

REPUBLIC OF SOUTH SUDAN

**TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING
NON FORMAL TVET COMPETENCY BASED CURRICULUM**

LEARNER'S BOOK

**For
CERTIFICATE OF PROFICIENCY
IN
AUTOMECHANICS**

SEPTEMBER 2019

DISCLAIMER

This curriculum has been produced by the EMPOWER Project with financial support from European Union. Its contents are the sole responsibility of the EMPOWER Consortium and do not necessarily reflect the views of the European Union.

FOREWORD

Learners are central to the success of any competence-based learning approach. This document is the Learner's Book which has been developed as part of the competence-based learning package of the South Sudan non-Formal TVET Curriculum development assignment. The purpose of this book is to provide essential competence-based learning information to the trainees of the seven priority trades. The document is presented in six sections.

Section one gives general introduction and goes further to give information on learning program, structure, organization of the training course contents, learning strategies in a competency based learning environment and how to use the learner's book. Section two provides for the theory of competence-based learning and its assessment criteria. Section three provides for the competency profile of the Certificate of Proficiency (Level I) holder and market job opportunities available on successful completion of the training. Section Four gives information on the various learning modules for the trade. Section five gives information on the on-job training during industrial attachment and section six gives the summary notes for theoretical understanding of the various modules theories, trade tools, equipment's and knowledge. This has been provided in the form of learning information sheet.

The competence-based curriculum gives the learners an opportunity for the second chance education through the acquisition of technical and vocational skills. It is my wish to the learners of these curricula to take this life-long journey seriously and make use of the learning opportunities provided to them to be of value addition. These opportunities will enable them acquire skills for direct employment in the relevant industries as well as for self-employment in the practice of trade specific skills.

The Ministry of General Education and Instruction wishes all the users of this Learner's Book the very best in their quest for discovering knowledge through competence-based learning.



Hon. Deng Deng Hoc Yai
Minister of General Education and Instruction

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Appreciation is extended to development partners and private actors who participated throughout this curriculum development process. Specifically, we recognise the contributions from United Nations Development Programme (UNDP), EMPOWER Consortium members (NRC, FCA, ACROSS, Nile Hope, BBC Media Action and VOSDO), Academy for Professional Development, World Vision, Save the Children, AAHI and Dorcas Aid International.

Through this learner's guide, we look forward to a great future in developing Tailoring and Garment making skills for the South Sudan labor market and beyond.

ACRONYMS AND ABBREVIATIONS

AAH	Action Africa Help International
ACROSS	Association of Christian Resource Organisation Serving Sudan
BBC MA	BBC Media Action
CBET	Competence Based Education and Training
DACUM	Developing A Curriculum
ICT	Information Communication Technology
FCA	Finn Church Aid
MoGEI	Ministry of General Education and Instruction
MOG	Module Outcome Guide
MoLPSHRD	Ministry of Labour, Public Service and Human Resource Development
MTC	Multi-Purpose Training Centre
NGO	Non-Governmental Organization
NRC	Norwegian Refugee Council
NVQF	National Vocational Qualifications Framework
OJT	On-The-Job training (OJT)
OHS	Occupational Health and Safety
PLAR	Prior Learning Assessment and Recognition
RPL	Recognition of Prior Learning
SSOPO	South Sudan Older People's Organization
TAR	Training Achievement Record
TVET	Technical Vocational Education and Training
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
VOSDO	United Nations Educational, Scientific and Cultural Organization

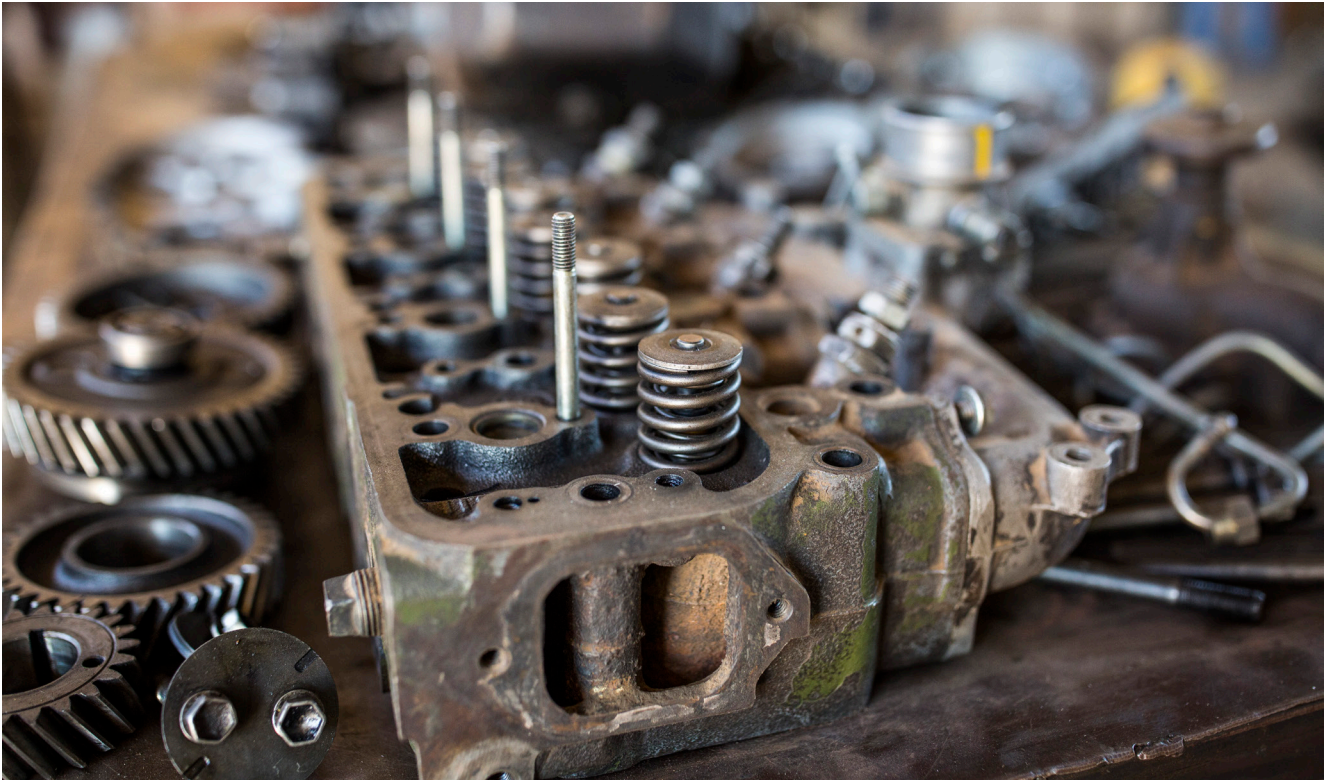
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SECTION ONE : INTRODUCTION TO LEARNER'S BOOK



