CHAPTER NO. 1

Introduction to Industry & Atul motors

1.1 Introduction to industry
1.2 Introduction to Atul motors
1.3 Hierarchy of Atul motors
1.4 Service department
1.5 Bodyshop department
1.6 Modified layout
1.1 Introduction To Industry

Maruti Udyog Limited was established in February 1981, though the actual production commenced only in 1983. It started with the Maruti 800, based on the Suzuki Alto kei car which at the time was the only modern car available in India. Its only competitors were the Hindustan Ambassador and Premier Padmini. Originally, 74% of the company was owned by the Indian government, and 26% by Suzuki of Japan. As of May 2007, the government of India sold its complete share to Indian financial institutions and no longer has any stake in Maruti Udyog.

In 1970, a private limited company named Surya Ram Maruti technical services private limited (MTSPL) was launched on November 16, 1970. The stated purpose of this company was to provide technical know-how for the design, manufacture and assembly of "a wholly indigenous motor car". In June 1971, a company called Maruti limited was incorporated under the Companies Act. Maruti Limited went into liquidation in 1977. Maruti Udyog Ltd was incorporated through the efforts of Dr V. Krishnamurthy.

In 1982, a license & Joint Venture Agreement (JVA) was signed between Maruti Udyog Ltd. and Suzuki of Japan. At first, Maruti Suzuki was mainly an importer of cars. In India's closed market, Maruti received the right to import 40,000 fully built-up Suzukis in the first two years, and even after that the early goal was to use only 33% indigenous parts. This upset the local manufacturers considerably. There were also some concerns that the Indian market was too small to absorb the comparatively large production planned by Maruti Suzuki, with the government even considering adjusting the petrol tax and lowering the excise duty in order to boost sales. Finally, in 1983, the Maruti 800 was released. This 796 cc hatchback was based on the SS80 Suzuki Alto and was India’s first affordable car. Initial product plan was 40% saloons, and 60% Maruti Van.Local production commenced in December 1983. In 1984, the Maruti Van with the same three-cylinder engine as the 800 was released and the installed capacity of the plant in Gurgaon reached 40,000 units.

In 1985, the Suzuki SJ410-based Gypsy, a 970 cc 4WD off-road vehicle, was launched. In 1986, the original 800 was replaced by an all-new model of the 796 cc hatchback Suzuki Alto and the 100,000th vehicle was produced by the company. In 1987, the company started exporting to the West, when a lot of 500 cars were sent to Hungary. By 1988, the capacity of the Gurgaon plant was increased to 100,000 units per annum.

Maruti Suzuki has two manufacturing facilities in India. Both manufacturing facilities have a combined production capacity of 14,50,000 vehicles annually. The Gurgaon manufacturing facility has three fully integrated manufacturing plants and is spread over 300 acres (1.2 km2). The Gurgaon facilities also manufacture 240,000 K-Series engines annually. The Gurgaon Facilities manufactures the 800, Alto, WagonR, Estilo, Omni, Gypsy, Ertiga, Ritz and Eeco.
The Manesar manufacturing plant was inaugurated in February 2007 and is spread over 600 acres (2.4 km²). Initially it had a production capacity of 100,000 vehicles annually but this was increased to 300,000 vehicles annually in October 2008. The production capacity was further increased by 250,000 vehicles taking total production capacity to 800,000 vehicles annually. The Manesar Plant produces the A-star, Swift, Swift DZire, SX4, Vitara Brezza, Ritz, Baleno and Celerio. On 25 June 2012, Haryana State Industries and Infrastructure Development Corporation demanded Maruti Suzuki to pay an additional Rs 235 crore for enhanced land acquisition for its Haryana plant expansion. The agency reminded Maruti that failure to pay the amount would lead to further proceedings and vacating the enhanced land acquisition. It plans to set up a plant in Gujarat and has acquired 600 acres of land.

In 2012, the company decided to merge Suzuki Powertrain India Limited (SPIL) with itself. SPIL was started as a JV by Suzuki Motor Corp. along with Maruti Suzuki. It has the facilities available for manufacturing diesel engines and transmissions. The demand for transmissions for all Maruti Suzuki cars is met by the production from SPIL.

![Fig 1.2 Maruti Suzuki](image-url)
• Some of Maruti Suzuki Product

Fig 1.3 Maruti Products
Suzuki Alto and was India’s first affordable car. Initial product plan was 40% saloons, and 60% Maruti Van. Local production commenced in December 1983. In 1984, the Maruti Van with the same three-cylinder engine as the 800 was released and the installed capacity of the plant in Gurgaon reached 40,000 units.

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Fig 1.4 Maruti suzuki
1.1.1 Awards and recognition of Maruti Suzuki

The Brand Trust Report published by Trust Research Advisory, a brand analytics company, has ranked Maruti Suzuki in the thirty seventh position in 2013 and eleventh position in 2014 among the most trusted brands of India. Blue bytes News, a news research agency, rated Maruti Suzuki as India's Most Reputed Car Company in their Reputation Benchmark Study conducted for the Auto (Cars) Sector which launched in April 2012. In 1994 Maruti Suzuki produced its 1 millionth vehicle since the commencement of production, being the first company in India to do so. Maruti also launches a 24-hour emergency on-road vehicle service, the first of its kind in the country. In 2000 Maruti became the first car company in India to launch a Call Centre for internal and customer services. In 2004 the Alto became India’s new bestselling car, overtaking the Maruti 800.

Fig 1.5 Awards & Achievement
1.2 Introduction to Atul Motors pvt Ltd

- The founder of organization is Mr. Jayantibhai Chandra. In 1990 he started production ‘Khusbu Rickshaw’ in the city of Jamnagar. Later on in the year 1995, he established production plant of auto rickshaw in outskirts of Rajkot in Shapar-Veraval. He named it as ‘Atul Shakti’. The name ‘Atul’ is used in all enterprises of Mr. Jayantibhai Chandra in the memory of his beloved son Late. Atul Chandra.

  Jayantibhai was a native of Jamnagar city so he thought to develop the city therefore most his entrepreneurship begins from this city. After having experience of 5 years in production, he started manufacturing of rickshaw designed by him namely Atul Shakti. As a result after a decade his continuous efforts made him one of the leading manufacturers of auto rickshaws. After the successful production of auto rickshaws, Atul Group started dealership of Maruti Suzuki cars which is under the leadership of successor Mr. Alpesh Jagdishbhai Chandra. In the year 2000, Atul Motors was started possessing dealership of Maruti Suzuki cars at Jamnagar.

  Initially workshop was at Hapa, Jamnagar city and Motikhavdi. In 2005, authorized dealership of Maruti Suzuki was started at Tagore road, Rajkot. Later on other two workshops were started in Rajkot at University road in 2006 and Kuvadva road in 2010. Later the network of Atul Motors was spread in the entire region of Saurashtra by starting workshops as given below:

  1. Gondal
  2. Wankaner
  3. Jasdan
  4. Rajula
  5. Amreli
  6. Porbandar

  Today Atul Motors owns 4 showrooms and 12 workshops providing example of excellence in the field of automobile. Therefore Atul Group provides employment to a huge number of people by starting automotive workshops at small cities in Gujarat. Atul Enterprise is distributor of Maruti Genuine spare parts in entire Saurashtra and Kutch region. It also distributor of spare parts for Mahindra and Mahindra in Saurashtra – Kutch. Atul Group is also a authorized dealer of Mahindra and Mahindra, Honda (two wheelers) and Enfield India in Jamnagar.
Atul Group has been in Automobile Field since last 35 years. Atul Auto Ltd [Pioneer of Diesel Three Wheeler Rickshaw Manufacturer] is located at Rajkot

Organisation

Khushbu Auto Finance Ltd.

