UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS

UNIT I

MAINTENANCE, WORKSHOP PRACTICES SAFETY AND TOOLS

IMPORTANCE OF MAINTENANCE

Maintenance is the routine repairing work, required to keep the vehicle in good condition so that it canbe Utilized for designed capacity and efficiency.

Repair is the restoration of the vehicle to a condition substantially equal to its original condition by changing Parts (or) by reconditioning it.

Objectives of maintenance system

* To keep the vehicle available for protective work for maximum period.

* To extract optimum life for the vehicle.

* To get maximum utilization of vehicle at minimum cost.

PREVENTIVE (SCHEDULED) AND BREAK DOWN (UNSCHEDULED) MAINTENANCE

Scheduled maintenance system:-

In this system, servicing of the vehicle is done at pre determined time interval, in order to avoidbreakdown of the vehicle

Un Scheduled maintenance:-

In this system, servicing or repairing work is done only after the vehicle breakdown.

Advantages of scheduled maintenance:-

It reduces cost of operation It renders work scheduling easy. It reduces starting problem. Control of store inventory easy

LAYOUT OF AN AUTOMOBILE REPAIR, SERVICE AND MAINTENA NCE SHOP.

SERVICE STATION:

A service is a place where in addition to care of the motor vehicle like mechanical service and minor repairs, petrol is supplied, cars are lubricated, and cleaned, washed and other types pf simpler services that are required daily are performed. In general it includes a number of sections like garage general services, mechanical service, major repair shop, tyre shop, paint shop, body shop etc.

A service station is addition to the equipment available is garage is usually run in conjunction with a sales agency for a particular type of motor vehicle to provide comprehensive repair service for that particular vehicle.

The equipment available, in general garage will be added with specialized equipment like lifting tackle, and different types of jigs, fixtures and tools specially designed for checking, adjusting and repair of particular type and make of vehicle. A service station may consist of a machine shop having a lathe, drilling machine etc.

In case of big service station special types of machines like crankshaft grinding machine, valve refacer, surface grinder, reboring and boring machine, brake drum lathe also will be used. In service station fuel filling and water servicing facilities are available. It has a small workshop to provide repair for

particular make of vehicle. It may have sales agency for a particular type of vehicle. All the equipment in the garage plus small workshop tools: viz, lathe, drilling machine, jigs, fixtures are available.

LAYOUT OF GARAGES AND SERVICE STATION :

The internal layout of a garage should be such as to make it water proof, clean and spacious to provide sufficient space for small workbenches to storage and repair benches. Following considerations should be made in the layout of garage and service stations:

- To provide light to the workbenches, openings the windows should be provided at the proper place.
- To keep the floor cleanable, it should be a smooth concrete floor with a surface-scaling compound.
- The doors are provided as many members as required for easy flow of men and materials.
- The electrical control should be accessible to the operators.
- To form a neat storage for hanging tools, hooks or screw eyes should be provided on the pegboards.
- To provide a deposit of waste material.

<table>
<tr><td>Wheels and Tyres Repairs</td><td>Transmission Repairs</td><td>Body Repairs</td><td>Main Replacements</td></tr>
<tr><td colspan="2">Supervisor Cabin</td><td colspan="2">Waiting Room</td></tr>
</table>

Air Supply	Lubrication	Petrol Supply	Diesel Supply

Painting Section
Tinkering Section
Inspection Section

Repair :
Engine oil changed at :
Gear box overhauled at :

Maintenance Checklist:-

1. Check the oil level in the sump
2. Check the replacement of engine oil period
3. Check the oil level in the fuel injection pump
4. Check the steering gear box.
5. Check the condition of the rubber sleeve on cylinder head cover.
6. Check the belt tension of the cooling fan.
7. Check and adjust clutch free pedal play.
8. Check the wheel alignment parameters.
9. Check the level of battery electrolyte level.
10. Check all the lighting system.
11. Check the sock observers.
12. Check the brake shoe pins and holes.
13. Check the tyre inflation pressure.
14. Check the level of fluid in fluid coupling.
15. Check all the instruments working in dashboard.

GENERAL LUBRICATION SERVICE

It is recommended that general lubrication service is rendered at an in revel of 5000km.