I.1 INTRODUCTION

This learners' book is an information book let that provides learners of certificate of Proficiency in Auto mechanic trade with the key and strategic information that they need to know as they go about their competency learning experiences in both the IBTVET and EBTVET. The South Sudan Non-Formal Competency based TVET curriculum has been designed to facilitate learning at three places namely, Theory classes at the IBTVET, Practical classes at the IBTVET and on job training experience in the place of work within the relevant industry of the trade. This document provides learners with the key information about the competency based learning for the COP in Auto mechanic. It gives the specific objectives for each of the learning modules as derived from the learning outcomes in the main curriculum and the associated Trainers' Guide. The learning activities for each module are reflected in the Learners' Guide only in order to avoid unnecessary repetition and also with the understanding that each activity can only be executed effectively under the guidance of the trainer.

The document gives sample revision questions and self-competency assessment questions. These are provided within the Learner's Guide to enable learners to gauge the extent to which they have digested the material associated with each module and learning outcomes as contained in the training syllabus. The learners are advised not to set the limit of his/her scope of subject knowledge and competence to the few sample questions provided in this book let. They should read wider so as to gain more knowledge and competencies. This is a long life learning journey experience and learners are encouraged to be motivated and learn to learn the skills that will increase their chances of getting sustainable livelihood within their communities.

Learning Information Sheet comprising of summarized notes for each unit of the module has been provided in this Learners' book only. The notes in the information sheet are only meant to compliment other additional references and reading materials provided by the trainer. Learners are also advised to obtain further reading materials from school/college libraries as well as from the internet and other prescribed text books.

I.2 PRESENTATION OF LEARNER'S BOOK PROGRAM STRUCTURE AND INFORMATION

The specific trade occupation skills that once acquired will lead to the award of certificate of proficiency in Auto mechanic trade are organised in the form of Modules which are in themselves complete Basic Employable Skills Training (BEST) programs capable of being offered and certified on their successful completion as single modules with the exception of module I that cuts across all the trades.

The module one covers the issues surrounding specific trade theory, trade tools and equipment, occupational health and safety. Fundamentals of trauma awareness and understanding of competency based learning and its assessment criteria. The course comprises of seven modules of competencies with each module being a certifiable basic industry employable skill in the practice of occupation of Auto mechanic skills in the Auto mechanic related work environment.

The course aims at formal, non-formal and informal training for persons who wish to acquire knowledge, attitude and skills that will enable them to either engage in salaried employment in Auto mechanic business operating firms at junior level or be self-employed by managing their own business within the trade of Auto mechanic course has been designed and developed to achieve the objectives of providing multi skilled worker for the Auto mechanic industry in South Sudan and beyond.

I.3 ORGANISATION AND PRESENTATION OF THE LEARNER'S BOOK CONTENTS

The course comprises of life skills, trade theory, modules of competency, practical skills and on job training industrial attachment. The course is structured into Core competencies attainment modules and Cross Cutting Skills Modules. Modules are subdivided into Units of Learning which are further sub-divided into Learning Outcomes with Assessment Criteria. Each module is a comprehensive self-contained employable skills short course training capable of being offered alone. Each modules training has been designed to last for about 80-120 hours.

The course has been designed to allow for practical on the job training industrial attachment on completion of each module or with an option of industry attachment at the end of the IBTVET training on all the prescribed modules.

I.4 TRAINING AND LEARNING STRATEGIES FOR A COMPETENCY-BASED LEARNING AND TRAINING CURRICULUM

Competency-based training delivery is based on the defined competency standards, which are established by the industry or trade occupation. The traditional role of a trainer changes and shifts towards facilitation of learning. A facilitator encourages and assists trainees to learn by themselves. Trainees learn at their own pace. Individual differences are considered. Trainees present themselves for assessment only when they are ready. As trainees learn at different paces, they might well be at different stages in their learning, thus learning must be tailored to suit individual needs of the learners.

I.5 HOW TO USE THIS LEARNER'S BOOK

This is a learner's book. Its aim is to guide the learners in conducting self-paced study that will enable them gain competencies and be certified with the skills for each module and with the entire modules

on completion of all the modules. This book is to guide learners on the key learning testing questions, Competency assessment criteria of self-assessment, formative assessment and summative assessment. The learner's book also provides information on fundamentals of competency based learning and the differences between the traditional knowledge based approach to Education and competency based education and training approaches. It goes further to show learners on the key competencies profile for certificate of proficiency in Auto mechanic trade and job profile of the COP holder in Auto Mechanic trade

I.6 PRESENTATION OF THE LEARNER'S BOOK FOR THE COP IN AGRIBUSINESS TRADE

The document is presented in six sections with section one providing for the introduction to the learner's book and goes further to give information on learning program structure, organization of the training course contents, learning strategies in a competency based learning environment, how to use the learners book and presentation of the learner's book. Section two provides for the theory of competency

based learning and its assessment criteria.

Section three provides for the competency profile of the certificate of proficiency holder in Auto mechanic and market job opportunities available on successful completion of the training.

Section Four gives information on the various learning modules for the Auto Mechanic trade. Section five gives information on the job training during industrial attachment and section six gives the summary notes for theoretical understanding of the various modules theories, trade tools, equipment's and Occupational Health and safety. This has been provided in the form of learning information sheet which appears at the end of this document.