Auto Finance Company

Atul Motors Pvt Ltd

Maruti Suzuki Dealership

Atul Auto Agency

Honda Motor Cycle Dealership

Atul Petroleum

IBP Petroleum

Atul Auto Limited

Manufacturing of Diesel 3-Wheelers [at Rajkot]

Atul Auto Industries

Manufacturing of Diesel 3-Wheelers [at Jamnagar]

New Chandra Motor Cycle House

Royal Enfield Motor Cycles

Fig 1.6 Atul Motors Show room
1.3 Hierarchy of Atul Motors

Fig 1.7 Hierarchy
1.4 Industry Garage Layout

1.4.1 Service Department (Ground Floor)

General Manager is the head of any automotive workshop. Managers of different departments work under the general manager. Service Manager is head of the service department. Floor supervisors, computer operator, tool room operator and service advisors work under guidance of service manager. We can also find store room and engine room in service area. Costumer records and costumer related problems are managed by costumer relationship department. Floor supervisor manages the technicians and helpers and sees to that the vehicle is serviced on time. Whereas, costumer are attended by the advisors and make job cards according to the requirements.

Fig 1.8 Service area
1.4.2 Body shop Department (First Floor)

- Body shop Manager is the head of this department. Here denters and body shop mechanics repairs vehicles under guidance of floor supervisor and advisors. Vehicles with major or minor damages are being repaired in this department.

Fig 1.9 Body shop Area
1.4.3 Modified Garage Layout

- The workshop is located in a residential area, therefore the parking issue was a necessity. Therefore, parking space has been increased within the workshop so that parking could be avoided on the road.

Fig 1.10 Modified layout
CHAPTER 2

Equipments And Instruments Used In Automobile Industry

2.1 Major equipments
2.2 Hand Tools used in Workshop
2.3 Power tools used in Workshop
There are many tools and equipments used in the automobile industry which is a basic requirement. They are mainly power tools and hand tools used for repairing. They are given as follows:

**2.1 Major Equipments**

2.1.1 Wheel Alignment machine
2.1.2 Tyre inflator
2.1.3 Multi car scanner
2.1.4 Tyre changer
2.1.5 Brake/Clutch bleeding machine
2.1.6 Wheel Balancing machine
2.1.7 Two post car lift
2.1.8 Tool Trolley
2.1.9 Chain pulley blo
2.1.10 Injector Cleaner CEA-05
2.1.11 Floor jack

**2.2 Hand Tools Used In Workshop**

2.2.1 Screwdrivers
2.2.2 Spanner and Wrenches
2.2.3 Pliers
2.2.4 Filler Guage
2.2.85 Hammer
2.2.6 Ratchet handel
2.2.7 Sliding T handel
2.2.8 Allen ke
2.2.9 Combination wrench
2.2.10 Flare nut wrench
2.3 Power tools used in Workshop

2.3.1 Air gun

2.3.2 Spray gun

2.3.3 Drill

2.3.4 Bench grinder
2.1.1 Wheel Alignment Machine

- Wheel alignment is part of standard automobile maintenance that consists of adjusting the angles of the wheels so that they are set to the car maker's specification. The purpose of these adjustments is to reduce tire wear, and to ensure that vehicle travel is straight and true (without "pulling" to one side). Alignment angles can also be altered beyond the maker's specifications to obtain a specific handling characteristic. Motorsport and off-road applications may call for angles to be adjusted well beyond "normal" for a variety of reasons. Approximate cost of it is Rs 2-5 lakhs.

Fig 2.1 Wheel Alignment machine

<table>
<thead>
<tr>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meas.</td>
</tr>
<tr>
<td>Toe</td>
</tr>
<tr>
<td>Individual Toe</td>
</tr>
<tr>
<td>Camber</td>
</tr>
<tr>
<td>Caster</td>
</tr>
<tr>
<td>SAI / KPI</td>
</tr>
<tr>
<td>Set-Back</td>
</tr>
<tr>
<td>Thrust Angle</td>
</tr>
</tbody>
</table>

Table 2.1 wheel alignment machine
2.1.2 Tyre inflator

- Digital Tyre Inflators that are provided in styles such as wall mounted, and Floor standing pedestal or Air Cabinet & Air Towers. They are widely used in petrol pumps, automobile garages, tyre shops and service centers, these tyre inflators are highly sleek and appreciated for their long service life. Approximate cost of tyre inflator is ranging from Rs 10000 to Rs 25000.

**Specification**

- Designed for petrol pumps and service centers
- Extremely rugged and reliable design.
- Large backlit 1" Dual LCD Display.

2.2 Tyre Inflator

- Automatic filling speed adjustment using intelligent software ensure fast inflation. Safe with self diagnostics and always confirms a high set point to avoid wrong set point entry.
- Range up to 135 psi, makes it suitable for all vehicles including heavy trucks.
- selection for PSI and Bar.
- Air tower cabinets and air-towers are optional.
2.1.3 Multi car scanner

- It has 32 bit Linux System with 24 column thermal printer along with touch screen. Display Data Streaming in wave form which is used for diagnosis. Covers all Indian & Imported vehicles available on Indian roads and complete after sales service available all over India

Reliable Hardware proven platform, software & technology, over 80,000 X-431 units sold worldwide. It is also available in Blue-Tooth & Color Display Models. Up gradation via Internet is periodically free of cost and no compulsion on software up gradation after I year.

Fig 2.3 Multi car scanner

- It covers functions like reading OTC, erasing DTC, reading live data, actuation test, cruise control, adaptation, immobilizer, Can Bus II Connector System (optional). Covering heavy duty diesel and gas-fueled vehicle models of 12V & 24V voltage. Compact design for convenient use and has color touch screen.

**Specification**


- Display: LCD backlit 320x240 resolutions.

2.1.4 Tyre Changer

- Tyre changer is made of Toughest and robust steel body. This tyre changer ensures easy fitting and removal of tyre within very short time without any hassle. The powerful bead-breaker is operated by a double action cylinder (186mm) with drawn high tensile alloy steel barrel designed to last for a long time even under unfavorable conditions such as humidity/poor lubrications etc. As soon as a wheel has been placed between the rubber support bracket and the bead breaking plate, the pneumatic arm can be actuated by means of paddle. The arm exerts a break force of 16kn at 12bar which helps in relieving even the difficult to shift type bead from the rim without any risk of damage.

**Specification:**

- **External Rim Clamping:** 10” to 18”
- **Internal Rim Clamping:** 10” to 20”
- **Wheel Rim Width:** 10”
- **Max. Wheel Dia:** 40” (1010mm)
- **Compressed Air Required:** 6 to 12Bars
- **Motor:** 0.75kw/1HP/3phase/412V or 0.75kw/1HP/1Phase/230V
- **Bead Breaking Pressure:** 16.5kn at 12Bar

![Tyre Changer Image](image-url)
2.1.5 Brake/Clutch bleeding machine

- The air operated 3-chamber brake bleeding device is suitable for bleeding the hydraulic brakes & clutches of all motor vehicles. The pressurized (8-10 bar) air reserve chamber enables several bleeding operation to be carried out without having to recharge the device. The brake-bleeding device is equipped with an elastic inner membrane which hermetically separates the oil from the air, thus avoiding the risk of emulsion. It is also suitable for system with braking control & ABS (max. At 1 bar)

**Specifications:**

- Bleeder Reservoir Capacity: 1.3 quarts (1.2 liters)
- Working Pressure: 60 – 150 psi (4.1 – 10.3 bar)
- Vacuum @ 90 psi (6.2 bar): 20 in. Hg (68 kPa)
- Air Consumption @ 90 psi (6.2 bar): 7.3 cfm (3.4 l/s)
- Flow Rate: @ 60 psi (4.1 bar): 22 oz/min (650 ml/min)
  - @ 90 psi (6.2 bar): 37 oz/min (1095 ml/min)
  - @ 150 psi (10.3 bar): 32 oz/min (945 ml/min)
- Packaged Weight: 1.7 lbs (0.77 kg)
- Packaged Size: 11" wide x 5.5" deep x 9" tall
  - (280 mm wide x 140 mm deep x 230 mm tall)

Fig 2.5 Brake/clutch bleeding Machine
2.1.6 Wheel Balancing Machine

- When the wheel rotates, asymmetries of mass may cause it to hop or wobble, which can cause ride disturbances, usually vertical and lateral vibrations. It can also result in a wobbling of the steering wheel or of the entire vehicle. The ride disturbance, due to unbalance, usually increases with speed. When tires are fitted to wheels at the point of sale, they are measured again on a balancing machine, and correction weights are applied to counteract the combined effect of the tire and wheel unbalance.

