which join the inner and outer tie-rod ends, permitting the tie-rod length to be adjusted for correct toe settings.




**Ball joints** allow parts of the steering linkage to rotate about the longitudinal axis of the ball joint. They also allow limited swivel movements transversely to the longitudinal axis.

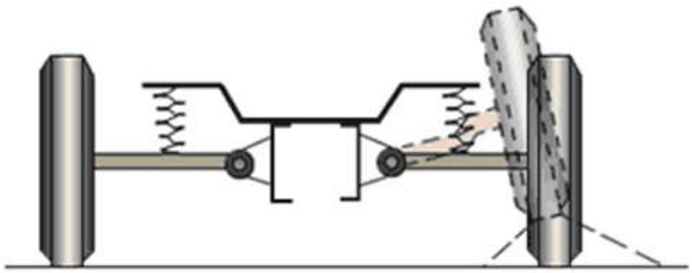
1, Rotation;
2, Connecting Flange;
3, Taper;
4, Possible Swivel Movement;
5, Gaiter;
6, Lubricating Grease;
7, Ball Pivot;
8, Plastic Cup



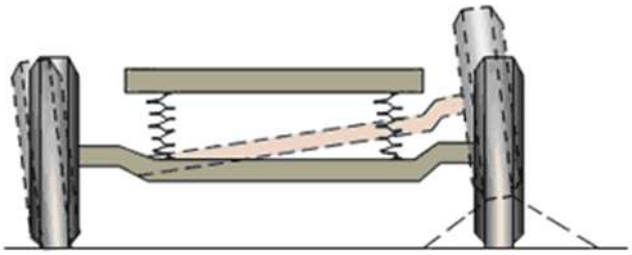

**Suspension system**

The suspension system is the link between the vehicle body and the wheels. Its purpose is to maintain the wheels in contact with the road and minimize road shocks.

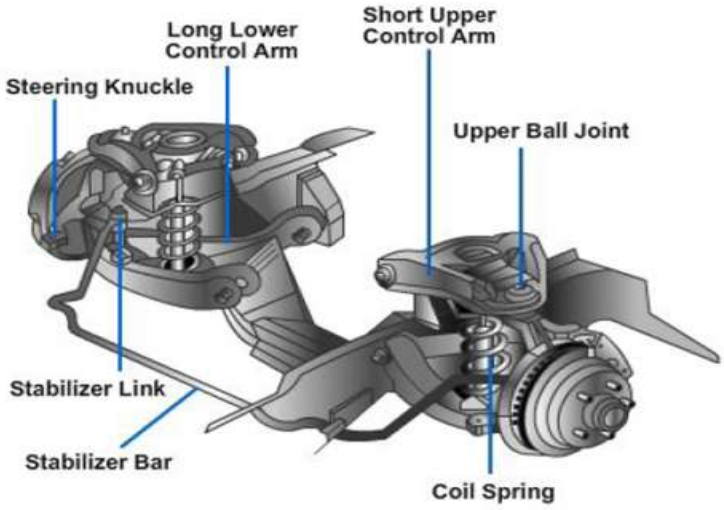
Independent Suspension



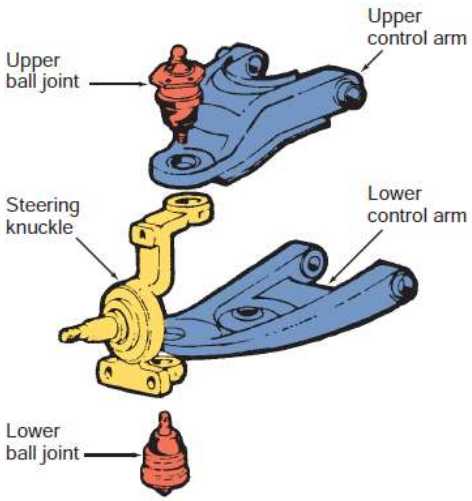
Dependent Suspension



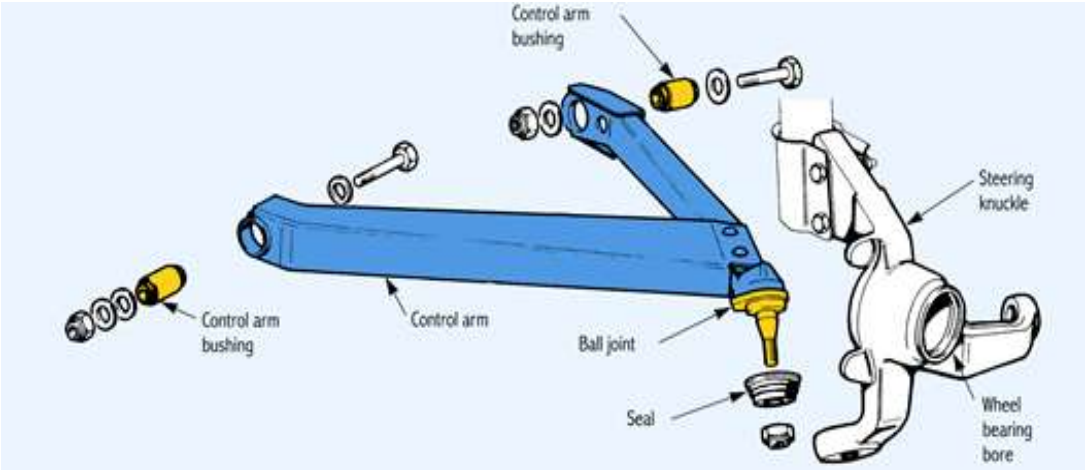
Suspension System Component



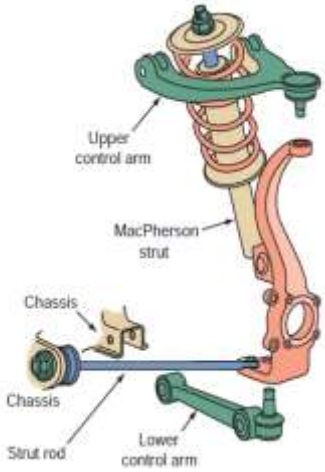

**Control arms** a movable lever that fastens the steering knuckle to the vehicle frame or body.



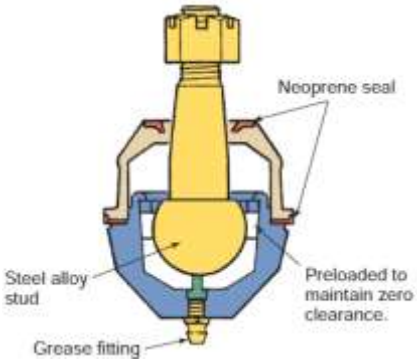
**Control arm bushing** a sleeve which allows the control arm to move up and down on the frame.



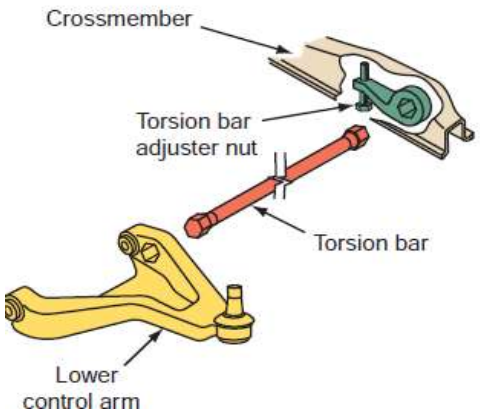

**Strut rod** prevents the control arm from swinging to the front or rear of the vehicle.



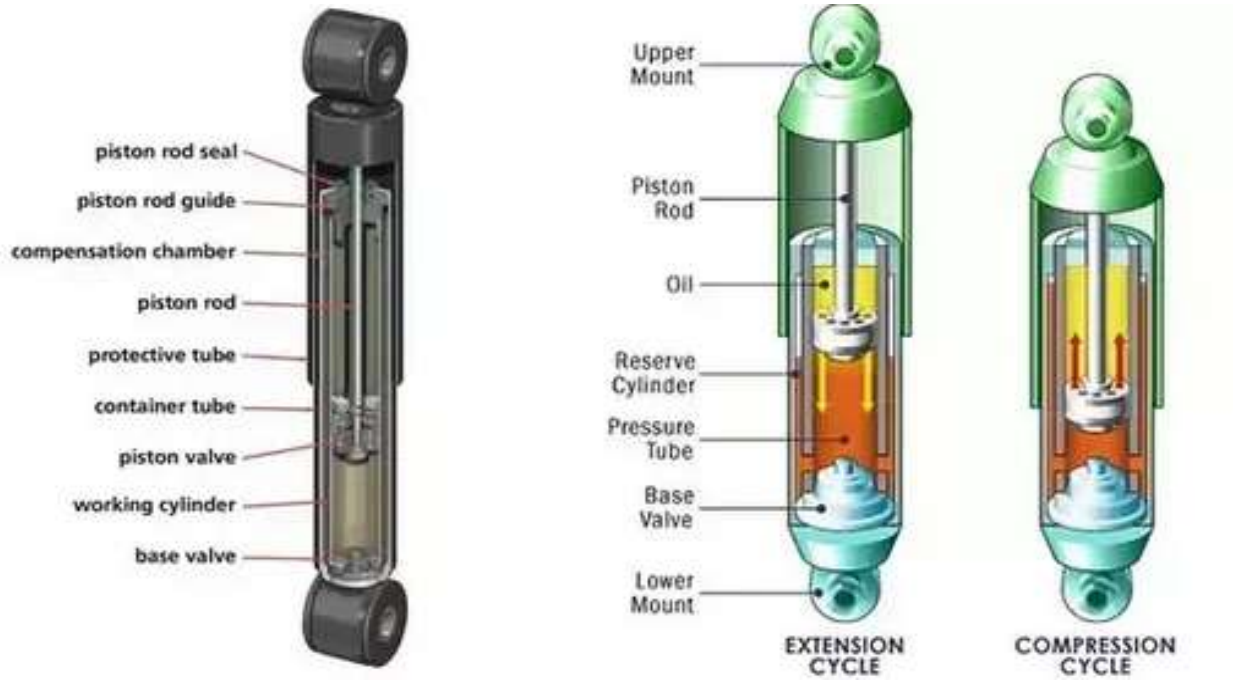

**Ball joints** a swivel joint that allows the control arm and steering knuckle to move up and down, as well as side to side.