2.0 SECTION TWO : COMPETENCY BASED LEARNING AND ASSESSMENT

2.1 What is a Competency Based Learning Approach?

Many learners and stakeholders of TVET learning environment have taken their education and learning experience through the use of tradition approach. As such most people are not familiar with competency-based learning approaches. This section of this learner's book is meant to provide you with basic answers to some of the most frequently asked questions about competency-based education learning and training. The term competency-based education is an approach to designing learning programs with a focus on competencies to be attained as a result of going through the learning system. These competencies are related to knowledge, skills and abilities rather than time spent in a classroom to achieve the competencies.

According to the Competency-Based Education Network (C-BEN) 2017. The term competency-based education combines an intentional and transparent approach to curricular design with an academic model in which the time it takes to demonstrate competencies varies and the expectations about learning are held constant. Learners acquire and demonstrate their knowledge and skills by engaging in learning exercises, activities and experiences that align with clearly defined programmatic outcomes. Students receive proactive guidance and support from faculty and staff. Learners earn credentials by demonstrating mastery through multiple forms of assessment, often at a personalized pace. Competency-based education therefore is an approach to teaching and learning that clearly identifies the competencies that students must master on a module for them to be declared competent and awarded with module of competency completion certificate.

The modern use of competency based approach to education and training concept has its origin in the United States of in the late 1960 and 70. Since then, many countries of the world are using the approach in the delivery of their education system and especially in the area of TVET programs. The individual and gradual training module certification received by the learners will later on qualify the learners for prior learning assessment experience when they wish to join other courses that could have similar modules that they have been trained on.

2.2 INFORMATION ON HOW TO CONDUCT COMPETENCY ASSESSMENT

Attainment of competency is undertaken through competency-based assessment. There are different kinds of assessment that are administered to the learners of these programs, and the most popular ones are:

Table 2.1 Assessment criteria and related information

SNo.	Assessment Criteria	Description
1	Initial assessment:	This kind of assessment is taken on the admission to the vocational training centre. Its aim is to engage the occupation of interest and level of trauma based on the learner's background. South Sudan is one of the conflict-affected countries of Africa. The learners being admitted into these programs come from various traumatised backgrounds and experiences. This assessment will help the institution, trainer and the sponsor to gauge the motivation for learning and identify any learning difficulty or challenge likely to be faced by the learners. This assessment will also inform on the need of giving learners numeracy and literacy skills.
2.	Prior learning experience assessment:	This is carried out by the teacher who is engaged with the training of the learner. Since learners come from different backgrounds, the aim of this assessment is to establish if the learner had previously acquired some competencies such as through learning on-the-industry job working environment. In such a case, the learner will apply for prior learning experience assessment and if they meet the requirement, then such prior learning experience will be recognised and exempted. The form for this application is provided for in the trainer's guide.
3.	Self-assessment guide:	This is done by the learner on completion of each module. If the learner is convinced that he or she is now ready to be assessed, then the learner will inform the trainer that he or she is ready to be assessed. Samples of these self-assessment guides for each module have been developed.
4.	Formative Assessment:	This is the assessment provided by the trainer to certify that the learner has attained the competencies. The trainee's performance in the formative assessment will be recorded on the trainee's achievement record. Instructors of this curriculum need to be trained on how to administer a competency-based assessment. This is because in a competency-based learning assessment, the learner is either competent or not yet competent. When assessed and proved competent, then they are awarded with certificate of competency in that respective module or modules. If the assessment result shows that they are not yet competent, then the communication is made to the learner who will repeat the learning on those modules until when they have attained competency and are ready for the assessment. The learning progression is individualised and each learner progresses at his or her own pace

5	Summative assessment:	This is done at the end of the training by an external assessor from the industry. In most cases it is done practically when the learners are practicing their acquired skills through on -job training. This curriculum design has provided for 20 hours on-the-job training industrial attachment after each and every module or with an option of taking the on-Job training upon completion of all the prescribed modules. South Sudan needs to put down systems and policies to govern this kind of assessment practice, and there is a need to identify professionals from each trade who can be used to administer this important assignment. This will also require active industry participation. In the absence of these, the trainers might be allowed to use the IBTVET assessment as the country prepares to roll-out this kind of assessment. There is also a great need for this training curriculum to be supported by EBTVET training guide. These will be two. One for supporting the learner; and the other one for supporting the on-job training instructor.
6.	Competency Attainment Verification:	This is done both internally and externally by the verifiers to confirm that indeed the competency has been attained by the learners.

2.3 INFORMATION ON CERTIFICATION SYSTEM FOR COMPETENCIES ATTAINED.

Learners who demonstrates the attainment of competencies will be issued with respective modules of competency certificate that shows that the learner has attained the competencies in the respective module and modules. There is no certificate being issued for module I as it is not an employable skills training. The certification is issued on a module basis and there will be gradual certification for each module where competencies have been attained and there will be a final competency certification with the issue of certificate of proficiency in Auto mechanic trade on successful demonstration of the competencies in all module.

3.0 SECTION THREE : COMPETENCY PROFILE FOR COP HOLDER IN AUTO-MECHANIC

3.1 COMPETENCY PROFILE

The term competency profile refers to the key learning skills areas that trainees of the curriculum program are expected to show competence in as a proof that they have acquired learning through the occupation learning system and environment. The competence profile informs the formulation of learning outcomes, contents of design of modules of competency, application of Blooms taxonomy learning experience action verbs, self-assessment guide, formative assessment, summative assessment and certification. In this document the competency profile has been classified in to 3 categories namely:

1. Core, Technical /functional or hard skills
2. Soft skills or self /personal skills
3. Business skills

The table below shows the competency profiles of the certificate of proficiency holder in Auto- mechanic.

Table 2.1 Competency profile of certificate of proficiency in automechanic.