1. Fuel injection pump.
2. Gear box
3. Steering gear box.
4. Front and rear wheel bearing.
5. Steering linkage.
6. Lubricants used – Engine oil, Transmission oil, General grease, Bearing grease.

Periodic Maintenance Check Sheet

Dealer: Place: Date of Sale: SERVICE TYPE			Ro No: Mileage: Kms:			Ro Date: Engine No. Fraame No:		
Mileage(Kms)	10000	30000	50000	70000	90000	110000	130000	150000
Service type								
Mileage(Kms)	170000	190000	210000	230000	250000	270000	290000	310000
Service type								
Mileage(Kms)	330000	350000	370000	390000	410000	430000	450000	470000
Service type								
Mileage(Kms)	490000	510000	530000	550000	570000	590000	610000	630000
Service type								

S. No	CHECK ITEM	CHECK	STATUS	REMARKS
1	BASIC ENGINE COMPONENETS Engine Oil Engine oil filter	 R R		
2	IGNITION SYSTEM Battery	 T		
3	FUEL AND EMISSION CONTROL Pre-filter Water sediment filter	 R CA		

Periodic maintenance check sheet

The periodic maintenance check sheet is used to record the inspection status made during the maintenance check operation. It contains various details such as the dealer name, place, date of sale, manufacturers name, mileage, frame number, chassis number etc. the mileage and service type are indicated in the various cells of the check sheet. The check sheet also contains the check item name, status and remarks.

	Air cleaner filter	C		
4	CHASSIS AND BODY Brake pedal, Parking brake Brake pads and discs Brake linings and Brake drums Brake line pipes and hoses Brake fluid Clutch Power steering fluid Ball Joints and dust covers Tyres and inflation pressures Lights, horns, wipers Steering wheel linkage and gear box oil Front and rear suspension Tightening of bolts and nuts	 CA CA CA CR R CA CR CR CA CA CA CA T		
5	AC / Cooler Refrigerant	NA		
C → Clean; R → Replace; CA → Check& Adjust; CR → Check & Replace; T → Tighten				
ADDITIONAL JOB:				
MILEAGE	1.50,000	4,50,000		
TIMING BELT	Replace	Replace		
Name of the Inspector		Signature		

The check items include the following:

- Basic engine components.
- Engine oil
- Engine oil filter
- Ignition system
- Battery
- Fuel and Emission Control
- Pre- Filter
- Water sediment filter
- Air cleaner filter
- Chassis and Body
- Brake pedal, parking brake
- Brake pads and discs
- Brake linings & brake drums
- Clutch
- Power steering fluid
- Ball joints and dust covers
- Tyres and inflation pressures
- Lights, horns, wipers
- Steering wheel linkage & gear box oil etc.

The status and remarks for all the items mentioned above are indicated on the check sheet during the maintenance operation.

Vehicle Reg No: Job No :
Chassis No : Date :

Test Report / Inspections Forms

S.No	Parameter to check	Before work	After work
1	Front side abnormal noise		
2	Rear side abnormal noise		
3	Front/rear suspension noise		
4	Steering noise		
5	Brake caliper noise		
6	Misfiring / starting		
7	Hunting problems / Stopping problems		
8	Underbody noise		
9	Abnormal noise from doors / glasses and body		
10	Overheating of engine on AC and Non AC operation		
11	Brakes poor / Weak line effective / noisy		
12	Wheel bearings noisy		
13	Drive shaft noise / vibration		
14	Vehicle pulling to one side		
15	Poor pick up of vehicle (with AAAC and without AC)		

Table 2.3 TRIP SHEET

Name and Address of the Agency	REPORT TO Mr. / Mrs. ---------- ---------- ----------		
Engaged by Arranged by ---------- Vehicle Number ----------	No. ---------- Driver Name ----------	Date: ----------	
Closing Time ---------- Starting Time---------- TOTAL Time Signature of the Customer	Hire Charges Charge Per km Driver Batta Excess Hours Excess Kms Service Tax Permit Charges	Rupees	Paise
Advance Rs. ----------	TOTAL		
Driver‟s Signature		For Agency	

ROAD TEST REPORT:

1. The road test inspector or the machine makes the road test report after the completion of the maintenance operation.
2. This report contains the vehicle reg number, chassis number, job no, date of test etc.
3. The parameters to be checked include the following:
   - Front side and rear side abnormal noise.
   - Steering and brake caliper noise.
   - Ilunting, misfiring, sudden stoppage of vehicle.
   - Brake condition.
   - Wheel and bearing check.
   - Pick up of the vehicle.
   - Mileage of the vehicle etc.