![Wheel balancing machine](image)

**Fig 2.6 Wheel balancing machine**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply / Motor power</strong></td>
<td>220V / 250W</td>
</tr>
<tr>
<td><strong>Max. Wheel weight</strong></td>
<td>75kg</td>
</tr>
<tr>
<td><strong>Rim width range</strong></td>
<td>1.5&quot; -20&quot; (38-508mm)</td>
</tr>
<tr>
<td><strong>Rim diameter range</strong></td>
<td>10&quot; -24&quot; (254-610mm)</td>
</tr>
<tr>
<td><strong>Imbalance Resolution</strong></td>
<td>±1gm</td>
</tr>
<tr>
<td><strong>Cycle time</strong></td>
<td>6-9 s</td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>&lt;70Db</td>
</tr>
<tr>
<td><strong>N.W./G.W.</strong></td>
<td>102kg/129kg</td>
</tr>
<tr>
<td><strong>Balancing Modes</strong></td>
<td>Dynamic, STA, ALU1, ALU2, ALU3, ALU4</td>
</tr>
</tbody>
</table>

Table 2.2  wheel balancing machine
2.1.7 **Two post car lift**

- Automobile lift with electro mechanical operation used to lift vehicles up to 3.2 ton capacity. Asymmetrically designed posts for easy door opening. It costs 1.2 lakhs to 3 lakhs approximately.

**Specifications:**

- Lifting capacity 3.2 Ton
- Load distribution (Front : Rear) 2 : 3
- Lifting time 60 seconds
- Bay width 3.3 meters
- Drive through clearance 2100 mm
- Maximum lifting height 875 mm
- Minimum lowering height 145 mm
- Lifting arm adjustments Front Rear
- Minimum length 685 mm 955 mm
- Maximum length 1020 mm 1380 mm
- Power supply 440V AC, 3 Phase, 50Hz

![Fig 2.7 Two post Lift](image-url)
2.1.8 Tool Trolley

- The Tool Trolleys are used to store general, special tools and for various other purposes. The Tool Storage Trolleys are generally designed in vertical order so as to save the floor area and easy approach to tools. Catering to the specific requirements of the clients, the company has acquired noteworthy position amidst the major Mechanics Tool Trolleys Manufacturers and Suppliers in India. The Tool Trolleys are sturdy and handy tool storage units designed to operate right in the workplace with time saving and added productivity. The right storage units to complement the work of automobile mechanics, body repair specialist, maintenance engineers and other users also. Trolleys are designed to provide the fast service. It posses with various features such as:
  - Job Card Holder
  - Tire Stand
  - Heavy Duty Castor Wheels
  - Facility to operate pneumatic tool

![Fig 2.8 Tool Trolley](image)
2.1.9 Chain pulley blo

- To remove engine and gearbox from car for complete overhaul and reinstall after the same, a chain pulley block is essential as other temporary arrangements may be dangerous. It costs about Rs 4000 – Rs 6000.

Specifications

- Light weight and sturdy
- Easy handling
- Minimum maintenance required
- Extended working life
- High operating efficiency
- Smooth passage of load chain
- Machine guiderollers
- Smooth hand chain operation

Calibrated link

Fig 2.9 chain Pulley blo
2.1.10 Injector Cleaner CEA-05

Features

- Testing content
- Tests 1-4 injectors, can check injectors for leakages and spray pattern.
- Testing model
- Simulates engine running status and injector spray time.
- Tests up to 4 injectors at one time to check flow rate.
- Ultrasonic bath for cleaning injectors. Injectors can also be pulsed while being cleaned.
- This high quality machine has many features to make injector cleaning and checking simple. This machine comes with a wide range of adaptors for many injectors.

Fig 2.10 Injector Cleaner

<table>
<thead>
<tr>
<th>Power</th>
<th>AC220v 50hz 160W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working place temp</td>
<td>5°C~45°C</td>
</tr>
<tr>
<td>Injectors</td>
<td>1 to 4</td>
</tr>
<tr>
<td>Rpm range</td>
<td>0-9950 r/min</td>
</tr>
<tr>
<td>Pulse width</td>
<td>0-20 ms; step 0.1r/min</td>
</tr>
<tr>
<td>Count</td>
<td>0-9950r/min step 50 r/min</td>
</tr>
<tr>
<td>Working system pressure</td>
<td>0.64mm (90 Psi)</td>
</tr>
</tbody>
</table>

Table 2.3 injector cleaner
2.1.11 Floor jack

A floor jack is used to raise either the front, sides, or rear of a vehicle. To avoid vehicle damage, place the jack saddle under a solid part of the car such as the frame, suspension arm, or axle housing.

If a floor jack is for raising the car only, saddle is not properly located, it is very easy to smash the oil pan, muffler, floor pan, or another part of the vehicle. To raise the vehicle, turn the jack handle or knob clockwise and pump the handle. To lower the vehicle, turn the handle or knob counter clockwise slowly to release the pressure-relief valve.

When raising the front of a vehicle, place the transmission in neutral and release the parking brake. This lets the vehicle roll, preventing it from pulling off the jack. After raising, secure the vehicle on jack stands. Place an automatic transmission in park and a manual transmission in gear. Apply the emergency brake and block the wheels. It is then safe to work under the vehicle.

Cost: Rs:-2000(for light), Rs:- 10000(for heavy)
2.2 Hand Tools Used In Workshop

2.2.1 Screwdrivers

- A typical simple screwdriver has a handle and a shaft, and a tip that the user inserts into the screw head to turn it
- The shaft is usually made of tough steel to resist bending or twisting.
- Handle are typically made of wood, metal, or plastic and usually hexagonal, square, or oval in cross-section to improve grip and prevent the tool from rolling.
- Prise- 100 to 2700

Fig 2.12 Screwdriver

2.2.2 Spanner and Wrenches

- The ring spanner, open end spanner & the combination spanner are its types.
- Used according to size for the nut or the bolt to be turned.
- A torque wrench tightens bolts and nuts by giving specified torque.
- A pipe wrench grips pipes and tubes.

Fig 2.13 Spanner & Wrenches
2.2.3 Pliers

Combination pliers are made from 2 pieces of high carbon or alloy steel. They pivot together so that any force applied to the handles is multiplied in the strong jaws. Some pliers provide a powerful grip on objects, others are designed to cut. Combination pliers can do both - that’s why they’re the most common type.

2.2.4 Filler gauge

A feeler gauge is a tool used to measure gap widths. Feeler gauges are mostly used in engineering to measure the clearance between two parts. They consist of a number of small lengths of steel of different thicknesses with measurements marked on each piece. They are flexible enough that, even if they are all on the same hinge, several...
2.2.5 Hammers

- The most common hammer in an automotive workshop is the ball peen or engineer's hammer. They are combinedly used to pull small dents. These tools are commonly used by blacksmiths during the forging process.

- A hammer is a tool or device that delivers a blow (a sudden impact) to an object. Most hammers are hand tools used to drive nails, fit parts, forge metal, and break apart objects. Hammers vary in shape, size, and structure, depending on their purposes.

- Hammers are basic tools in many trades. The usual features are a head (most often made of steel) and a handle (also called a helve or haft). Most hammers are hand tools, but there are also many powered versions, called power hammers (such as steam hammers and trip hammers) for heavier uses, such as forging.

- Some hammers have other names, such as sledgehammer, mallet and gavel. The term "hammer" also applies to other devices that deliver blows, such as the hammer of a firearm or the hammer of a piano.
2.2.6 Ratchet-handle

The most common socket handle, the ratchet, makes easy work of tightening or loosening a nut where not a lot of pressure is involved. It can be set to turn in either direction and it doesn’t need much room to swing it. It’s built to be convenient, not super-strong, so too much pressure could damage it.