Technical competencies	Soft skills competencies	Business skills
1. Automotive Engine Servicer and Repairer.	1. Manage interpersonal communication	1. Auto-mechanic spare parts business sales assistant
2. Automotive Transmission System Servicer and Repairer	2. Trauma awareness	2. Perform basic Customer care services in Auto-mechanic garage.
3. Automotive Chassis System Servicer and Repairer	3. Manage difficult customers	3. Self-entrepreneur in Auto-mechanic Business operations
4. Wheels and Tires Servicer and Repairer.	4. Environmental safety awareness	4. Auto-mechanic Business information and records keeper
5. Automotive Electrical System Servicer and Repairer	5. Knowledge of basic equipment and tools for Auto-mechanic	
6. Motor bike repairer and Servicer	6. Occupational Health and Safety.	
7. Generator repairer and servicer	7. Learning to learn and self-study skills	

3.2 POTENTIAL LABOR MARKET JOB OPPORTUNITIES

The holder of Certificate of Proficiency in Auto-mechanic trade will be able to do the following jobs in the market.

- ◇ Serve as Assistant Auto-mechanic technician
- ◇ Assistant Auto spare parts shop attendant
- ◇ Assistant Auto-mechanic garage administrator
- ◇ Customer care services assistant in Auto-mechanic industry.

4.0 SECTION FOUR : SYLLABUS FOR CERTIFICATE OF PROFICIENCY IN AUTO-MECHANIC

4.1 LEARNING MODULES OF COMPETENCY FOR CERTIFICATE OF PROFICIENCY IN AUTO-MECHANIC

Table 4.1: Modules of competency for certificate of proficiency in auto-mechanic trade

CODE	MODULES	NOMINAL HOURS	ON-THE-JOB TRAINING/ INDUSTRIAL ATTACHMENT HOURS
4.1	Trade theory, Tools and Safety	100	
4.2	Automotive Engine Servicer and Repairer	80	40
4.3	Automotive Transmission System Servicer and Repairer	80	40
4.4	Automotive Chassis System Servicer and Repairer	80	40
4.5	Wheels and Tires Servicer and Repairer	80	40
4.6	Automotive Electrical System Servicer and Repairer	80	40
Total		500	200



4.2 MODULE 4.1: TRADE THEORY, SAFETY, TOOLS AND EQUIPMENT FOR AUTO-MECHANICS

Table 4.1: Trade theory, Safety, Tools and equipment for Auto-Mechanics module

A:MODULE CODE	4.1	TTH	PTH	OJT
Module level	I	30	70	0

B: UNITS OF MODULE

Unit of Learning 4.1.1: Trade theory, Tools and Safety in Auto-mechanics

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.1.1.1 Define Trade theory in Auto-mechanics
- 4.1.1.2 Understand the essence of occupational safety and health
- 4.1.1.3 Identify and explain hazards associated with Auto-mechanics
- 4.1.1.4 Understand the basic principles and techniques of accident prevention and safety measures
- 4.1.1.5 Explain First Aid procedures
- 4.1.1.6 Explore basic provisions for occupational safety and health under South Sudan legislation
- 4.1.1.7 Relate pollution to the environment
- 4.1.1.8 Exhibit knowledge

C: Sample Questions

1. List the tools used in Auto-mechanics
2. Describe the concept of Auto-mechanics trade
3. Explain the different types of hazards and way to minimize them.
4. Explore the importance of maintaining a clean and safe working environment.
5. State the importance of first aid kit at the work place.
6. List possible emergency cases that may happen in an Auto-mechanics workshop.
7. Describe different wastes produced in the field of Auto-mechanics and its management.
8. Explain the importance of danger and safety signs.
9. Explain organizational safety and health protocol
10. List South Sudan regulations on occupational health and safety
11. State the advantages of waste separation

<p>Learning and teaching Resources Required</p>	<ul style="list-style-type: none"> • Course training curriculum • Learner’s guides • Students Guides • South Sudan Vocational qualification framework for level descriptors • Competency assessment guides • Workshop • Trade tools and Equipment
<p>Assessment Method</p>	<ul style="list-style-type: none"> • Oral and Written • Performance Assessments and Observation. • Assessment of group work (small manageable groups) • Simulation where necessary



4.3 MODULE 4.2: AUTOMOTIVE ENGINE SERVICER AND REPAIRER

Table 4.2: Automotive Engine Servicer and Repairer Module

A: MODULE CODE	4.2	TTH	PTH	OJT
Module level	I	24	56	40

B: UNITS OF MODULE

Unit of Learning 4.2.1: Diagnose and Service Engine

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.2.1.1 Explain the parts of the engine and its operation
- 4.2.1.2 Perform recommended inspection and testing procedures to determine causes of engine failures.
- 4.2.1.3 Diagnose and service Engine systems

Unit of Learning 4.2.2: Diagnose and Service Engine Fuel System

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.2.2.1 Explain the construction and operation of the Engine-Fuel
- 4.2.2.2 Diagnose and service Engine Fuel systems (this should include systems air filters' replacement and bleeding diesel fuel injection)

Unit of Learning 4.2.3: Diagnose and Service Engine Lubrication System

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.2.3.1 Explain construction and operation of engine lubrication system.
- 4.2.3.2 Service engine oil system
 - a) Single cylinder engines
 - Motor boat engines
 - Motor cycle engines
 - Lawn mowers
 - b) Multi cylinder engines
 - 4-cylinder engines
 - 6-cylinder engines.

Unit of Learning 4.2.4: Diagnose and Service Engine Cooling System

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

4.2.4.1 Explain the construction and operation of the engine cooling system.

4.2.4.2 Diagnose and service engine cooling system

Unit of Learning 4.2.5: Diagnose and Service Exhaust System

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

4.2.5.1 Explain the construction and types of the engine exhaust system.

4.2.5.2 Diagnose and service exhaust system

C: Sample Questions

1. Explain the fundamentals of engine component failure analysis and diagnosis.
2. Explain the principles of operation of engine testing and diagnostic equipment.
3. Explain the constructional and operational differences between SIE and CIE Engine Fuel systems.
4. Interpret the operation of the SIE and CIE Fuel systems.
5. Describe the procedure for servicing a lubrication system.
6. Describe the procedure for servicing a Fuel system.
7. Explain the construction and operation of an engine lubrication system.
8. Use the procedure for servicing an engine Lubrication system
9. Describe the procedure for servicing an engine-cooling system.
10. Describe the procedure for servicing an engine exhaust system.