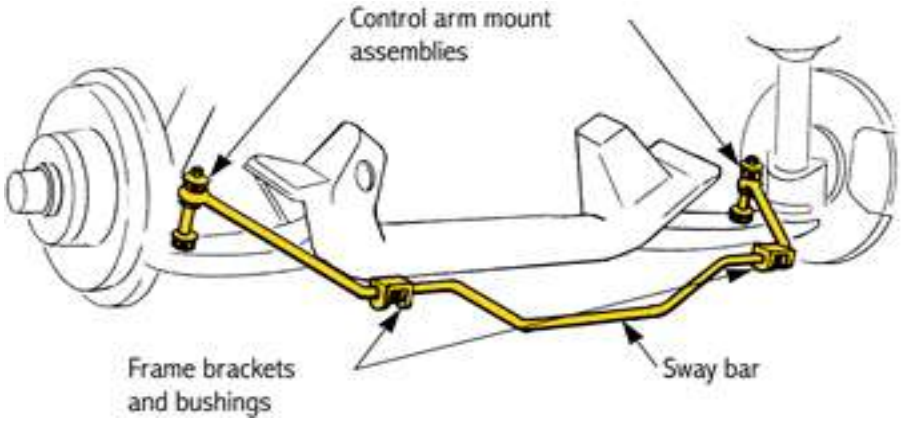
**Torsion bar** Torsion bars serve the same function as coil springs. They are often described as straightened-out coil springs. Instead of compressing like coil springs, a torsion bar twists and straightens out on the recoil. That is, as the bar twists, it resists up and down movement. One end of the bar made of heat-treated alloy spring steel is attached to the vehicle frame. The other end is attached to the lower control arm.



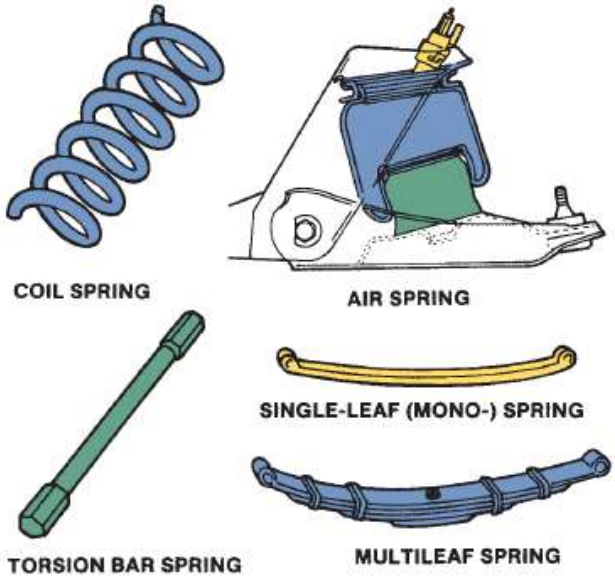

**Shock absorber** keeps the suspension from continuing to bounce after spring compression and extension. Shock absorbers damp or control motion in a vehicle or Limit spring oscillations to smooth a vehicle's ride. One end is connected to the body or frame, the other to the axle or control arm. When compressed or extended, oil inside the shock is forced through small orifices, absorbing energy, damping spring action.



**Stabilizer bar** Used to keep the body from leaning excessively in sharp turns. It is made of spring steel and it fastens to both lower control arms and to the frame. When the body leans, it twists the bar and the bar's resistance to twisting limits body lean in corners.

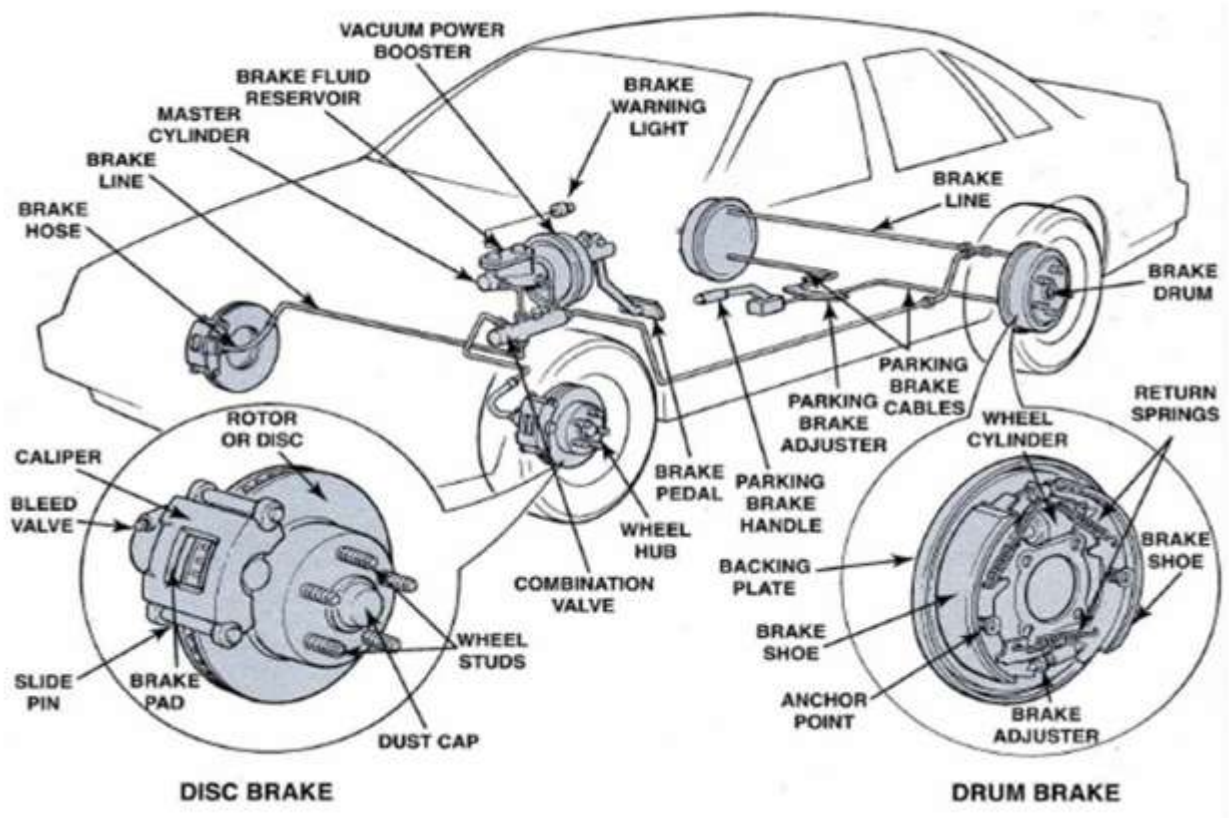



**Spring** supports the weight of the vehicle; permits the control arm and wheel to move up and down. Springs carry the weight of the vehicle and absorb shock forces while maintaining correct riding height. They are compressible links between the vehicle's frame and body and the tires. Doing this, they dampen road shock and provide a comfortable ride.



## Brake System

The main purpose of the braking system is to slow down or stop a vehicle.