Fig 2.17 Ratchet

2.2.7 Sliding t-handle

- The most common socket handle, the ratchet, makes easy work of tightening or loosening a nut where not a lot of pressure is involved. It can be set to turn in either direction and it doesn’t need much room to swing it. It’s built to be convenient, not super-strong, so too much pressure could damage it. For heavier tightening or loosening, an adjustable offset handle or breaker bar, gives the most leverage.

Fig 2.18 Sliding t handle
2.2.8 Allen key

A wrench used to turn screw or bolt heads designed with a hexagonal socket (recess) to receive the wrench. The wrenches come in two common forms: L-shaped and T-handles. The L-shaped wrenches are formed from hexagonal wire stock, while the T-handles are the same hex wire stock with a metal or plastic handle attached to the end. There are also indexable driver-bits that can be used in indexable screwdrivers.
2.2.9 **Combination wrench**

![Combination wrench](image1)

Fig 2.20 Combination wrench

- A double-ended tool with one end being like an open-end wrench or open-ended spanner, and the other end being like a box-end wrench or ring spanner. Both ends generally fit the same size of bolt.

2.2.10 **Flare-nut wrench**

A wrench that is used for gripping the nuts on the ends of tubes. It is similar to a box-end wrench but, instead of encircling the nut completely, it has a narrow opening just

![Flare nut wrench](image2)

Fig 2.21 Flare nut wrench
2.3 Power Tools Used in Workshop

2.3.1 Air gun

- Air gun use the energy of compressed air for operation. They are also called pneumatic tools. Air gun are labor-saving devices and well worth their cost. Always lubricate an air gun before and after use. While pressing the air gun's trigger, squirt a few drops of air gun oil into the gun's air inlet fitting. Not only will the oil protect the internal parts of the gun during use, but it will also prevent the internal parts from rusting during storage.

- Cost: Rs:-2000

![Air gun](image1)

2.3.2 Spray gun

- It is a painting technique where a device sprays a coating through the air onto a surface
- The air gun has a nozzle, paint basin, and air compressor.
- When the trigger is pressed the paint mixes with the compressed air stream and is released in a fine spray.
- Market price- 900 to 2000

![Spray gun](image2)
2.3.3 Drill

Drills are used to create holes in metal and plastic parts. Some drills are portable; others are mounted on a workbench or the floor. Drills use different-size bits to create the size of hole needed.

- cost: Rs:- 2000

2.3.4 Bench Grinde

A bench grinder can be used for grinding, cleaning, or polishing operations. A bench grinder usually has two wheels—a grinding wheel and a wire wheel. The hard, abrasive grinding wheel is used for sharpening and deburring. The soft wire wheel is used for cleaning and polishing.

- cost Rs -450
CHAPTER 3

Particular of Practical Experiences

3.1 Overhauling of Engine

3.2 Removal of small dents and bulges using a file.

3.3 Engine oil filter replace

3.4 Major vehicle Repair

3.5 Faults And Remedies.
3.1 Overhauling of Engine

- Procedure for gearbox dismantle are given as follows

Fig 3.1 Overhauling of engine
3.1 Clutch housing – Remove

- If fitted remove and discard clips retaining clutch release bearing pads, remove bearing and clutch release lever, recover pads.
- Remove 2 bolts securing release lever pivot post, remove post. Remove 6 bolts securing clutch housing to gearbox, remove housing.

![Fig 3.2 Clutch Housing](image)

3.1.2 Gear change/selector housings – Remove

- Remove 4 bolts securing gear change housing, remove housing.
- Remove 4 bolts securing transfer box selector housing, remove housing

3.1.3 Selector quadrant – Remove

- Remove and discard set screw securing selector quadrant.
- Move selector shaft forwards, remove quadrant.
3.1.4 Extension housing – Remove

- Remove and discard self-locking nut securing selector shaft pin to selector shaft; remove pin.

- Carefully price speedometer pinion housing and gear out of extension housing, remove and discard ‘O’ ring.

- Remove 5th gear spool retainer, remove and discard ’O’ ring.

- Noting their fitted position, remove 10 bolts securing extension housing to gear case.

- Using a soft faced mallet, tap extension housing to free it from locating dowels.

- Remove extension housing.

- Remove and discard selector shaft oil seal.

- Secure centre plate to gear case with 2 bolts 8 x 35mm.

Fig 3.3 Extension housing
3.1.5 5th and Reverse gear – Remove

- Using a suitable two legged puller remove 5th gear layshaft support bearing track from the end of layshaft.
- Using tool LRT-37-023 to hold the 5th laygear, remove the 5th laygear nut.
- Remove thrust collar segments, retaining ring and segments, drift out the roll pin.
- Later gearboxes: Remove split washer securing 5th laygear to shaft. Remove 5th laygear.
- Remove main shaft rear support bearing track using tools LRT-37-009 and LRT-37-024.
- Remove 12mm bolt from end of mainshaft.
- Remove mainshaft 5th gear with synchromesh baulk ring
- Remove mainshaft 5th gear split needle roller bearing.
- Remove circlip securing 5th gear synchromesh hub.
- Rotate selector spool clear of synchro hub fork and remove 5th and reverse synchromesh hub assembly complete with fork and spool.
- Remove mainshaft reverse gear complete with needle roller bearing and bush noting selectable spacer between reverse gear bush and centre plate bearing. Remove layshaft reverse gear.
- Remove centre plate detent plug, spring and ball.
- Remove 2 bolts securing spool retainer, remove retainer. Remove 'slave' bolts

3.4 Reverse gear
3.1.6 Main shaft and lay shaft – Remove

1. Align selector shaft pin with slot in centre plate and using wooden blocks and hide mallet, drive off centre plate.
2. Collect detent ball and spring, remove bearing tracks and shims.
3. Remove lay shaft, main shaft and selector shaft from casing as complete unit.
4. Remove input shaft, and 4th gear baulk ring. (If not already removed with main shaft.

![Main shaft](image)

Fig 3.5 Main shaft

3.1.7 Synchromesh assemblies – Overhaul

1. Remove spring clips from both sides of assembly.
2. Remove slippers and separate the hub from the sleeve.
3. Examine all parts for damage and wear including spring clips for tension.
4. Check no excessive radial movement exist between inner members and mainshaft splines
5. Examine inner and outer splines for wear
3.2 Removal of small dents and bulges using a file.

- When most of the dents and bulges in a panel surface are removed by use of a washer welder, use a file to find remaining small dents.
- The purpose to locate dent and bulges by making visible filing marks in the metal so that repairs can be done with hammer, stud welder and washer welder.
- The filing operation should be repeated as often as necessary.
- By alternating filing and repair of dents and bulges, the area will eventually have filing marks over entire surface and the dent removal operation will be completed.
- A flat, vixen file is generally used for metal filing, but other files which have curved surfaces are used to file the curved surfaces of body panels.
- Some files are adjustable which allows them to be used for a wide range of filling operations.

3.6 Types of file
3.2.1 Gear oil replace

- Gear oil or transmission oil changed at every 40000 km or 4 years.
- And the surface of gearbox has to be seen for any leakage.
3.2.2 Air filter service or replace

- Air filter service means cleaning the filter by compress air at low presser

Fig 3.8 Air filter replace

- Air filter changed at every 40000 km in petrol filter
- Air filter changed at every 20000 km in diesel because diesel engine takes more air in every stroke in compare of petrol engine.

3.2.3 Coolant replacement

- Coolant replace at every 10000km.
- In maruti Suzuki that coolant and water ratio are 1:1 for petrol and 1:2 for diesel.

Fig 3.9 Coolant replace
3.2.4 Diesel filter replace

- Diesel filter changed at every 20000 km.
- Our workshop use paper type Diesel filter.