Resources:

- PPE, Manuals, First Aid Kit, Fire extinguishers, Vehicle Cleaning liquids
- Engine fuels, oil, grease and sealants
- Mechanic toolbox and spare parts
- Handouts, Flip charts, Multimedia, Over-head projector, and Chalkboard/ white board

Assessment Method:

- Oral and Written questions
- Performance Assessments and Observation.
- Assessment of group work (small manageable groups)



4.4 MODULE 4.3: AUTOMOTIVE TRANSMISSION SYSTEM SERVICER AND REPAIRER

Table 4.3: Automotive Transmission System Servicer and Repairer Module

A: MODULE CODE	4.3	TTH	PTH	OJT
Module level	I	24	56	40

B: UNITS OF MODULE

Unit of Learning 4.3.1: Perform Basic Clutch Diagnosis and Service

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.3.1.1 Explain the construction and operation of transmission clutch.
- 4.3.1.2 Diagnose and service the manual clutch by removing, checking and re-installing clutch assembly, and carrying out clutch master cylinder service and bleeding

Unit of Learning 4.3.2: Perform Manual Gearbox Service

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.3.2.1 Construction and operation of transmission gearbox.
- 4.3.2.2 Diagnose and service the manual gearbox.

Unit of Learning 4.3.3: Perform Universal Joints, Constant Velocity Joints and Propeller Shaft Diagnosis and Service

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.3.3.1 Explain construction and operation of universal joint, constant velocity (C.V) joint and propeller shaft
- 4.3.3.2 Diagnose and service the Propeller shaft and Universal joint.

Unit of Learning 4.3.4: Perform Differential and Rear Axle Service

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.3.4.1 Construction and operation of differential and rear axle assembly.
- 4.3.4.2 Diagnose and service the differential unit
- 4.3.4.3 Inspect and service the half axle

C: Sample Questions

1. Explain the operation of steering gearboxes.
2. Explain the construction and operation of a clutch.
3. Explain the construction and operation of a gearbox.
4. Explain the construction and operation of a rear axle assembly.
5. Describe the procedure for removal and servicing of a clutch system
6. Describe the procedure for removal and servicing of a gearbox
7. Describe the procedure for removal and serving of a rear axle assembly

Resources:

- PPE, Manuals, First Aid Kit, Fire extinguishers
- Vehicle
- Cleaning liquids, engine fuels, Oil, grease and sealants
- Mechanic toolbox and Spares
- Handouts, Flip charts, Multimedia, Over-head projector, and Chalk-board/white board

Assessment Method:

- Oral and Written questions
- Performance Assessments and Observation.
- Assessment of group work (small manageable groups)

4.5 MODULE 4.4 AUTOMOTIVE CHASSIS SYSTEM SERVICER

Table 4.4: Automotive Chassis System Servicer Module

A: MODULE CODE	4.4	TTH	PTH	OJT
Module level	I	24	56	40

B: UNITS OF MODULE

Unit of Learning 4.4.1: Perform Suspension System Service

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.4.1.1 Explain the construction and operation of suspension system
- 4.4.1.2 Diagnose and service the leaf spring suspension.
- 4.4.1.3 Diagnose and service the Wishbone suspension.
- 4.4.1.4 Diagnose and service the Mac-pherson strut suspension

Unit of Learning 4.4.2: Perform Steering System Service

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.4.2.1 Explain the construction and operation of steering system.
- 4.4.2.2 Inspect and service steering system.

Unit of Learning 4.4.3: Perform Brake System Diagnosis and Service

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.4.3.1 Explain the construction and operation of brake system
- 4.4.3.2 Diagnose and service disc brakes
- 4.4.3.3 Diagnose and service drum brakes.

Unit of Learning 4.4.4: Service of under chassis

On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:

- 4.4.4.1 Check clutch and brake fluid and lines.
- 4.4.4.2 Inspect and change power transmission/differential gear oil.
- 4.4.4.3 Inspect/replace power steering fluid.
- 4.4.4.4 Check/refill automatic transmission fluid.
- 4.4.4.5 Inspect/bleed air tank.
- 4.4.4.6 Check tire and tire pressure
- 4.4.4.7 Check under-chassis body bolts and nuts

C: Sample Questions

1. Explain the construction and operation of a suspension system
2. Prepare the construction and operation of a steering system.
3. Explain the construction and operation of a braking system
4. Describe the procedure for removal and servicing of a steering system
5. Describe the procedure for removal and servicing of a braking system
6. Describe the procedure for removal and servicing of a suspension system.

Resources:	<ul style="list-style-type: none"> • PPE, Manuals, First Aid Kit, Fire extinguishers • Vehicle • Cleaning liquids, engine fuels, Oil, grease and sealants • Mechanic toolbox and Spares • Handouts, Flip charts, Multimedia, Over-head projector, and Chalk-board/white board
Assessment Method:	<ul style="list-style-type: none"> • Oral • Written • Performance Assessments and Observation. • Assessment of group work (small manageable groups)



4.6 MODULE 4.5: WHEELS AND TYRES SERVICER AND REPAIRER

Table 4.5: Wheels and Tyre Servicer and Repairer

A: MODULE CODE	4.5	TTH	PTH	OJT
		24	56	40
B: UNITS OF MODULE				
Unit of Learning 4.7.1: Farming as a Business				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.5.1.1 Explain the construction of a tyre				
- Radial ply				
- Cross ply				
4.5.1.2 Repair tubed -tyre.				
4.5.1.3 Repair tubeless tyre.				
Unit of Learning 4.5.2: Perform Wheel Balancing and Alignment				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.5.2.1 Wheel removal and inspection.				
4.5.2.2 Carrying out wheel balancing and wheel alignment				
C: Sample Questions				
1. Explain the operation of wheels and tires				
2. Set out the procedure for removal and servicing a punctured wheel				
3. Describe the procedure for wheel balancing				
4. Describe the procedure for wheel alignment.				
Resources:	<ul style="list-style-type: none"> • Vehicle, jacks, wheel spanners, tyre lever, hammer or tyre bead breaker. • Tyre changer, air compressor, depth gauge, water bath, Puncture repair kit, pressure gauge, service manual. • Hot vulcanizing machine, wheel block, support/safety stands, and safety boots. 			
Assessment Method:	<ul style="list-style-type: none"> • Oral • Written • Performance Assessments and Observation. • Assessment of group work (small manageable groups) 			