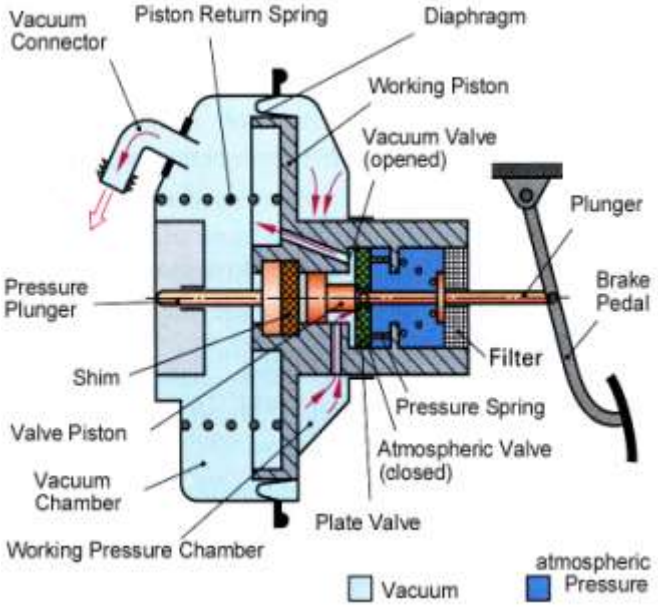



## Brake pedal

The brake pedal is designed in such a way that it can multiply the force from driver's leg several times before any force is even transmitted to the brake fluid. The brake pedal provides instant control over the brakes being applied and released.

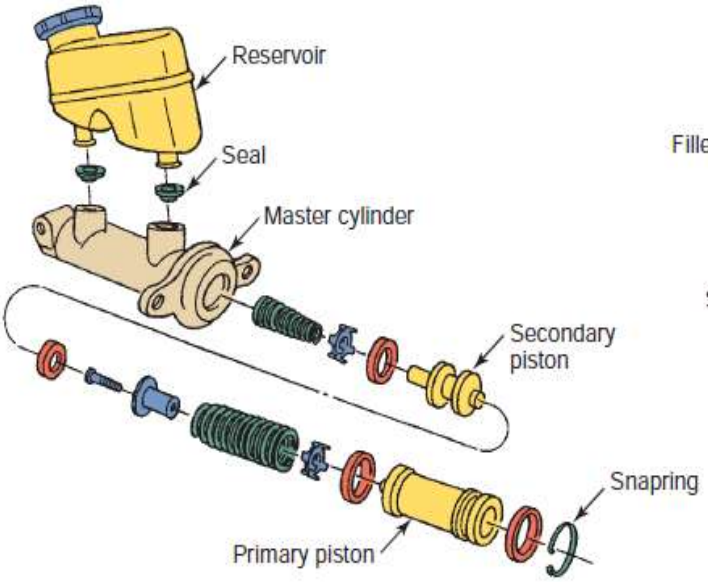
## Brake booster

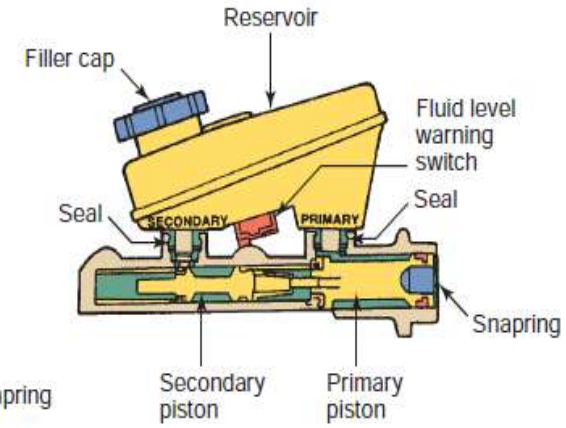
The brake booster, also known as the brake servo, increases the force applied by the brake pedal via either vacuum from the engine (or a vacuum pump on diesels), or via a hydraulic pump. Without the brake booster, the brakes feel very hard and require much more effort to slow the car. The booster only works when the engine is running.




**Master Cylinder Action**

The master cylinder then converts the action of you pressing on the brake pedal into hydraulic pressure. As you press the pedal it moves pistons within the cylinder which in turn applies pressure to the brake fluid forcing it around the system. The master cylinder has a brake fluid reservoir attached to the top of it to ensure there is always an adequate supply of fluid in the system whether the brakes are applied or released.



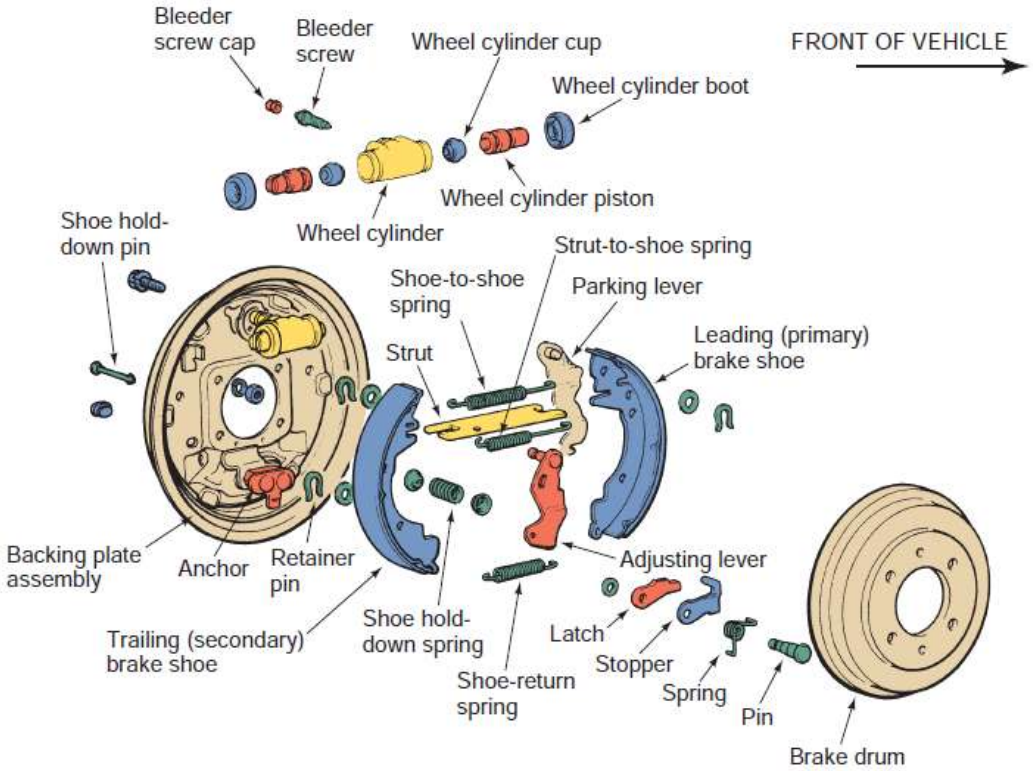
When driver press the brake pedal, it pushes on primary piston through a linkage. Pressure is built in the cylinder and the lines as the brake pedal is depressed further. The pressure between the primary and secondary piston forces the secondary piston to compress the fluid in its circuit. If the brakes are operating properly, the pressure will be same in both the circuits.

**Brake lines and hoses**

Brake lines and hoses consist of a series of thin metal pipes which connect the various components together to transfer the brake fluid around the system. Most of the pipes are made of metal, however, the area where the pipes meet the brake calipers needs to consist of flexible rubber hoses to allow the wheels to turn.

**Drum brakes**

A drum brake assembly consists of a cast-iron drum which is bolted to and rotates with the vehicle's wheel, and a fixed backing plate to which the shoes, wheel cylinder, automatic adjusters and linkages are attached.



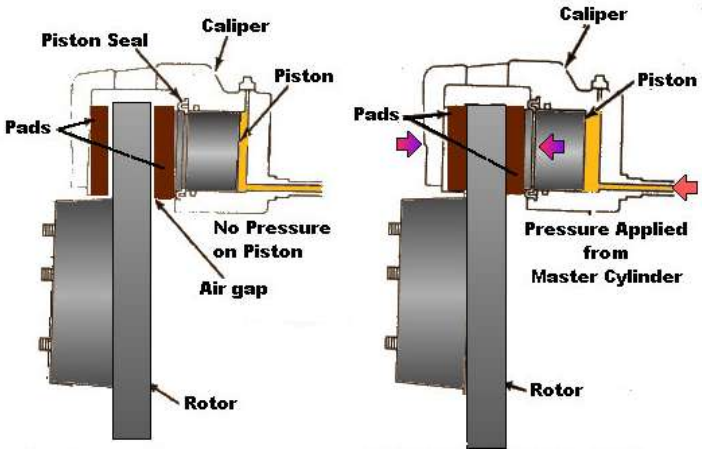

The shoes are surfaced with friction linings, which contact the inside of drum when brakes are applied. The shoes are forced outward by piston located inside the wheel

cylinder. As drum rubs against shoes, the energy of the moving drum is transformed to heat. This heat energy is passed into the atmosphere. When brake pedal is released, hydraulic pressure drops and the shoes are pulled back to their unapplied position by return springs.

**Disc brakes**

In disc brakes the friction elements are in the form of pads, which are squeezed or clamped about the edge of a rotating wheel. With automotive disc brakes, there is a separate wheel unit called the Rotor (commonly called as disc) alongside the vehicle's wheel. This rotor is made of cast iron. Since pads clamp against both sides of it, both sides are machined smooth. Usually the two surfaces are separated by a finned center section for better cooling (such rotors are called ventilated rotors or in common words as ventilated discs).The pads are attached to metal shoes, which are actuated by pistons, the same as with drum brakes.