3.2.5 A.C. blower service

- In A.C. blower service, we have to clean blower of A.C. with the help of compressed air.
3.2.6 Throttle body

- To know how to open it,
- Cleaning of Throttle body
- Removing of dirt from it
- To clean it with brake fluid

3.2.7 Spark plug Replace

- Spark plug replacement in wagonr
- Due to damage of upper part of it, they were replaced
- And it was necessary to change because the car had run 45000 km and still they were not replace.
3.3 Major vehicle Repair

- The repair method used for restoring a vehicle damaged in a collision is determined by area damaged, extent of damage, paint refinishing requirements, repair cost and other similar conditions.
- It covers most of the repair operations and use of tools used in modern auto body repairs.
- Firstly, vehicle is brought to the shop where damage estimate is prepared. Then decision is made whether damage is major or minor.
- Repair instructions are written on job card and the repair operations are carried out according to it.
- **Major Repair**: Use frame repair machine and a frame alignment bench. Panel and frame sections with major damage are replaced.
- **Minor Repair**: Panels repaired using washer welder, hammer, dolly, plastic filler.
- Repair is given as below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Damaged Panel</td>
<td></td>
</tr>
<tr>
<td>• Determining the extent of the damaged</td>
<td></td>
</tr>
<tr>
<td>• Removal of debris materials from panels</td>
<td></td>
</tr>
<tr>
<td>• Repair with washer welder or hammer and dolly</td>
<td></td>
</tr>
<tr>
<td>• Repair or replacement of panel</td>
<td></td>
</tr>
<tr>
<td>• Removal of small dents and bulges and repair with a file</td>
<td></td>
</tr>
<tr>
<td>• Filling with plastic filler (putty) or solder</td>
<td></td>
</tr>
<tr>
<td>• Rust proofing the back side of panel</td>
<td></td>
</tr>
<tr>
<td>• Completion of repairs</td>
<td></td>
</tr>
</tbody>
</table>

3.1 Major vehicle repair
### 3.3.1 Determining the extent damage

- Before the beginning the repair, determine the extent of damage.

- An inspection reveals the sections which have plastic deformation which will not return to their original shape without working the metal.

- If the body line and portions are repaired, the portions with shaded lines should be returned to their original shape by working on metal.

- According to the damage determined it is categorized into different major or minor damages.

![Fig 3.14 extent of damage](image)

Fig 3.14 extent of damage
3.3.2 Repair with washer welder or hammer and dolly

- A washer welder allows simple, easy body repair, especially in inaccessible areas such as sills and rocker panels.
- This method also has many drawbacks. The heat generated by the welder will damage the protective undercoating on the back side of the panel, making it necessary to retreat the damaged panel with an anti rust agent after restoring it to original shape.
- Small uneven dents can be removed by welding washer welders to damaged area.
  After this, using sliding hammer or sliding chain washers are pulled outside pulling out the dent to original body line.
- Hammer and dolly method is used to smooth small shallow dents and bulges.
- Place a dolly against back side of the panel directly behind bulge and use a hammer from front side to flatten bulge.
- Body repairman should able to calculate amount of panel to be worked. If it is not done then panel will stretch and elongate.

Fig 3.15 Hammer and dolly
3.4 Faults And Remedies.

- **Starter motor not rotating**

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine stop switch off</td>
<td>Battery voltage low</td>
</tr>
<tr>
<td>Neutral gear not selected.</td>
<td>Faulty neutral indicator switch or clutch interlock switch.</td>
</tr>
<tr>
<td>-Wiring open or shorted</td>
<td>Check battery terminal connections</td>
</tr>
</tbody>
</table>

Table 3.1 Stator motor not rotating

- **Starter motor rotates but engine does not turn over.**

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter motor clutch defective</td>
<td>Suspect jammed or worn engagement rollers, plungers and springs</td>
</tr>
<tr>
<td>Damaged starter motor drive train</td>
<td>Inspect and renew components where necessary.</td>
</tr>
</tbody>
</table>

Table 3.2 Stator motor work but engine does not turn over

- **Starter motor and clutch function but engine will not turn over.**

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine seized</td>
<td>Damage to internal components due to lubrication failure</td>
</tr>
</tbody>
</table>

Table 3.3 Engine not working
3.4.1 Engine does not start when turned

- No fuel flow to engine

<table>
<thead>
<tr>
<th>Fault</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel pump faulty</td>
<td>Check first fuse number</td>
</tr>
<tr>
<td>Fuel filter blocked</td>
<td>due to accumulation of rust or paint</td>
</tr>
<tr>
<td>Fuel line blocked</td>
<td>Accumulation of debris</td>
</tr>
</tbody>
</table>

Table 3.4 No fuel

- No spark at plug

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignition switch not on/Engine stop switch off</td>
<td>Check fuse for ignition circuit. See wiring diagram</td>
</tr>
<tr>
<td>Starter motor inefficient</td>
<td>A starter motor with worn brushes and a worn or dirty commutator</td>
</tr>
<tr>
<td>Spark plug failure</td>
<td>Clean the spark plugs</td>
</tr>
<tr>
<td>Shorting due to moisture</td>
<td>A water dispersant spray may be used</td>
</tr>
<tr>
<td>Shorting or open circuit in wiring.</td>
<td>Failure in any wire connecting any of the ignition components</td>
</tr>
</tbody>
</table>

Table 3.5 No spark at plug

- Compression low

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark plug loose.</td>
<td>Remove the plugs and check that the threads in the cylinder head are not damaged</td>
</tr>
<tr>
<td>Cylinder, piston and ring wear</td>
<td>A top end overhaul will be required</td>
</tr>
<tr>
<td>Piston rings sticking or broken</td>
<td>A top-end overhaul will be required.</td>
</tr>
<tr>
<td>Cylinder head gasket leaking</td>
<td>Re-torqueing the fasteners to the correct specification may seal the leak</td>
</tr>
</tbody>
</table>

Table 3.6 Compression low
3.4.2 Gear selection problems

1. Gear selection difficult or impossible

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gear change shaft bent</td>
<td>Overhaul the selector mechanism</td>
</tr>
<tr>
<td>Selector claw arm spring broken</td>
<td>Renew spring.</td>
</tr>
<tr>
<td>Gear change drum detent cam or plunger damage</td>
<td>The damaged items must be renewed</td>
</tr>
<tr>
<td>Selector forks bent or seized</td>
<td>Result from a missed gear change or false selection at high speed.</td>
</tr>
</tbody>
</table>

Table 3.7 Gear selection

2. Over selection

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claw arm spring weak or broken</td>
<td>Renew the spring</td>
</tr>
<tr>
<td>Detent plunger worn or broken</td>
<td>Renew the damaged items</td>
</tr>
<tr>
<td>Selector claw arm ends worn</td>
<td>Repairs can be made by wending and reprofiling with a file.</td>
</tr>
<tr>
<td>Selector limiter claw components damage</td>
<td>Renew the damaged items.</td>
</tr>
</tbody>
</table>

Table 3.8 Over selection

3.4.3 Acceleration poor

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel system fault</td>
<td>Checking particularly the airflow meter and throttle butterfly assembly.</td>
</tr>
<tr>
<td>Brakes binding</td>
<td>Check brake adjustment</td>
</tr>
<tr>
<td>HT lead insulation failure</td>
<td>Change an HT lead and spark plug</td>
</tr>
</tbody>
</table>

Table 3.9 Poor acceleration
3.4.4 Engine stalls after starting

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel system fault</td>
<td>See Fuel</td>
</tr>
<tr>
<td>Ignition malfunction</td>
<td>Weak spark at plug</td>
</tr>
<tr>
<td>Fuel contamination</td>
<td>Clean the filter and, where water is in evidence, drain and flush the fuel tank.</td>
</tr>
<tr>
<td>Intake air leak.</td>
<td>Check for security of the hose connections</td>
</tr>
<tr>
<td>Fuel filler cap air vent blocked</td>
<td>Clean the vent orifice.</td>
</tr>
</tbody>
</table>

Table 3.10 Engine stalling

3.4.5 Poor running at idle and low speed

1. Weak spark at plug

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery voltage low</td>
<td>When coupled with a badly sulphated battery</td>
</tr>
<tr>
<td>Spark plugs fouled</td>
<td>faulty or incorrectly adjusted</td>
</tr>
<tr>
<td>Spark plug type incorrect</td>
<td>Fit plugs of correct type and heat range as given in Specifications</td>
</tr>
<tr>
<td>Ignition timing incorrect</td>
<td>Check the ignition timing.</td>
</tr>
<tr>
<td>Ignition system fault</td>
<td>Refer Ignition</td>
</tr>
</tbody>
</table>