The road test report gives a fare idea of the condition of the vehicle before and after the maintenance operation.

TRIP SHEET :

The trip sheet gives the entire details of the vehicle be fore and after a trip. The starting km and ending km, time of start and closing of the journey time and the charges per km and also the overall cost of trip is described in the trip sheet.

LOGBOOK :

The logbook of a vehicle gives the details of the vehicle, which will be useful not only for the owner of the vehicle but also to the mechanic who might take the job of vehicle maintenance latter. The logbook contains the following details:

- Distance covered
- Fuel consumption
- Average fuel consumption
- Best and worst mileage
- Total maintenance cost
- Running costs
- Faults in the vehicle
- Likes and dislikes

DATE OF THE PREVIOUS MAINTENANCE REPORT

Vehicle Log Book

vehicle reg..... gas ..... Diesel..... Miles ..... Kms.....

week beginning..... vehicle Name.....

	Start millage	Finish millage	How may journey?	Daily total	signature
MONDAY					
TUESDAY					
WEDNESDAY					
THURSDAY					
FRIDAY					

SATURDAY					
SUNDAY					
			Weekly total		

Gas/Diesel and engine oil

	Odo reading	Fuel in liters	Product (gas or diesel or oil)	Cost of fuel
MONDAY				
TUESDAY				
WEDNESDAY				
THURSDAY				
FRIDAY				
SATURDAY				
SUNDAY				
	total		total	

Other Maintenance Record Forms

Vehicle service form

Vehicle name ..... vehicle reg.....

Date of service ..... mileage.....

service to be carried out every three months/periodically

Unit	Yes	No	comments
oil			
Air filter			
Distributor cap			
Oil spindle			
Ignition leads			
Check spark plug gap			
Check and adjust fan belt			
Check and adjusting power steering belt			
Check OHC belt			
Check and replace broken bulbs			
Check front brakes			
Check Rear brakes			
Adjust hand brake			
Renew brake fluid			
Check battery water level			
Check and clean battery			
Grease steering			

VEHICLE REPAIR FORM

Vehicle reg..... vehicle mileage.....

Drive ..... date.....

Description of repairs carried out:.....
.....
.....

Why were repairs necessary?

.....

Total cost of repair.....

Details of person / company who carried out repairs:

Name..... Phone.....

Address.....

Were repairs supervised.....

Quality of repairs.....

poor..... satisfactory..... Good..... Excellent.....

supervisor..... Date.....

VEHICLE ACCIDENT REPORT FORM

Employee ..... Age..... Sex.....

Department..... Supervisor.....

Date of accident.....

Nature of injuries .....

Causes of accident.....

If employee left work.....

If employee returned to work.....

Name & address of physician:

If hospitalized name and address of hospital.....

Actions taken to avoid similar incident.....

Comments.....

DRIVERS INSPECTION REPORT

checks defects only..... Explain under remarks.....

Location/ Department..... Date.....

vehicle description: Year..... Make..... Model.....

Serial NO..... Mileage.....

General condition	Interior	Exterior
cab/door/windows	gauges / warning indicators	lights
body /doors	windshield wiper	Reflectors
oil leak	horn	suspension
Grease leak	Heater	tires
coolant leak	Mirrors	Wheels / Rims / tubes
Fuel tank	Steering	Battery
oil level	Emergency brakes	spare tire
coolant level	Fire extinguisher	Other coupling

Protection

seat belt.....

Remarks.....

Reporting driver..... Date.....

Reviewing driver..... Date.....

Maintenance action..... Repair made..... No repair.....

Work order/ purchase order no.....

Repaired by.....