The pistons are contained within a caliper assembly, housing the wraps around the edge of the rotor. The caliper is kept from rotating by way of bolts holding it to the car's suspension frame work.

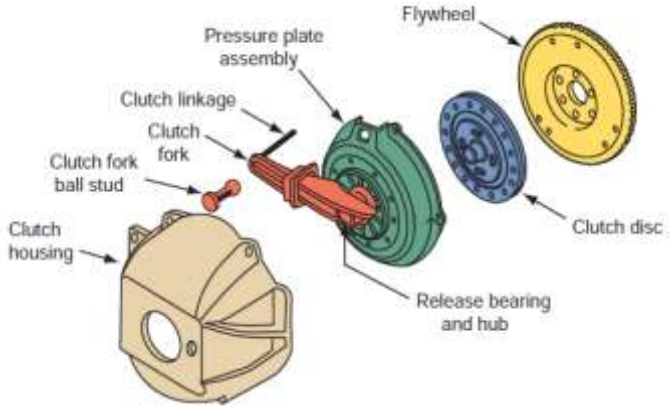


**Drive train system**

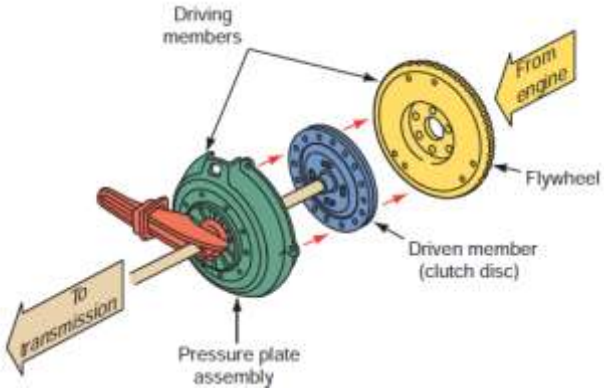
**Clutch:**

All manual transmissions require a clutch to engage or disengage the transmission. The clutch allows the engine to idle while the vehicle is stopped. It also allows for easy shifting between gears.

The clutch engages the transmission gradually by allowing a certain amount of slippage between the transmissions's input shaft and the flywheel. Below fig shows the components needed to do this: the flywheel, clutch disc, pressure plate assembly, clutch release bearing (or throw-out bearing), and the clutch fork.

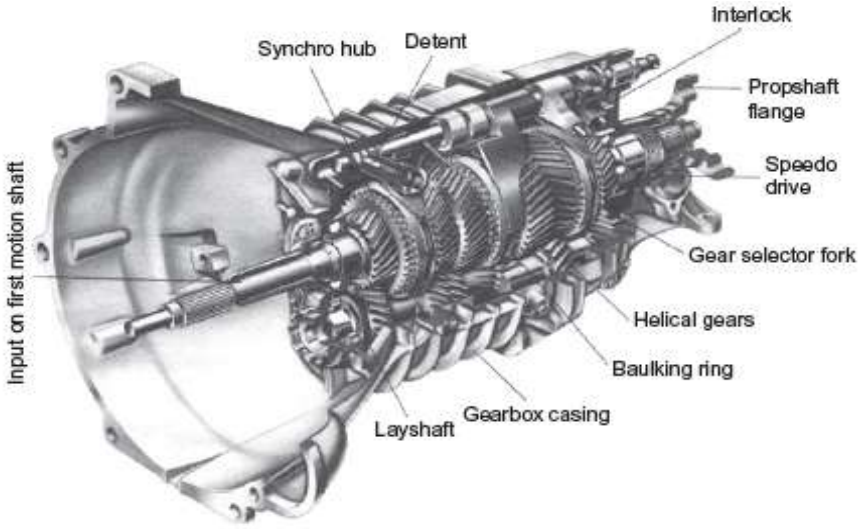



The pressure plate and flywheel are the drive or input members of the assembly. The clutch disc, also called the friction disc, is the driven or output member and is connected to the transmission's input shaft. As long as the clutch is disengaged (clutch pedal depressed), the drive members turn independently of the driven member, and the engine is disconnected from the transmission

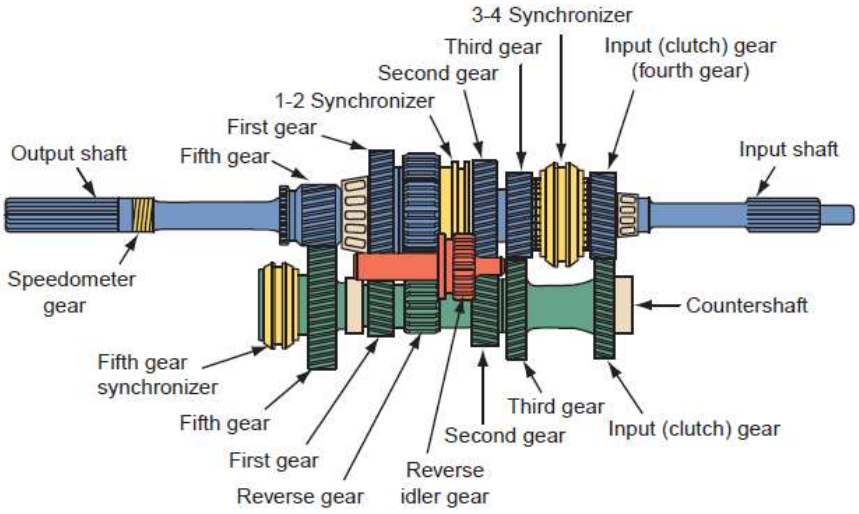


## Gearbox

A transmission system gearbox is required because the power of an engine consists of *speed and torque.* The transmission can adjust the proportion of torque and speed that is delivered from the engine to the drive shafts. The transmission also reverses the drive and provides a neutral position when required.




The gearbox converts the engine power by a system of gears, providing different ratios between the engine and the wheels. When the vehicle is moving off from rest, the gearbox is placed in first, or low gear. This produces a high torque but low wheel speed. As the car speeds up, the next higher gear is selected. With each higher gear, the output turns more quickly but with less torque.



**The drive line assembly** has several important functions. It must perform the following:

- Send turning power from the transmission to the rear axle assembly.
- Flex and allow up-and-down movement of the rear axle assembly.
- Provide a sliding action to adjust for changes in drive line length.
- Provide a smooth power transfer.

The drive line assembly consists of the following:

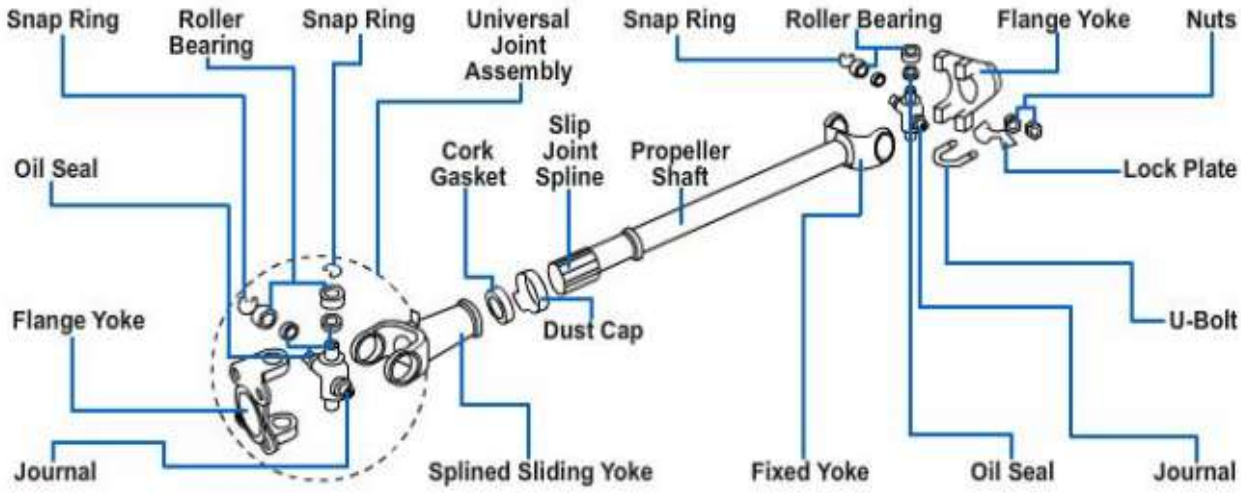
Slip yoke: connects the transmission output shaft to the front universal joint.

Front universal joint: the swivel connection that fastens the slip yoke to the drive shaft.

Drive shaft: a hollow metal tube that transfers turning power from the front universal joint to the rear universal joint.

Rear universal joint: a flex joint that connects the drive shaft to the differential yoke.

Rear yoke: holds the rear universal joint and transfers torque to the gears in the rear axle assembly.