Table 3.11 Weak spark at plug
### 3.4.6 Knocking or pinking

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon build-up in combustion chamber</td>
<td>Cylinder head removal will be required to allow inspection and cleaning</td>
</tr>
<tr>
<td>Fuel incorrect</td>
<td>A too highly leaded fuel will reduce detonation</td>
</tr>
<tr>
<td>Spark plug heat range incorrect</td>
<td>Uncontrolled pre-ignition</td>
</tr>
</tbody>
</table>

Table 3.12 Knocking

### 3.4.7 Overheating

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark plug fouled</td>
<td>Defective or maladjusted</td>
</tr>
<tr>
<td>Spark plug type incorrect</td>
<td>Spark plug type incorrect</td>
</tr>
<tr>
<td>Incorrect ignition timing</td>
<td>Check the ignition is correct</td>
</tr>
<tr>
<td>Idle speed mixture strength incorrect</td>
<td>Adjust airflow meter bypass</td>
</tr>
<tr>
<td>Engine oil too low</td>
<td>Check the oil level and replenish</td>
</tr>
<tr>
<td>Engine oil overworked</td>
<td>Always change the oil at the recommended interval</td>
</tr>
<tr>
<td>Oil filter and filter by-pass valve blocked</td>
<td>Renew filter</td>
</tr>
</tbody>
</table>

Table 3.12 Overheating

### 3.4.8 Gear selection problems

1. **Gear selection difficult or impossible**

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gear change shaft bent</td>
<td>Overhaul the selector mechanism</td>
</tr>
<tr>
<td>Selector claw arm spring broken</td>
<td>Renew spring.</td>
</tr>
<tr>
<td>Gear change drum detent cam or plunger damage</td>
<td>The damaged items must be renewed</td>
</tr>
<tr>
<td>Selector forks bent or seized</td>
<td>Result from a missed gear change or false selection at high speed.</td>
</tr>
</tbody>
</table>

Table 3.13 Gear selection
3.4.9 Abnormal transmission noise

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing or bushes worn or damaged</td>
<td>Renew the affected components</td>
</tr>
<tr>
<td>Gear pinions worn or chipped</td>
<td>Renew the gear pinions</td>
</tr>
<tr>
<td>Oil level too low</td>
<td>Top up immediately to prevent damage to gearbox</td>
</tr>
<tr>
<td>Gear change mechanism worn or damaged</td>
<td>Remedial action, by the overhaul of the gearbox, should be taken without delay.</td>
</tr>
</tbody>
</table>

Table 3.14

3.4.10 Exhaust smokes excessively

1. White/blue smoke (caused by oil burning)

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud of smoke released upon starting</td>
<td>A full engine strip will be required to investigate</td>
</tr>
<tr>
<td>Piston rings worn or broken</td>
<td>Overhaul the cylinder block and pistons</td>
</tr>
<tr>
<td>Cylinder block cracked, worn or scored</td>
<td>The cylinder block should be renewed</td>
</tr>
<tr>
<td>Valve oil seal damaged or worn</td>
<td>Renew the valve oil seals</td>
</tr>
<tr>
<td>Engine oil level too high</td>
<td>Reduce oil level</td>
</tr>
<tr>
<td>Cylinder head gasket blown</td>
<td>Renew the cylinder head gasket</td>
</tr>
</tbody>
</table>

Table 3.15 White smokes
3.4.11 Oil pressure indicator lamp goes on

1. Engine lubrication system failure

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine oil defective</td>
<td>Change oil and filter</td>
</tr>
<tr>
<td>Engine oil level too low</td>
<td>Inspect for leak or other problem</td>
</tr>
<tr>
<td>Crankshaft and/or bearings worn</td>
<td>Overhaul lower end</td>
</tr>
<tr>
<td>Relief valve stuck open</td>
<td>Repair or replace</td>
</tr>
</tbody>
</table>

Table 3.16 Lubrication system failure

3.4.12 Poor handling or road holding

1. Directional instability

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steering head bearing adjustment too tight</td>
<td>Re-adjust the bearings</td>
</tr>
<tr>
<td>Steering stem bent</td>
<td>The lower yoke/stem replace</td>
</tr>
<tr>
<td>Front or rear tire pressures too low</td>
<td>Correct the pressure</td>
</tr>
</tbody>
</table>

Table 3.17 Directional instability

2. Poor rear suspension performance

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear suspension unit damper worn</td>
<td>Replace</td>
</tr>
<tr>
<td>Weak rear spring</td>
<td>Change the spring</td>
</tr>
<tr>
<td>Warped brake disc</td>
<td>Renew the damaged brakes.</td>
</tr>
</tbody>
</table>

Table 3.18 Poor suspension
3.4.13 Brake problems

1. Brakes are spongy or ineffective – disc brakes

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air in brake circuit</td>
<td>Bleeding air should be done</td>
</tr>
<tr>
<td>Pad worn</td>
<td>Check the pad wear and renew pads</td>
</tr>
<tr>
<td>Brake fluid deterioration</td>
<td>Change fluid and bleed the air</td>
</tr>
<tr>
<td>Master cylinder seal failure</td>
<td>Overhaul the master cylinder</td>
</tr>
</tbody>
</table>

Table 3.19 Brake ineffective

2. Brakes drag – disc brakes

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc warped</td>
<td>Renew the disc</td>
</tr>
<tr>
<td>Caliper piston, caliper or pads corroded</td>
<td>Replace</td>
</tr>
<tr>
<td>Brake pad damaged</td>
<td>Renew the pad</td>
</tr>
</tbody>
</table>

Table 3.20 Brake drag

3. Disc brake noise

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake squeal</td>
<td>Apply silicon grease</td>
</tr>
<tr>
<td>Glazed pads</td>
<td>Renew the pads</td>
</tr>
<tr>
<td>Pad material incompatible</td>
<td>Avoid duplicate components</td>
</tr>
<tr>
<td>Disc warped</td>
<td>Replace disc</td>
</tr>
</tbody>
</table>

Table 3.21 Disc brake noise
### 3.4.14 Electrical Problems

1. Battery dead or weak

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery faulty</td>
<td>Maintenance required</td>
</tr>
<tr>
<td>Battery leads</td>
<td>Remove the battery leads and clean them and the terminals</td>
</tr>
<tr>
<td>Load excessive</td>
<td>Reduce the electrical load</td>
</tr>
</tbody>
</table>

Table 3.22 Battery dead

### 3.4.15 Alternator failure

1. Total electrical failure

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuse blown</td>
<td>Fit a new fuse</td>
</tr>
<tr>
<td>Earth failure</td>
<td>Check earthing</td>
</tr>
<tr>
<td>Ignition switch or power circuit failure</td>
<td>Check the ignition switch and current flow</td>
</tr>
</tbody>
</table>

Table 3.23 Electric failure

2. Circuit failure

<table>
<thead>
<tr>
<th>Faults</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable failure</td>
<td>Check circuit for continuity</td>
</tr>
<tr>
<td>Switch failure</td>
<td>Check continuity in switch</td>
</tr>
<tr>
<td>Fuse blown</td>
<td>Replace</td>
</tr>
</tbody>
</table>

Table 3.24 Circuit failure
3.5 Maintenance and Preventive maintenance of vehicles

- Vehicle maintenance describes the act of inspecting or testing the condition of car sub systems and servicing or replacing parts and fluids.

- Regular maintenance is critical to ensure the safety, reliability, comfort and longevity of the vehicle.

- During preventive maintenance, a number of parts are replaced to avoid major damage or for safety reasons.

- The actual schedule of car maintenance varies depending on the year, make, and model of a car, its driving conditions and driver behavior.

- Manufactures recommend the extreme or the ideal service schedule based on impact parameters.