SCHEDULED AND UNSCHEDULED MAINTENANCE

Scheduled Maintenance

In this system, servicing of the vehicle is done at pre-determined time interval, in order to avoid breakdown of the vehicle, this type of maintenance is also called as preventive, periodic and operative maintenance

- Maintenance scheduled for car
- Wash and lubricate chassis, do not spray under chassis
- Drain drum, gear box and axle, flush and refill with proper lubricants.
- Check under chassis for evidence of water, oil, brake fluid, shock absorber and petrol leaks
- Tighten engine, steering joints, U bolts and chassis bolts to torque specifications.
- Lubricate rear axle bearing. Tighten rear axle shaft nuts to torque specification.
- Check operation of body hardware, doors, glasses, locks and keys
- Check and fill battery, clean and tighten terminals
- Check operation of all instruments, lights horns and accessories
- Check and adjust fan belt tension
- Check clutch pedal free travel and linkage
- Adjust brakes. Check and adjust pedal free travel.
- Check master cylinder fluids
- Check wheel alignment
- Aim headlights
- Tune engine, including adjustment tappets
- Adjust ignition timing and carburetor
- Clean body rim and tires
- Carry out daily and weekly maintenance

Un scheduled maintenance

In this system, servicing or repairing work is done only after the vehicle brakedown. This type ofmaintenance is also called as breakdown maintenance.

Placing an emergency vehicle out of service

1. Braking system
    - Air line leak or bulge
    - Loose compreeor mounding bolts
    - Evidence of oil seepage
    - Cracked brake drums

- Inoperative low air warning device
- Master cylinder leakage

2. Steering system
    - Excessive free play
    - Worn or faulty universal joints
    - Steering wheel not properly secured
    - Loose tire rod ends
    - Any conditions that interferes with free movements
3. Exhaust system
    - Exhaust leak forward or below the gas
4. Frame
    - Cracked loose, or broken frame member
5. Fuel system
    - Visible fuel leak
    - Fuel tank not securely attached
6. Spring and suspension
    - Cracked, loose or missing U bolt or other spring to axle clamp
    - Any broken main leaf in the leaf spring
    - Any displaced leaf that could result in contact with tire
    - Broken or missing shocks
    - Missing or broken axle bolts
7. Windshield / Wipers
    - Visuals cracks or distortion that impair or inoperative
    - Both brake lights missing or inoperative
    - Both tail lights missing or inoperative
    - Any turn signal missing or inoperative
    - Inoperative siren
    - Emergency lighting not visible from all sides
8. Drive train
    - Engine overheating
    - Motor oil in engine
    - Engine coolant in motor oil
9. Broken or missing fan belts
    - Coolant leak at water pump
    - Any major coolant leak
    - Automatic transmission overheating
    - Defective clutch components
    - Defective foot throttle
    - Defective charging system
10. Cab / Body components

- Missing or broken mirrors that obstruct or limit the driver view
- Defective door latches

Classification of maintenance

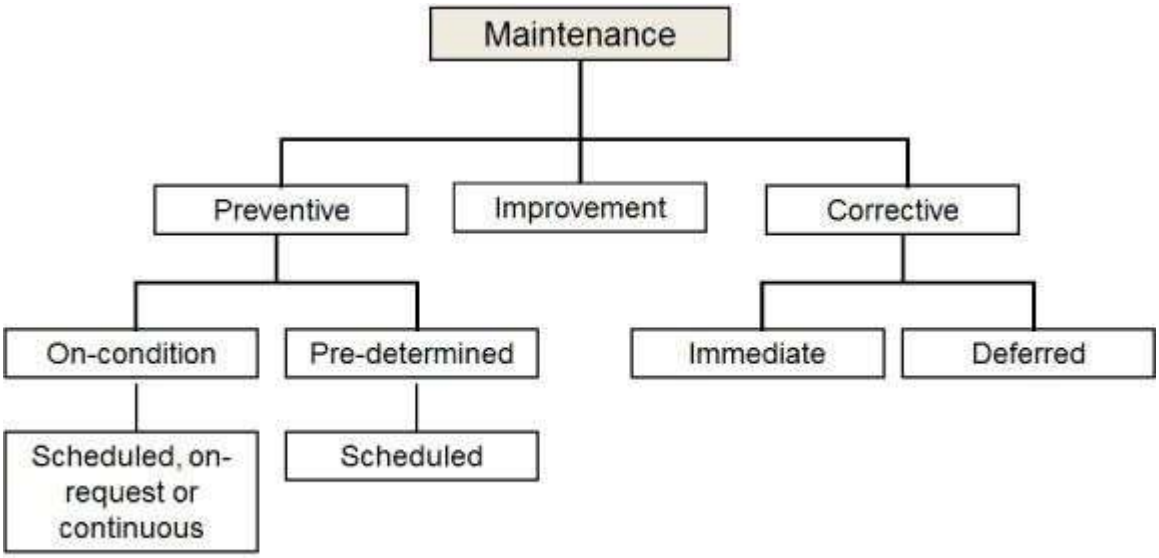

Figure 2: Major maintenance types or tactics (Adapted from BS 13306 [11])

Vehicle insurance.