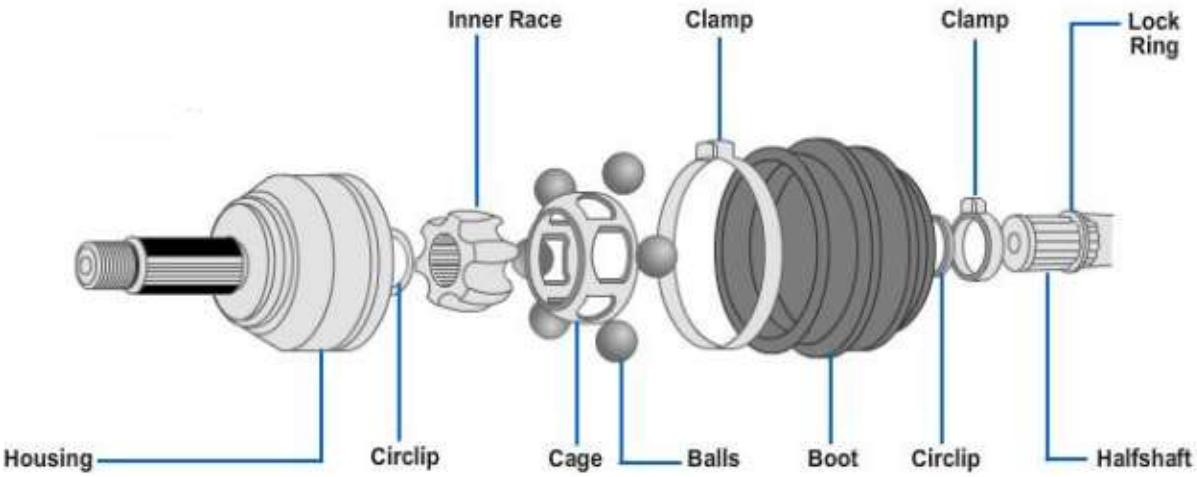



## Constant Velocity (CV) Joints

The speed fluctuations caused by the conventional universal joints do not cause much difficulty in the rear-wheel drive shaft where they have to drive through small angles only. In front-wheel drives, the wheels are cramped up to 30 degrees in steering. For this reason velocity fluctuations present a serious problem. Conventional universal joints would cause hard steering, slippage, and tire wear each time the vehicle turns a corner. Constant velocity joints eliminate the pulsations because they are designed to be used

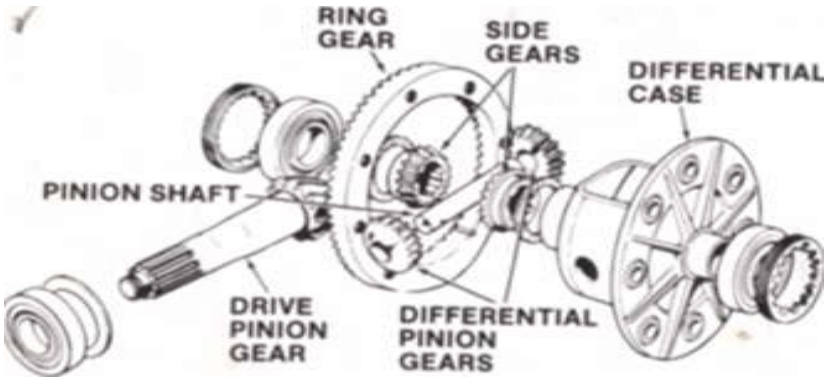
exclusively to connect the front axle shaft to the driving wheels. Basic operation of a CV joint is as follows:

- The outboard CV joint is a fixed joint that transfers rotating power from the axle shaft to the hub assembly.
- The inboard CV joint is a sliding joint that functions as a slip joint in a drive shaft for rear wheel drive vehicles.



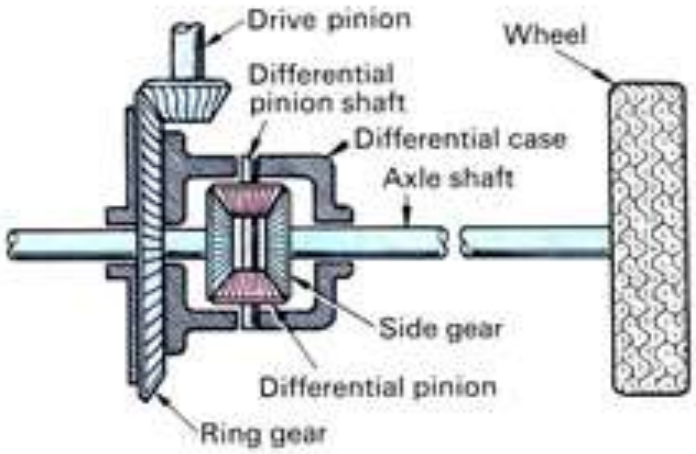

**Differentials**

The differential is located between the axles and permits one axle to turn at a different speed from that of the other. The variations in axle speed are necessary when a vehicle rounds a corner or travels over uneven ground. At the same time, the differential transmits engine torque to the drive axles. The drive axles are on a rotational axis that is 90 degrees different than the rotational axis of the drive shaft.



**Drive axles**

Axles are classified as either live or dead. The live axle is used to transmit power. The dead axle serves only as a support for part of the vehicle while providing a mounting for the wheel assembly.



| Self-Check - 1 | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Describe the purpose of the following basic automotive systems
   1.1. Lighting system
   1.2. Suspension system
   1.3. Steering system
   1.4. Fuel system
   1.5. Drive train system
   1.6. Engine
2. Write the function of the following components
   2.1. Shock absorber
   2.2. Wheel cylinder
   2.3. Clutch disc
   2.4. Brake shoe
   2.5. Steering gear box
   2.6. Differential

***Note:*** **Satisfactory rating - 5 points** **Unsatisfactory - below 3 points**

## Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

| Information Sheet 2 | Perform Troubleshooting process |
|---|---|

Trouble shooting process used for diagnosis of vehicle faults in which they are all in legal and systematic. It is a step by step representation of finding problems of system. When performing the troubleshooting process; follow the listed steps of troubleshooting processes.

Step 1: Confirm the symptom

Step 2: Gather information

Step 3: Consider the information and evidence gathered

Step 4: Locate the fault and its cause

Step 5: Repair the fault and its cause

Step 6: Check all systems and confirm fault is fixed.

1. Confirm the symptom

   Make sure that the customer's concern is valid (true).

   - Try to reproduce the symptoms described by the customer or have the customer demonstrate the symptom to you. If you do a road test- make sure it is done in a safe manner.

2. Gather information

   A. Question the customer closely about their concern. Once they leave the workshop you won't have easy access to them.

      - "When did you first notice the problem?
      - What conditions was the vehicle operating under at the time?
        - ✓ High load?
        - ✓ Light load?
        - ✓ In traffic?
        - ✓ Cruising on the freeway?
      - How long since the engine was started?
      - What repairs or service have been done recently?"

B. Try the “look and feel” test, if the problem allows it. Carefully inspect suspect areas, looking for obvious leaks, breaks, stains, noises, loose or damaged wiring etc.

C. Use other information sources:

- Your workplace colleagues- have any of them come across these symptoms before?
- On-board diagnostic trouble codes
- Service bulletins relevant to that vehicle to see if it is a known problem or subject to a recall
- Workshop manuals have trouble-shooting guides:

Example of the sort of information a workshop manual might provide:

| Symptom | Possible fault |
|---|---|
| Engine overheats | • Loss of coolant<br>• Belt tension incorrect<br>• Radiator fins obstructed<br>• Thermostat stuck closed<br>• Cooling system passages blocked by rust, scale or other foreign material<br>• Water pump not working- impeller loose, eroded |

- Trade associations have technical information lines for advice and/or vehicle specifications Such as;
  - ✓ the Australian automobile chamber of commerce (aacc), or
  - ✓ the institute of automotive mechanical engineers (iame)
- Commercial data suppliers- companies who sell automotive technical and repair information in book or digital form.

3. Consider the information and evidence gathered

At this stage you have eliminated most of the possibilities, and have strong suspicions about one or two others. You may need to do some more tests, or partially dismantle a system, to finally identify the fault.

- What you have learned from your investigation and any tests you have carried out so far?
- What things are not possible faults, based on the evidence?
- What things could be causing the problem?

Example: The complaint is "*overheating all the time*", and you have found that the vehicle recently had the head gasket replaced. You would probably do some more tests to see if a failure of that repair was causing the symptoms.

4. Locate the fault and its cause

   If all has gone well you will now be able to confidently identify the faulty component or system.

   Example: The engine is overheating, and the fault is "the cooling system passages are blocked with rust".

- What caused the rust build-up?
  - ✓ You suspect that the coolant and corrosion inhibitor is old, worn out, or at the wrong concentration.
  - ✓ A further test of the coolant should confirm this. You now know what the fault is, and what caused the fault.

5. Repair the fault and its cause

   Decide on the most suitable repair to eliminate the fault.

   Example: Thorough flushing and cleaning of the entire system, including blocked passages, replacement as required of welsh plugs and any other consumable items like hoses, and filling with new coolant.