- Vehicle maintenance is divided into free service and paid service.
### 3.5.1 Free Services

- **First free service (1000 km / 1 month)**
  - Regular check up
  - Checkup of electrical systems
  - Change engine oil and oil filter
  - Add AC filter

- **Second free service (5000 Km / 6 months)**
  - Regular check up
  - Tuning of the vehicle
  - Wheel alignment and balancing if required

- **Third free service (10,000 Km / 12 months)**
  - Regular checkup
  - Cleaning of air filter and change if necessary
  - Change radiator coolant
  - Tune up engine oil

### 3.5.2 Paid Services

- **Demand Service**
  - General repair work is carried out
  - Costumer’s queries are taken care

- **Running Service**
  - Regular checkup
  - Transmission system checkup
  - Suspension system checkup
  - Braking system checkup and brake fluid checkup
  - Engine operation and engine noises checkup
  - Engine cooling checkup
  - Wheel alignment and balancing
3.5.3 Periodic Maintenance

1. Engine Oil
   - 10,000 Km or 12 Month – Petrol and Diesel
   - Synthetic oil at 1,00,000 km

2. Oil Filter
   - 10,000 Km or 12 Month – Petrol and Diesel

3. Spark Plug
   - 20,000 Km or 24 Month – Petrol
   - Euro 40,000 Km as per requirement

4. Air Filter
   - Every 40,000 Km – Petrol
   - Every 20,000 Km - Diesel

5. Fuel Filter
   - 40,000 Km or 48 Month – Petrol
   - 20,000 Km or 24 Month- Diesel

6. Brake & Clutch Fluid
   - 20,000 Km or 24 Month – Petrol and Diesel

7. Gear / Transmission Oil
   - 20,000 Km or 24 Month - Petrol and Diesel (75W90)
   - 75W80 Grade 1,60,000 Km / 3 years
8. Wheel Alignment, Balancing & Rotation
   ➢ 10,000 Km or 12 Month - Petrol and Diesel
9. Engine coolant
   ➢ 40,000 Km or 2 years – Petrol
   ➢ 20,000 Km or 2 years – Diesel
10. Water pump belt
    ➢ 50,000 Km or 3 years – Petrol
    ➢ 40,000 Km or 2 years – Diesel
11. Tapping setting
    ➢ 40,000 Km or 4 years- Petrol
12. Brake pads
    ➢ 40,000 Km or 2 years – Petrol
    ➢ 20,000 Km or 2 years – Diesel
13. Fuel injectors
    ➢ 40,000 Km or 4 years – Petrol
    ➢ 20,000 Km or 4 years – Diesel as per requirement clean and replace
14. Suspension
    ➢ Every 70,000 Ksm or 2 years as per requirement
15. Battery Testing
    ➢ 20,000 Km or 2 years – Petrol
    ➢ 10,000 Km or 1 year – Diesel
16. Engine mounting
    ➢ 50,000 Km or 5 years – Petrol
    ➢ 40,000 Km or 4 years – Diesel
17. Wheel bearings
    ➢ 60,000 Km or 5 years – Petrol
    ➢ 50,000 Km or 4 years – Diesel
Common work

1. Car wash
2. Check/replace the engine oil and replace oil filters
3. Check/replace fuel filters
4. Inspect or replace windshield wipers
5. Check or refill windshield washer fluid
6. Inspect tires for pressure and wear
7. Tire balancing
8. Tire rotation
9. Wheel alignment
10. Check, clean or replace battery terminals and top up battery fluid
11. Inspect or replace brake pads
12. Check or flush brake fluid
13. Check or flush transmission fluid
14. Check or flush power steering fluid
15. Check and flush engine coolant
16. Inspect or replace spark plugs
17. Inspect or replace air filter
18. Inspect or replace timing belt and other belts
19. Lubricate locks, latches, hinges
20. Check all lights
21. Tighten chassis nuts and bolts
22. Check if rubber boots are cracked and need replacement
23. Test electronics, e.g., anti-lock braking system or abs
24. Read fault codes from the Engine control unit
CHAPTER 4

Safety Features in Workshop & vehicle

4.1 Safety Features In Workshop

4.2 Safety Features In vehicle

4.3 Accidentel vehicle Studies

4.4 Cost estimates
➢ To prevent accidents some of the safety rules given below must be followed.

- Work quietly and give your full attention to the job you are doing.

- Keep your tools and equipments under control.

- Keep jack handles out of way and stand creeper against wall when not in use.

- Never indulge in horse play or other foolish action. You could cause someone to get seriously hurt.

- Never put screw drivers or other sharp objects in your pockets

- Make sure your clothes are right for the job. Dangling sleeves or ties can get caught in machinery and cause serious injury.

- Do not wear any rings, bracelets, or watches when working around moving machinery or electrical equipment.

- Wipe oil and grease off your hands and tools. You need a good grip on tools and parts.

- Never use compressed air to blow dirt from your clothes. Never point a compressed air blow gun at another person.
4.1 Safety features in Workshop

- Never use compressed air to blow dirt from your clothes. Never point a compressed air blow gun at another person.
- Always wear eye protection when liquid spray or particles are flying about. Safety glasses, goggles or face shield should be available. Always wear eye protection when grinding wheel.
- Watch out sparks flying from a grinding wheel or a welding job. It can set fire to hair or clothes.
- When using chemical solvents wear goggles to protect your eyes. If you get chemical in your eyes flush them with water once.

- When using a floor jack position it carefully. It should not slip. Never lift a vehicle while someone is working under it. Always put safety stands in place before going under the vehicle.
4.2 Safety features in vehicles

- Some of safety features of cars are given as follows:

1. Dual Airbags
   - Ciaz, Swift / Dzire, Grand Vitara, Ertiga,

![Fig 4.4 Air bag](image)

- Modern vehicles may contain multiple airbag modules in various side and frontal locations of the passenger seating positions, and sensors may deploy one or more airbags in an impact zone at variable rates based on the type, angle and severity of impact; the airbag is designed to only inflate in moderate to severe frontal crashes.

- Airbags are normally designed with the intention of supplementing the protection of an occupant who is correctly restrained with a seat belt. Most designs are inflated through pyrotechnic means and can only be operated once. Newer side-impact airbag modules consist of compressed air cylinders that are triggered in the event of a side impact vehicle impact.
2. Anti-lock Braking System (ABS)

Operation:

- ABS reduces the risk of tires skidding under heavy braking. ABS uses sensors to detect when a Wheel is about to lock. ABS selectively releases and applies the brake to prevent the wheel from locking.
- When this happens there may be a vibration or shuddering through the car
- And the brake pedal may pulsate. For ABS to work properly keep constant firm pressure on the brake pedal.

Benefits

- ABS helps drivers to:
  - Stop the car quickly and safely on most surfaces
  - Steer and brake heavily at the same time

![Image of ABS system](image-url)
3. Reverse Parking Sensor

Parking sensors are proximity sensors for road vehicles designed to alert the driver to obstacles while parking. These systems, which use either electromagnetic or ultrasonic sensors, are marketed variously by vehicle manufacturers under proprietary brand names such as Park Distance Control, Park Assist, Parktronic or Electromagnetic Parking Sensor (EPS)

The Parking sensor system is a safety device that accurately detects all objects that are behind your vehicle while you back up. The beeping as well as LCD display

4.6 Reverse parking sensor
4. Seat belt

Operation:

- In the event of a crash, seatbelts are designed to keep you inside the car. Lap sash seatbelts are the most effective. Seatbelt warning devices help you and your passengers remember to buckle up.
- Seatbelts are the single most effective way to protect you in a crash. They also reduce the risk that you or your passengers will collide with parts of the car (e.g. the steering wheel, dashboard, windshield, or even other occupants).
- In overall Hyundai car seat belt coming because in India Seatbelts are compulsory.

4.7 seat belt
4.3 Accident vehicle Studie

Whenever accidental vehicles are bought to the workshop, they are received by accident department advisors and they are bought up the accident repair area.

Now the vehicle is inspected by the supervisor from all sides of the vehicle to find the damaged parts so as find a cost estimate.