Vehicle insurance (also known as car insurance, motor insurance or auto insurance)is insurance for cars, trucks, motorcycles, and other road vehicles. Its primary use is to provide financial protection against physical damage or bodily injury resulting from traffic collisions and against liability that could also arise there from. Vehicle insurance may additionally offer financial protection against as theft of the vehicle, and against damage to the vehicle sustained from events other than traffic collisions, suchas keying and damage sustained by colliding with stationary objects. The specific terms of vehicle insurance vary with legal regulations in each region.

Automotive service procedure.

- Check Service Log Book for history & other work due
- Check if vehicle is registered, so it can be test driven legally
- Check to see how many KM since last oil change
- If over 7,000km recommend engine flush to Service Adviser
- Test drive vehicle and report
- Carry out Safe T Stop test, dynamically testing steering, suspension and brakes
- Checks for lights, wiper, washer and horn (report)
- Check cooling system hoses (report)
- Check and test brake fluid (report)
- Check air filter and clean if not replaced (report)

- Check radiator condition (report)
- Test coolant / inhibitor condition with test strips (report)
- Connect cooling system pressure tester
- Check power steering fluid level and condition (report)
- Check automatic transmission level and condition (report)
- Visual check over the whole engine bay (report)
- Audible check for anything unusual (report)
- Check accessory belts with testers, check tensioner and tensions (report)
- Test battery, alternator output, print report, attach to job card ü Disconnect pressure tester (report)
- Raise vehicle and drain engine oil ü Perform 65 point check under vehicle (report)
- Check all diff levels, Transfer case levels and Gearbox levels
- Grease all grease nipples, look for blanking plugs where grease nipple need to be fitted (report) Grease steering stops
- Measure brake pad wear, remove wheels if needed (report)
- Drum brakes, remove drums wipe down shoes, check brake wheel cylinders for leaks 'pulling back rubbers' & (report)
- Measure tyre tread depth (report)
- Check flexible brake hoses for cracks (report)
- Check shock absorbers for leaks (report) ü Check oil leaks (report)
- Check all mounts and rubbers (report) ü Remove oil filter if accessible under vehicle and fit new filter Adjust brakes and it wheels
- Check tyre pressures
- Fit sump plug & clean around oil filter area and sump plug area
- Fill engine oil, start engine and recheck ü Wipe down under bonnet
- Fill out new service sticker
- Clean off old service sticker & residue & fit new service sticker
- Lube door strikers
- Wash and chammy vehicle & apply tyre shine
- Test drive ü Park vehicle & give keys to Service adviser to check.

MOTOR VEHICLE WORKSHOP OPERATION

A motor vehicle workshop operation consists of operating a workshop on a commercial basis involving any of the following relating to motor vehicles:

- Maintaining mechanical components, engine cooling radiators or body panels; • Spray painting body panels; or
- Detailing or washing. A motor vehicle workshop for the purposes of this legislation does not include:
- Operating a workshop for the purposes of a farming, gas, mining or petroleum activity
- A fleet vehicle workshop to maintain or repair fewer than 10 vehicles;

- Washing motor vehicles if all the water used is discharged to a sewerage infrastructure under a trade waste approval or the washing is required under a law of the State for weed or pest control;
- Operating a workshop to maintain or repair:- – auto electrical, exhaust, suspension or air conditioning components of motor vehicles; or – wheels or tyresof motor vehicles, including wheel alignments; or – minor scratches, chips or dents using a brush, air brush or paintless method; or – motor vehicle hoses.
- operating a mobile and temporary workshop