6. Check all systems and confirm fault is fixed.

   Check all related systems, as well as the faulty one, to confirm that: the original symptoms are no longer present under any operating conditions, and no other faults have been introduced.

| Self-Check -N | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define troubleshooting.
2. Describe trouble shooting processes.
   - 2.1. ----------
   - 2.2. ----------
   - 2.3. ----------
   - 2.4. ----------
   - 2.5. ----------
   - 2.6. ----------

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

***Note:*** **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

| Information Sheet 3 | Forward Report |
|---|---|

**Report and document diagnosis processes**

After completion of diagnosis tasks in the automotive workshop a technician should write a report and documents in a standard way to be able to present/ record results of activities.

Why is it important to write a report in a standard way? It helps to make sure that:

- All the important parts of the work are covered
- Another person can understand what has been done
- Another technician can repeat your work if necessary (if it is part of a research or development project)

Why do we need to document the diagnostic process?

Recording information about diagnostic processes is important so that:

- The technician can keep track of the process ***e.g*** tests done and their results
- The technician can see the build-up of information which will help them eventually recognize the fault
- The business can communicate accurately with the customer from the start of the diagnostic procedure until the repair is completed and paid for
- The business can obtain authority to repair at the appropriate stages as the procedure is worked through
- There is an accurate record if there is any dispute over the work done
- There is a service record can be a helpful reference for future jobs.

**Parts of a Report**

**Contents**

- Useful for longer reports ( more than a few pages)
- Helps a reader to quickly find what they want.

**Introduction**

- Explains the reason for writing the report (why was the report requested? Who asked for it?)
- Summarises the symptom and task that the report covers.

**Procedure**

- Explains exactly what was done during the diagnosis and repair. Don't leave out anything important
- Identify any special test equipment used
- A description of the conditions under which a test was done eg ambient temperature and humidity for a performance test on a vehicle's air conditioning system.

**Results of tests and investigations**

- Record measured test results
- A report on component condition (serviceability)
- Might give details of specific test procedure/s, if that could affect the test outcome eg measuring a/c pressures with or without a workshop fan in front of the condenser.

**Conclusion**

- Explain what you have discovered/ observed/ concluded from your investigation of the problem
- What you believe caused the problem
- What you have done to repair it
- If you haven't solved the problem, explain why.

**Recommendations**

- Recommend any further action you believe is needed to make sure the problem stays fixed (eg if you have just replaced an air filter element blocked with dust from unmade country roads, you might advise that the service intervals for the vehicle should be shortened from 10,000km to 5,000 km.)

## Report on Job No. 1234 - Radio losing tuning pre-sets

**Introduction**

Report for Mr. A Person, owner of Daewoo Lanos, reg no. ABC 123, VIN KLATF08YE3B12345xxx. Re: diagnosis and repair of the fault responsible for the following symptom: Radio loses tuning pre-sets intermittently.

**Procedure**

Vehicle delivered with radio un-tuned (pre-sets had been lost). Owner said he could re-tune the radio but the settings would be lost at irregular intervals, but only after an engine start.

Technician carried out the following checks:

Re-tuned radio without difficulty, and checked for normal operation- it performed correctly.

Visual inspection of radio and harness after re-tuning - no fault found.

Wriggle test in an attempt to re-create the problem- no fault found.

A series of engine re-starts. After the 11th re-start, the radio had lost its tuning pre-sets. Cranking speed was slower than normal, so battery volt-drop suspected as the cause of the problem.

A cranking voltage test indicated a battery problem, although a hydrometer test showed it to be fully charged.

Starter current draw was tested using a good slave battery, and alternator output was measured. Both were found to be within specifications.

A battery capacity test indicated a faulty battery. The battery was replaced with a newN480ZZ.

**Results** of tests and investigations

| | |
|---|---|
| Operation of re-tuned radio | normal |
| Visual check | no faults found |
| Wriggle test | no faults found |
| Cranking voltage drop | 10 volts- LOW |
| Starter current draw | 80 amps- OK |
| Alternator output | 14.4 volts @ 50 amps- OK |
| Battery specific gravity | 12.65- OK |
| Battery capacity test | 40%- faulty |

**Diagnosis**

Inspection and testing of the systems connected with the radio showed that the radio circuit was operational, but that a faulty battery suffered excessive voltage drop on starting, leading to radio memory loss.

**Repair**

A new battery fixed the problem. Repetition of the start, re-start test confirmed the fault was eliminated.

**Recommendations**

That this vehicle be regularly serviced, with special attention to regular checks of battery electrolyte, terminal cleanliness, and mounting security to maximise battery service life.

## STEADY EDDIE REPAIRS

**Diagnostic Report on Job No. 5678**

**Introduction**

**Procedure**

**Results of tests and investigations**

**Conclusion**

**Recommendations**

| Self-Check | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define report in the workplace.
2. Why is it important to write a report in a standard way?
3. List parts of a report.

***Note:*** **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

| **Operation Sheet - 1** | **Troubleshoot headlight** |
|---|---|

Operation sheet title: Troubleshooting headlight

Purpose: - Used to know the likely causes of headlight problem.

Tools and equipment's:

- Screw driver
- Test light
- Multi-meter
- Fuse
- Head lamp

**Procedures:**

Step 1: Headlight do not work

Step 2: Information about headlight problem

- Question to customer:
  - ✓ When does the problem occur?
  - ✓ How do you observe the problem?
  - ✓ Do you use any inspection?
- Manual information:
  - ✓ Go to troubleshooting section and refer the problem

| Symptom | Problem/Fault |
|---|---|
| Lights do not work | • Bulbs blown<br>• Fuse blown<br>• Loose or broken wiring/connector/ fuse<br>• Relay not working<br>• Corrosion in light unit<br>• Switch not making contact |

  - ✓ Location of parts of the system

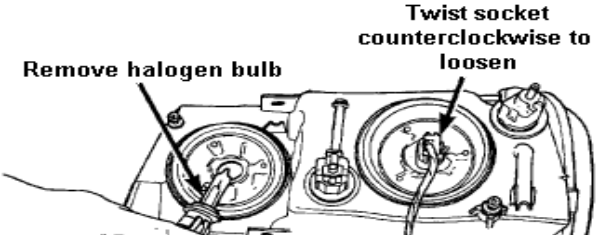
Step 3: Inspect the headlight problem.

- Inspect the main fuse
- Inspect fuse
- Inspect the bulbs/ lamps
- Inspect wires through the circuit

Step 4: Locate the problem of headlight and identify the cause

- Blown fuse





- Blown lamp
- Loose connection
- Corrosion/ rust

Step 5: Repair the fault and cause of headlight

- Replace the main fuse
- Replace the lamp
- Repair the connection

Step 6: Check the headlight and confirm its fault is fix.

- If the lamp is ok, but it shows dim light, use a multi meter and check resistance in the circuit and visually check discolored lenses or reflectors.

**Lamp OK**

- If the fuse is ok, use a volt meter or 12-volt test light to check for power at the fuse. Most headlight circuits are on (powered) all the time, so there should be voltage to the power side of the fuse. No power at the fuse would indicate a wiring fault possibly in the fuse block or in the wiring between the fuse block and the battery. You will need a wiring diagram to trace the wiring circuit and find the fault.

**Fuse OK**

- If the fuse has blown, replace it with a new fuse (same amp rating) and try again. If the fuse blows immediately, there is a short in the headlight circuit that will have to be found and repaired before the headlights will work. If the fuse does not blow and the headlights work, problem solved. There may be in intermittent short or overload that caused the fuse to fail.

**Replace fuse/ Repair short circuit**

- Next check the headlight relay, pull it out and shake it. If anything inside rattles, replace the relay.

**Relay OK**

*Source: http//:www.AA1Car.com*

| **Operation Sheet - 2** | **Troubleshoot Headlights out of adjustment** |
|---|---|

Operation sheet title: Troubleshooting headlight out of adjustment

Purpose: - Used to know the likely causes of headlight out of adjustment problem.

Tools and equipment's:

- Screw driver
- Test light
- Multi-meter
- Fuse
- Head lamp
- Headlight beam adjuster/tester

**Procedures:**

Step 1: Headlight is out of adjustment

Step 2: Information about headlight problem

- Question to customer:
  - ✓ When does the problem occur?
  - ✓ How do you observe the problem?
  - ✓ Do you use any inspection?
- Manual information:
  - ✓ Go to troubleshooting section and refer the problem

| Symptom | Problem/Fault |
|---|---|
| Headlights out of adjustment | • Suspension fault<br>• Loose fittings<br>• Damage to body panels<br>• Adjustment incorrect |

  - ✓ Location of the parts and adjustment points.

Step 3: Inspect the headlight problem.

- Check suspension parts
- Check visually body panels (fender, hood panels, lamp holder)
- Check fitting parts for loose
- Inspect headlight beam direction

Step 4: Locate the problem of headlight and identify the cause

- Suspension fault
- Loose fittings
- Damage to body panels
- Adjustment incorrect

Step 5: Repair the fault and cause of headlight

- Repair/replace suspension parts
- Repair loose fittings
- Repair body panels
- Adjust the headlight beam

Step 6: Check the headlight and confirm its fault is fix.