4.7 MODULE 4.6: AUTOMOTIVE ELECTRICAL SYSTEM SERVICER AND REPAIRER

Table 4.6: Automotive Electrical System Servicer and Repairer Module

A: MODULE CODE	4.6	TTH	PTH	OJT
		24	56	40
B: UNITS OF MODULE				
Unit of Learning 4.6.1: Service Battery				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.6.1.1 Explain the construction and operation of automotive electrical system				
4.6.1.2 Inspect and service battery				
Unit of Learning 4.6.2: Service Starting System				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.6.2.1 Inspect and service starting system.				
4.6.2.2 Inspect and service solenoid switch.				
Unit of Learning 4.6.3: Service Charging System				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.6.3.1 Inspect and service A.C. charging system.				
4.6.3.2 Inspect and service D.C. charging system.				
Unit of Learning 4.6.4: Service Conventional Coil Ignition System				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.6.4.1 Inspect and service ignition coil				
4.6.4.2 Inspect and service distributor				
Unit of Learning 4.6.5: Service Lighting System				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.6.5.1 Inspecting and servicing head lamps and other lamps				
Unit of Learning 4.6.6: Service Vehicle Auxiliaries				
On completion of this learning unit, the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements:				
4.6.6.1 Inspecting and servicing wiper motor mechanism				
4.6.6.2 Inspecting and servicing gauges.				

C: Key Points/Contents

1. Explain the operation the of car battery.
2. Report the construction and operation of starting system
3. Explain the construction and operation of charging system
4. Explain and test out the operation the of ignition system.
5. Explore the construction and operation of auxiliary systems
6. Demonstrate the procedure for removal and servicing of car battery
7. Illustrate the procedure for removal and servicing of starting system
8. Describe the procedure for removal and serving charging system.
9. Describe the procedure for removal and servicing of ignition system
10. IDescribe the procedure for removal and servicing of auxiliary systems

Resources:	<ul style="list-style-type: none">• PPE, Manuals, First Aid Kit, Fire extinguishers• Vehicle Cleaning liquids• Starting system testing kit• Charging system testing kit• Ignition system testing kit• Multi-meters• Oil, grease and sealants• Mechanic toolbox and Spares• Handouts, Flip charts, Multimedia, Over-head projector, and Chalk-board/white board
Assessment Method:	<ul style="list-style-type: none">• Oral and Written questions.• Performance Assessments and Observation.• Assessment of group work (small manageable groups)

5.0 SECTION FIVE : ON-THE-JOB TRAINING / INDUSTRIAL ATTACHMENT SHEET

Table 5.1: On-The-Job Training / Industrial Attachment Sheet

Module Code:	5.0	
Module Level:	I	
Total Hours:	200	
Pre-requisite	Modules of Level I	
Learning Outcomes	Performance Criteria	Assessment Criteria
4.7.1 Engine service	4.7.1.1 Engine lubrication system service 4.7.1.2 Engine fuel system service 4.7.1.3 Engine cooling system service 4.7.1.4 Engine exhaust system service	Direct observation Practical demonstration
4.7.2 Transmission service	4.7.2.1 Clutch service 4.7.2.2 Gearbox service 4.7.2.3 Universal joint and propeller shaft service 4.7.2.4 Differential and rear axle service.	Direct observation Practical demonstration
4.7.3 Chassis service	4.7.3.1 Suspension system service 4.7.3.2 Steering system service 4.7.3.3 Braking system service 4.7.3.4 Under chassis service	Direct observation Practical demonstration
4.7.4 Wheels and tyre service	4.7.4.1 Puncture repair 4.7.4.2 Wheel balancing 4.7.4.3 Wheel alignment.	Direct observation Practical demonstration
4.7.5 Auto electrical service	4.7.5.1 Battery service 4.7.5.2 Starting system service 4.7.5.3 Charging system service 4.7.5.4 Ignition system service 4.7.5.5 Lighting system service 4.7.5.6 Vehicle auxiliaries service	<ul style="list-style-type: none"> • Direct observation • Practical demonstration • Oral Questioning, • Presentations by trainees,
4.7.6 Car wash	4.7.6.1 Car interior cleaning 4.7.6.2 Car exterior cleaning 4.7.6.3 Car waxing	<ul style="list-style-type: none"> • Direct observation • Practical demonstration • Oral Questioning, • Presentations by trainees,
Session assessment will be adopted and the following guidelines should be followed regarding Industrial attachment marks:		
1. Participation 25% 2. Attendance 10% 3. Time Management 10% 4. Log book: 15% 5. Safety 5% 6. Communication skills 5% 7. Creativity 5% 8. Customer care 5% 9. Cleanliness and hygiene 5% 10. Readiness to be corrected 5% 11. Team work 5% 12. General conduct 5%		
Internal evaluation: Total internal marks are 100.		
Marks shall be awarded at the end of every module of the attachment		