SAFETY RULES FOR AUTOMOTIVE MAINTENANCE

- Eye protection is mandatory for all operations which produce sparks, chips, flying objects or involve use of corrosive chemicals. Face shields shall be worn for all operations that involve use of a high-pressure steam system. Appropriate gloves and protective clothing shall also be worn.
- Mechanics shall not wear loose clothing around rotating equipment. Clothes saturated with oil, grease, or solvents shall not be worn.
- Compressed air shall not be used to clean clothing.
- Shop floors will be kept free of grease, oil, gasoline, or other slipping hazards.
- Employees shall not use defective electrical or mechanical shop equipment or hand tools. All automotive shop machinery shall be grounded.
- Vehicles shall not be towed unless appropriate tow bars or other approved equipment is used.
- Jacks, hoists, or other lifting devices shall not be used beyond the safe load capacity recommended by the manufacturer. Employees shall not remain in vehicles being lifted by hydraulic lifts or jacks.
- Mechanics shall not work under vehicles that are not properly supported with approved stands. Makeshift stands made of wood, cement blocks, or boxes shall not be used.
- Gasoline, acetone, kerosene, or similar solvents shall not be used to clean hands, floors, walls, or other surfaces. Parts shall be cleaned only in approved containers using appropriate solvents.
- Employees shall not use standard sanitary sewer drains for the disposal of gasoline, oil, or solvents. Contact EH&S for disposal guidelines.
- Tanks or containers that are used for gasoline or other flammable solvents shall not be mechanically opened or repaired by welding without purging and cleaning.
- Do not begin tire inflation before the rim is properly seated. It is dangerous to attempt adjustment with a hammer when the tire is being inflated.
- Do not place hands or arms between mounted dual tires during inflation. Always use a long air chuck for inflation.

- Do not change tires on the road unless wheel chocks and warning devices are used. Flares should be used to warn others whenever a vehicle tire is changed while on a heavily used road.
- Changing of tires on split-rim wheels will be performed only by individuals with proper training and using only appropriate equipment.

VEHICLE SAFETY EQUIPMENT'S

Service technicians help ensure that each vehicle has the following safety equipment:

- Portable Fire Extinguishers – proper type, size, and rating
- Emergency Reflective Triangles – warning devices for stopped vehicles
- Wheel Chocks – prevent accidental movement of vehicle while parked
- First Aid Kits – to match the maximum capacity of persons per vehicle

The US Department of Transportation and the Federal Motor Carrier Safety Administration (FMCSA), regulate the safety of commercial motor vehicles used on highways for transporting passengers or property.

FMCSA regulation 49 CFR Part 393.95 requires safety equipment on all of the following trucks, truck tractors, and buses:

Vehicles with GVWR, GCWR, or gross vehicle weight over 10,000 lb

Buses for compensation with over 8 persons and non-compensation buses with over 15

Vehicles transporting hazardous material requiring placards

FIRE EXTINGUISHERS

All buses, trucks, and tractors require a portable fire extinguishers for compliance with FMCSA. A 10-B:C unit is required for vehicles with hazardous materials and 5-B:C for all others. An extinguishing agent that doesn't freeze is required, and each unit must be secured in a manner that prevents sliding, rolling, and vertical movement. Most installations include a extinguisher in a vehicle bracket..

EMERGENCY REFLECTIVE TRIANGLES

The FMCSA requires warning devices for stopped vehicles. Although flares are acceptable, the following equipment is most commonly carried on each vehicle, as a minimum, for compliance:

At least 3 bidirectional emergency reflective triangles (P/N TKB1)

WHEEL CHOCKS

Wheel chocks (P/N HDLWC) are typically carried on all commercial motor vehicles to prevent accidental movement while vehicles are parked and during loading and unloading. Chocks are used against the rear tires in the direction of grade. On even surfaces, chocks are placed on both sides of tires. Chocks should always be used in pairs.

FIRST AID KITS

Be sure to check existing first aid kits for proper contents and replace depleted kits after getting the owner's consent. Every commercial motor vehicle should carry a complement of the right safety equipment. Others will appreciate your knowledge of the federal safety requirements and your recommendations for products and equipment that will help ensure the safety of vehicles, passengers, and drivers.

TEXT / REFERENCE BOOKS

1. Ed May, "Automotive Mechanics", Volume 1 and 2 , McGraw Hill Publications, 2003
2. Vehicle Service Manuals of reputed manufacturers
3. Bosch Automotive Handbook, Sixth Edition,2004
4. John Doke, "Fleet Management", McGraw Hill Co., 1984