- If the suspension is ok, check fittings for loose.

**Suspension OK**

- Check adjustment of the headlight beam, if it is not properly adjust, check the above again and make it adjust ok.

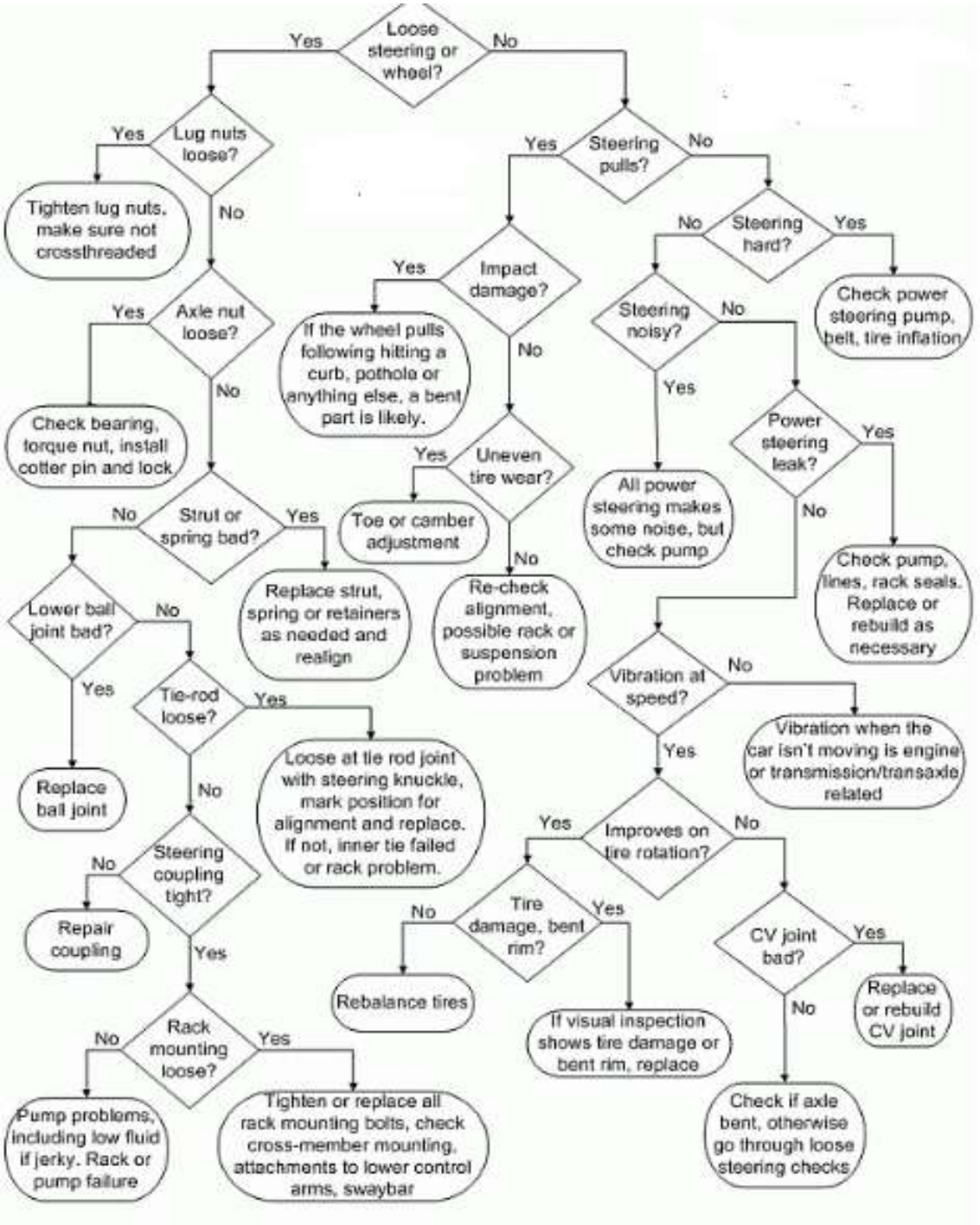

*Source: http//:www.AA1Car.com*

| **Operation Sheet - 3** | **Troubleshoot Steering system** |
|---|---|

Operation sheet title: Troubleshooting steering system

Purpose: - Used to know the likely causes of steering problem.

**Diagnostic flow chart:**

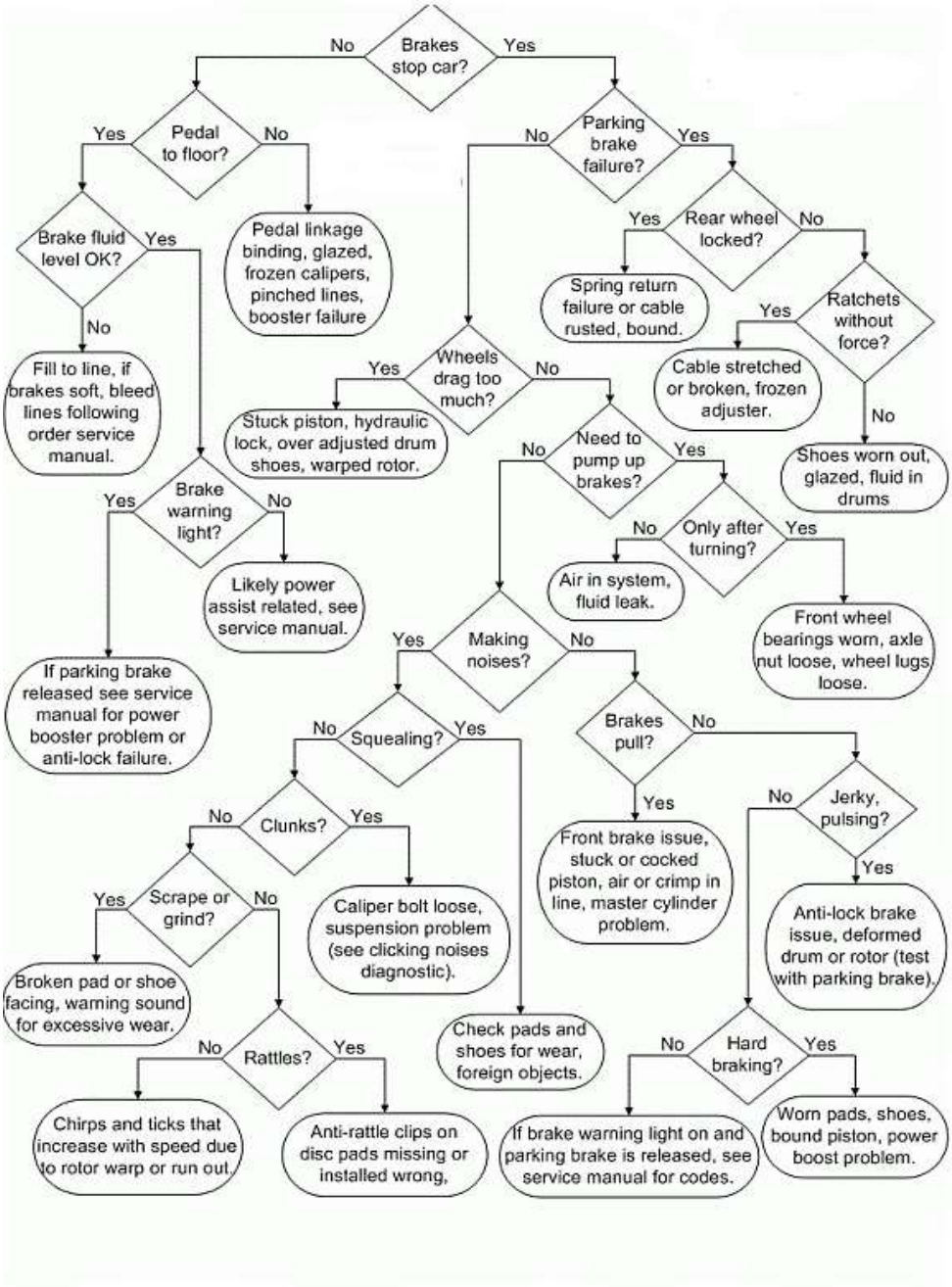


| Operation Sheet - 4 | Troubleshoot brake system |
|---|---|

Operation sheet title: Troubleshooting brake system

Purpose: - Used to know the likely causes of brake problem.