6.0 SECTION SIX: LEARNING INFORMATION SUPPORT SHEET

6.1 BASIC ENGINE SERVICE

Cooling Systems Basics

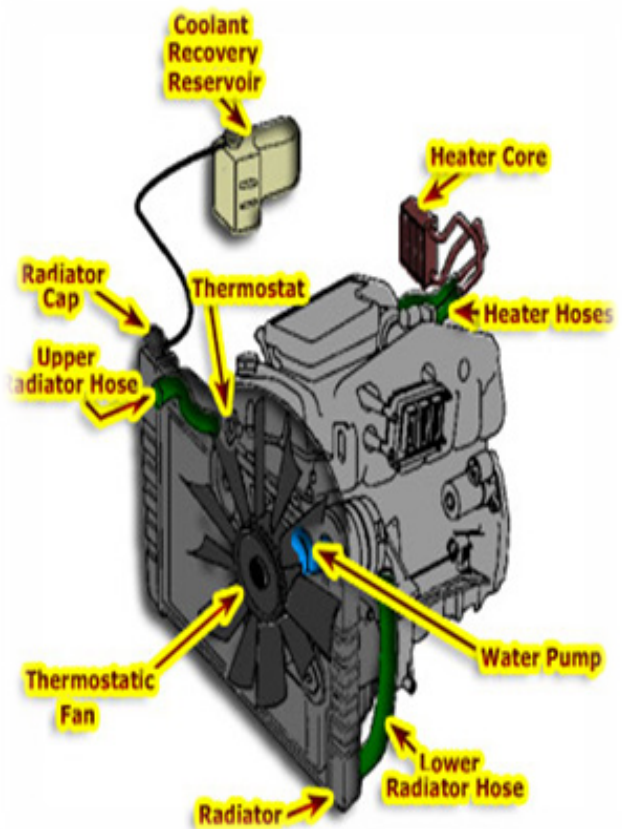
An efficient cooling system is very essential in order to protect the engine from overheating. Use good quality coolant for your car engine. The coolant level should be checked at least once a fortnight and preferably at more intervals that are frequent during summers.

Special attention should be given to the pressure cap over the radiator. When the coolant reaches very high temperature, it forces its way through a valve in the pressure cap and the overflow is then collected into coolant reservoir. When the engine is cool, the vacuum created in the radiator draws the overflow back. If the pressure cap is defective, the coolant evaporates through the pressure cap when it reaches high temperature, instead of flowing into the coolant reservoir. This reduces the level of coolant and can harm the engine.

Cooling system hoses should be checked regularly, especially before summer. Any hose that is cracked, and feels hard or spongy when squeezed should be replaced immediately. Ensure that the fan belt is working properly since it plays a vital part in cooling the engine

Cooling Systems

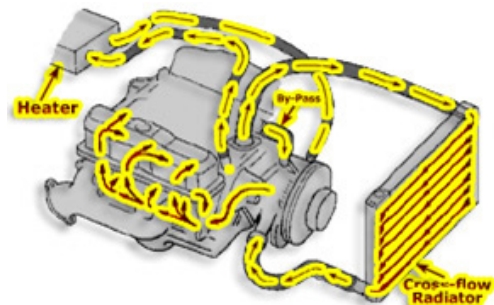
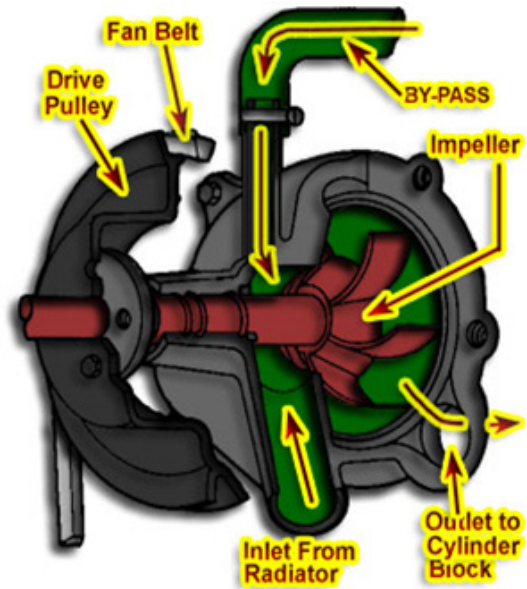
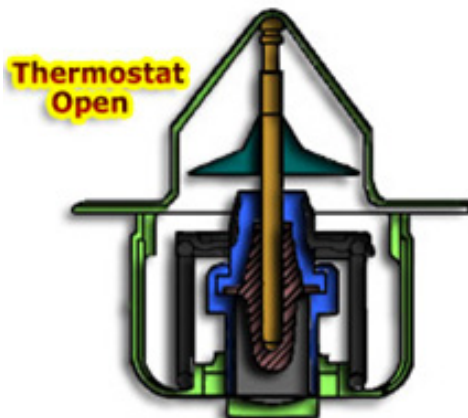
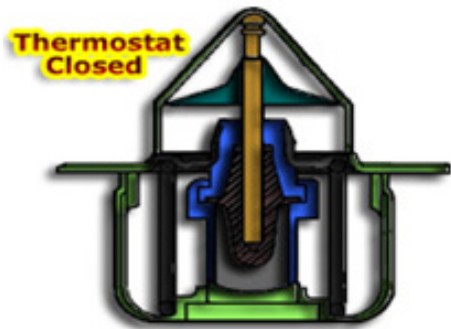
In a liquid-cooled system heat is removed from around the combustion chamber by a heat-absorbing liquid (coolant) circulating inside the engine. This liquid is pumped through the engine and, after absorbing the heat of combustion, flows into the radiator where the heat is transferred to the outside air. This system keeps engine temperature within a range where they provide the best performance.



Thermostat

- The thermostat controls the minimum operating temperature of the engine. The maximum operating temperature is controlled by the amount of heat being produced by the engine at the time and the cooling system's ability to dissipate the heat.
- The most common location of the thermostat is at the front of the engine block. Thermostat fits into a recess in the block where it is exposed to hot coolant.
- The thermostat permits fast warm-up of the engine. Slow warm-up causes moisture condensation in the combustion chambers, which finds its way into the crankcase and cause sludge formation.