After finding the damaged components and parts to be repaired cost estimated is calculated to be given to the costumer.

If the vehicle is insured then claim is made to company. As a procedure photos of damaged parts taken by insurance company to pass the claim.

After the claim is passed the repair work gets started and replacements are made where required.

Accident repair cars get a long period of time normally as parts are to be ordered which takes few days for arrival.

After repairing work the vehicle is tested for safety and then delivered to costume.

Fig 4.8 Damaged vehicle
### 4.4 Cost estimates

<table>
<thead>
<tr>
<th>Item</th>
<th>Price Including Taxes</th>
<th>Price</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Oil - Price including Taxes</td>
<td>Rs. 1330 (0W/20 - MGO) or 1040 (5W/30)</td>
<td>Rs. 2000 (5w/40 - Mobil One Super MGDO Oil) or Rs 3450 (0W/40 - Fully Synthetic)</td>
<td></td>
</tr>
<tr>
<td>Oil Filter</td>
<td>Rs. 100</td>
<td>Rs. 380</td>
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</tr>
<tr>
<td>Cabin AC Pollen Filter with Tax</td>
<td>Rs. 350</td>
<td>Rs. 350</td>
<td></td>
</tr>
<tr>
<td>Spark Plug (Set of 4 Spark Plug)</td>
<td>Rs. 360</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Fuel Filter</td>
<td>Rs. 300</td>
<td>Rs. 1300</td>
<td></td>
</tr>
<tr>
<td>Air Filter</td>
<td>Rs. 300</td>
<td>Rs. 300</td>
<td></td>
</tr>
<tr>
<td>Brake Oil (500 ml) with tax</td>
<td>Rs. 350</td>
<td>Rs. 350</td>
<td></td>
</tr>
<tr>
<td>Gear Oil (Transmission Oil)</td>
<td>xxx</td>
<td>Rs. 950</td>
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</tr>
<tr>
<td>Coolant + Distiller Water (Diluted with Distilled Water in Equal Proportion) with Taxes</td>
<td>Rs. 600</td>
<td>Rs. 800</td>
<td></td>
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<tr>
<td>Wheel Alignment and Balancing Charges, Weight Cost Additional</td>
<td>Rs. 700</td>
<td>Rs. 700</td>
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<tr>
<td>Maruti Swift Clutch Kit Replacement / Overhaul - Clutch Disc Plate, Pressure Plate, Flywheel, Bearing &amp; Labor</td>
<td>Rs. 2200 (Clutch &amp; Pressure Plate) + Rs 1200 (Flywheel) + Rs 750 (Bearings) + Rs 2500 (Labor) = Rs 6500 approx</td>
<td>Rs. 3500 (Clutch &amp; Pressure Plate) + Rs 1200 (Flywheel) + Rs 3000 (Bearing) + Rs 2500 (Labor) = Rs 10000 approx</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Service Life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>--------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Oil (3.1 Litre including 200 ml in Filter)</td>
<td>10,000 Kms or 12 Month</td>
<td>10,000 Kms or 12 Month</td>
<td></td>
</tr>
<tr>
<td>Oil Filter</td>
<td>10,000 Kms or 12 Month</td>
<td>10,000 Kms or 12 Month</td>
<td></td>
</tr>
<tr>
<td>Radiator Coolant (4.5 Lit in Petrol, 5.9 Lit in Diesel) - Diluted in 1:1 with Distilled Water</td>
<td>20,000 Kms or 24 Month</td>
<td>20,000 Kms or 24 Month</td>
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<tr>
<td>Spark Plug - In Petrol Cars only</td>
<td>40,000 Kms or 48 Month</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Air Filter</td>
<td>Every 40,000 Km</td>
<td>Every 20,000 Km</td>
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</tr>
<tr>
<td>Fuel Filter</td>
<td>40,000 Kms or 48 Month</td>
<td>20,000 Kms or 24 Month</td>
<td></td>
</tr>
<tr>
<td>Brake Fluid, Clutch Fluid</td>
<td>20,000 Kms or 24 Month</td>
<td>20,000 Kms or 24 Month</td>
<td></td>
</tr>
<tr>
<td>Throttle Body Cleaning</td>
<td>Rs 800</td>
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<tr>
<td>EGR Valve Cleaning</td>
<td>xxxx</td>
<td>Every 30000 Kms</td>
<td></td>
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<tr>
<td>Gear / Transmission Oil (2.2 Lit in Petrol, 2.6 Lit in Diesel)</td>
<td>In New Swift - 1.6 Lakh Kms or 10 yrs - Old Swift had replacement at 40K Kms</td>
<td>40000 Kms or 4 Year</td>
<td></td>
</tr>
<tr>
<td>Wheel Alignment, Balancing &amp; Rotation</td>
<td>10,000 Kms or 12 Month</td>
<td>10,000 Kms or 12 Month</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 5

5.1 Challenges faced during the training

- There were many challenges to be faced during training.
- Firstly, I have to adjust myself according to atmosphere of organization.
- There were many rules and regulations to be followed strictly and discipline was must.
- The technicians used dialects instead technical words while giving answers to my questions which was initially difficult to understand but later it was not a big thing.
- While fitting or removing parts from cars for the first time was like a big challenge as I have to learn identifying the parts correctly.
- One of the most difficult works I found was to remove the engine for replacing any damaged body part. This was because Maruti Suzuki vehicles are equipped with front supporting members which were obstructing the engine to pull out.
- Difficulty in doing new things can be solved by discussing with mechanics and new way can be found of working.
- Below we can see picture of jib crane removing engine

![Jib Crane Removing Engine](image)

Fig 5.1 Jib crane
Sometimes the mechanic repeatedly taught until I was able to understand it properly.

One of the challenging tasks I found while repairing a vehicle having a problem with its cooling system. Some of the technical procedures to solve out the fault are given below:

- **Fault:** AC cooling system not effective.
- **Remedies:**
  - Firstly the general check up of the cooling system was done but no fault was found.
  - Then cooling coil was disassembled and serviced but no result was obtained.

Fig 5.2 Cooling coil

- AC relay was checked by using wire to check whether continuity is obtained between 3 and 4. It was replaced, to find any defect with continuity.

Fig 5.3 Ac relay
Now the compressor relay was checked if there is any fault.
Its connector was disconnected to remove the relay.
Wire was used to check whether continuity is obtained between 3 and 4.

Ac gas commonly used R134A used as refrigerant did not have any leakage problem.

Now the magnetic clutch was checked.
Inspected the pressure plate and rotor for the signs of oil.
Checked the clutch bearing for grease leakage.
Finally no fault was found with magnetic clutch.
AC wiring was checked if it was broken or has any short circuit anywhere as wirings are often cut by mice.
Finally the vehicle was diagnosed using Suzuki Diagnosis Tool aka SDT which indicated a fault in dual pressure switch.
The switch was checked at normal temperature and was found ineffective which was later on replaced.
CHAPTER 6

My likes and Dislikes about the organization

➢ My Likes

1. Customer satisfaction
   • All customers are well satisfied by excellent service given to them. There is a 24/7 mobile services available to customers for breakdowns and pick up facilities.

2. Experienced team
   • A number of skilled and well trained team of technicians is available. They have got experience of more than 5 years in the field which is beneficial for organization as well as customers.

3. Wide service network
   • Maruti – Suzuki has a large number of service networks in all over India. Therefore a better service is gained as parts get easily available compared to other companies.

4. Dedication to work
   • All per observation I have found that each and every person from manager level to helper, all are dedicated towards their work which is helpful for the organization.

➢ My Dislikes

1. Timing for work
   • According to me workshop timing was unfair for the workers as compared to the wages paid to them. The negative point was that the workshop worked on Sunday which was disappointing for their staff.

2. Regularity
   • Vehicles in the accident department sometimes took more time than the deadline. One of the reasons was parts ordered from the company were not made available to dealer on time which was at last suffered by customers.
References

2. Automobile Engineering Volume 4 – Anil Chikara
3. Automobile Engineering – R B Gupta
4. Land Rover Engine Overhaul Manual – 300 TDI Diesel engine