**Diagnostic flow chart:**



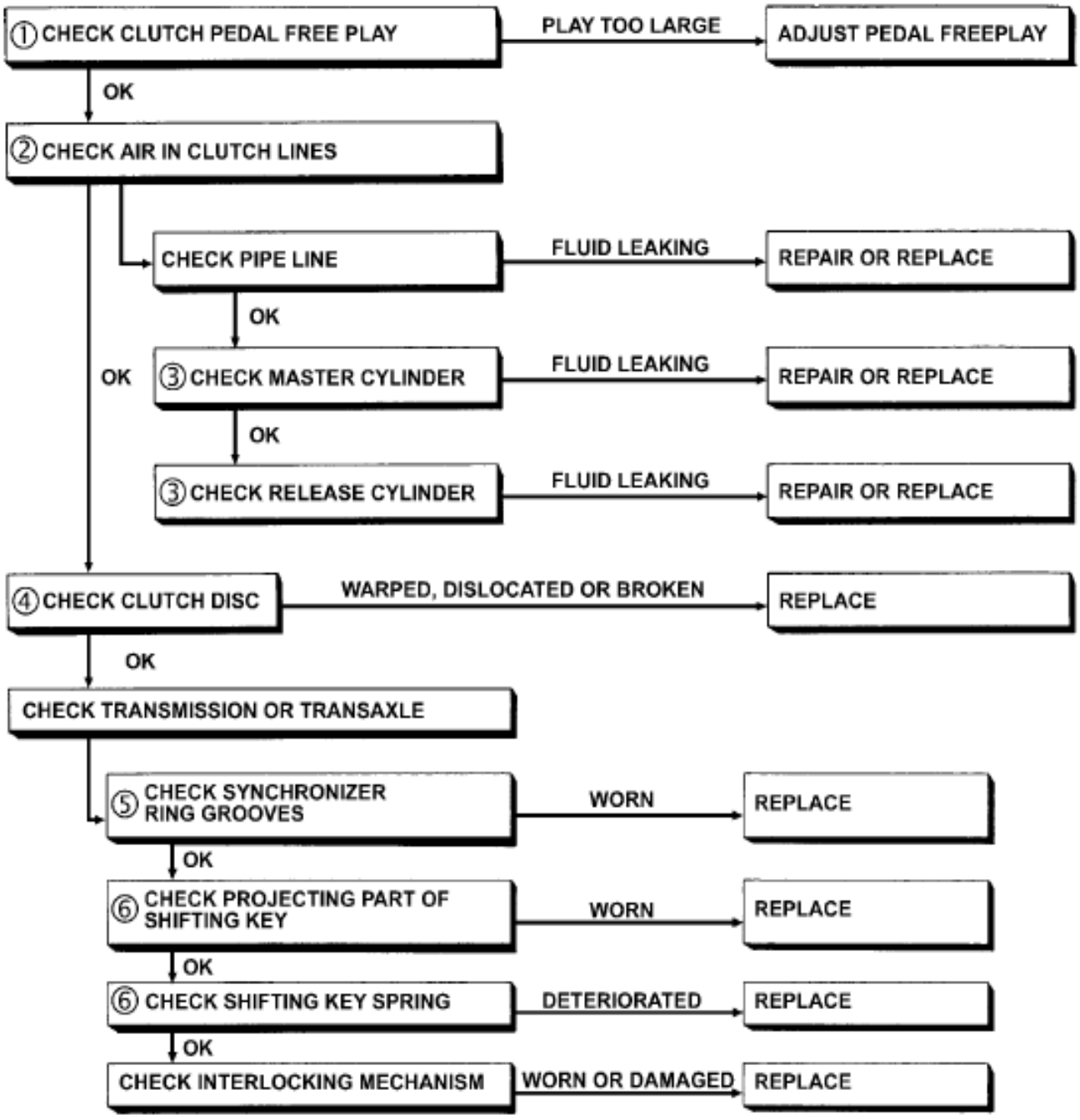
| Operation Sheet - 5 | Troubleshoot transmission |
|---|---|

Operation sheet title: Troubleshooting transmission

Purpose: - Used to know the likely causes of transmission problem.

**Diagnostic Flowchart:**

Hard to Shift or Will Not Shift

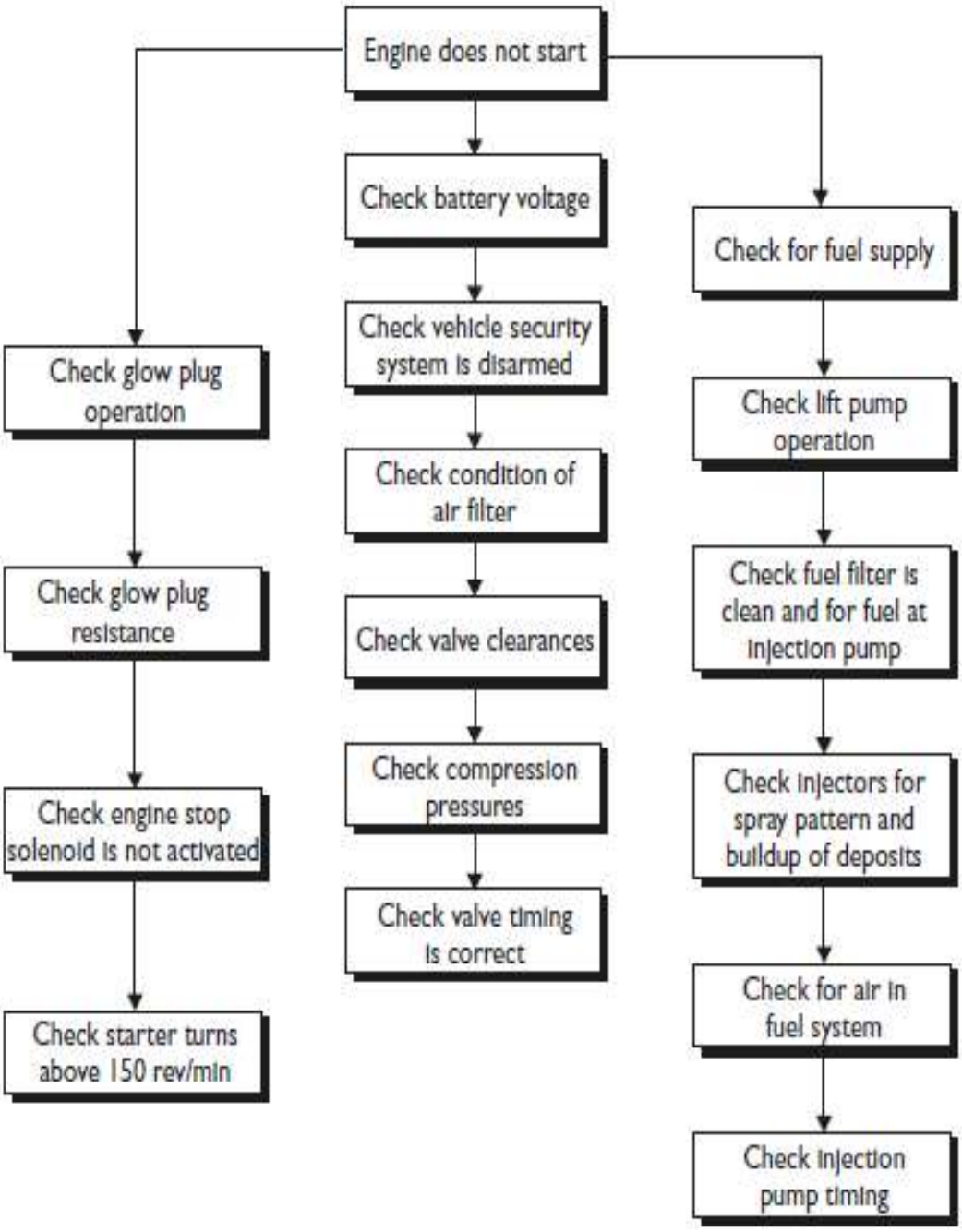


| Operation Sheet - 6 | Troubleshoot Engine |
|---|---|

Operation sheet title: Troubleshooting engine

Purpose: - Used to know the likely causes of engine problem.

**Diagnostic Flowchart:**



| LAP Test | Practical Demonstration |
|---|---|

Name: _____ Date: _____

Time started: _____ Time finished: _____

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 3 hour.

Task 1. Trouble shoot lighting system

Task 2. Trouble shoot steering system

Task 3. Troubleshoot brake system

Task 4. Troubleshoot manual transmission

Task 5. Troubleshoot engine

## List of Reference Materials


- *Diagnosis And Troubleshooting Of Automotive Electrical, Electronic, And Computer Systems S I X T H E D I T I O N, James D. Halderman*
- *Advanced Automotive Fault Diagnosis; Automotive Technology: Vehicle Maintenance and Repair, Third Edition, Tom Denton*
- *LEARNER WORKBOOK; AURT366108A ; Carry out diagnostic procedures*
- *Automotive Technician Training (ATT) Level 1; TOM DENTON*
- *Advanced Automotive Fault Diagnosis; Second edition, Tom Denton*
- *Advanced Automotive Fault Diagnosis; Automotive Technology: Vehicle Maintenance and Repair, Fourth Edition, Tom Denton*
- *Automotive Technician Training (ATT) Level 2; TOM DENTON*

- *http://www.aesharenet.com.au/FfE2*
- *www.attraining.com*
- *www.ifitjams.com; copyright 2008 by Morris Rosenthal*
- *http://www.slideshare.net>anigavai>suspension-system*
- *http//:www.AA1Car.com*