- Thermostats must start to open at a specified temperature, normally 30°F (1.6°C) above or below its temperature rating. It must be fully open at about 200°F (-6.6°C) above the start-to-open temperature



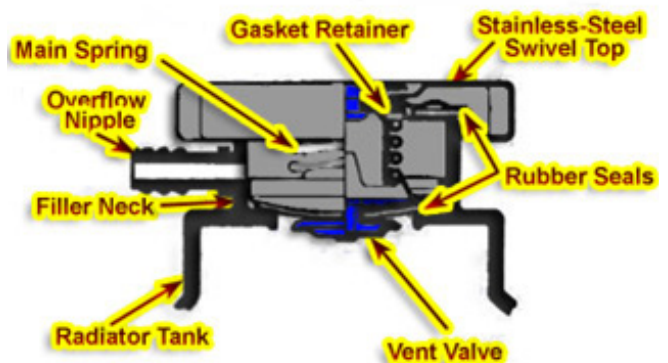
Adopted from Read, P. P. J. & Reid, V. C. (2007). Motor Vehicle Technology for Mechanics: Macmillan Texts for Industrial Vocational and Technical Education

Water Pump

- The heart of the cooling system is the water pump. Its job is to move the coolant through the cooling system.
- Usually the crankshaft drives the water pump through pulleys and a drive V-belt.
- Water pumps are centrifugal-type pumps with a rotating paddle-wheel-type impeller to move the coolant.
- When the engine is started, the impeller pushes the coolant from its pumping cavity into the engine block.
- When the engine is cold, the thermostat is closed. The coolant stops before reaching the radiator.
- In order for the water pump to circulate the coolant through the engine during warm-up, a bypass passage is added below the thermostat.

Radiator Pressure Cap

- The radiator of the car was at one time designed to keep the coolant from splashing out while providing a means to fill the radiator with coolant.
- Now, radiator caps are equipped with pressure springs and vents. The cap allows for an increase in pressure in the radiator, which raises the boiling point of the coolant



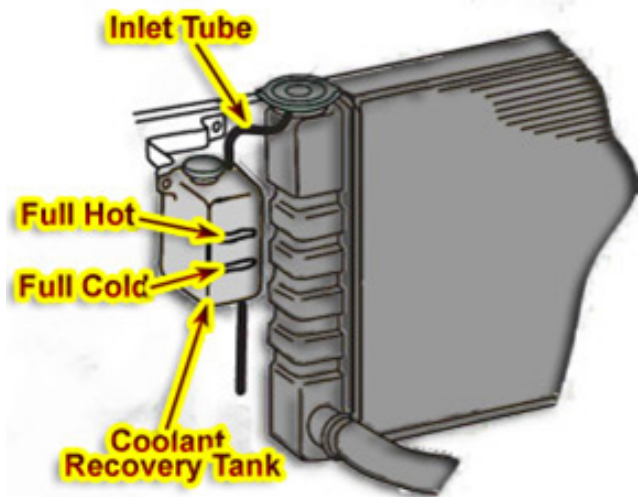
For every pound of pressure put on the coolant, the boiling point is raised about 3 1/4oF (1.8oC). Today's caps normally are designed to hold between 14 and 17 psi (96.35 and 117.21 kPa). When the pressures exceed this level, the seal between the cap and the radiator filler neck opens and allows the excessive pressure to vent into the coolant recovery tank.



Adopted from Read, P. P. J. & Reid, V. C. (2007). Motor Vehicle Technology for Mechanics: Macmillan Texts for Industrial Vocational and Technical Education

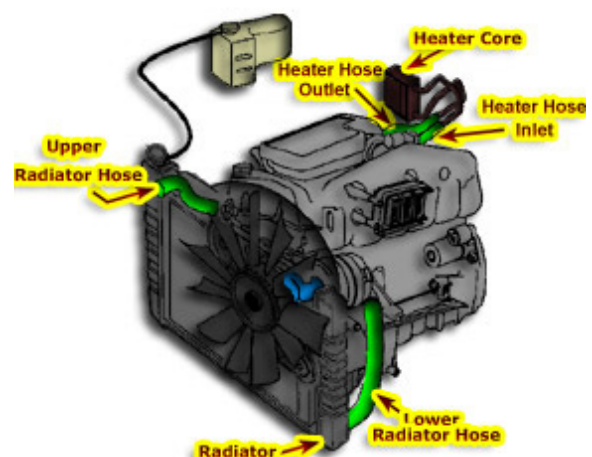
Expansion Tank

- Most cooling systems have an expansion or recovery tank. Expansion tanks are designed to catch and hold any coolant that passes through the pressure cap when the engine is hot. As the engine warms up, the coolant expands. This eventually causes the pressure cap to release. The coolant passes to an expansion tank.
- When the engine is shut down, the coolant begins to shrink. The vacuum spring inside the pressure cap opens and the coolant in the expansion tank is drawn back into the cooling system.
- The marks on the recovery tank show where coolant levels should be when the car is running and when it is not.



Hoses

- Coolant flows from the engine to the radiator and from the radiator to the engine through hoses. The radiator is solidly mounted to the vehicle and the engine sits on rubber mounts, which means the engine can move independently of the chassis and the radiator cannot. If the engine were connected solidly to the radiator, the radiator would soon break because of the vibration and stress.
- Hoses connecting the engine to the radiator are made up of three parts, an inner rubber tube, some reinforcement material, and an outer rubber cover.
- Cooling system hoses must be able to endure heavy vibrations and be resistant to oil, heat, abrasion, weathering, and pressure.
- Most vehicles have at least four hoses in the cooling system.

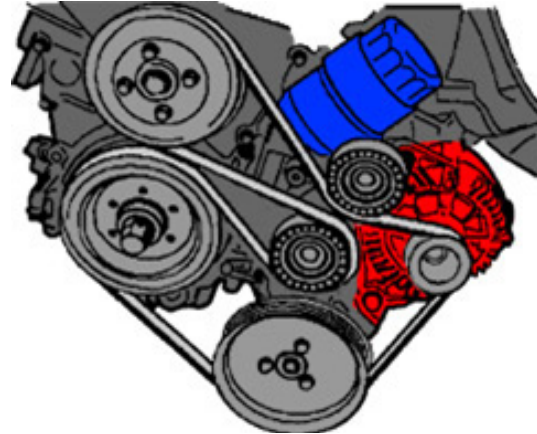


Hose Clamps

- Hoses are attached to the engine and radiator with clamps. Hose clamps are designed to apply clamping pressure around the outside of the hose at the point where it connects to the inlet and outlet connection at the radiator, engine block, water pump, or heater core.



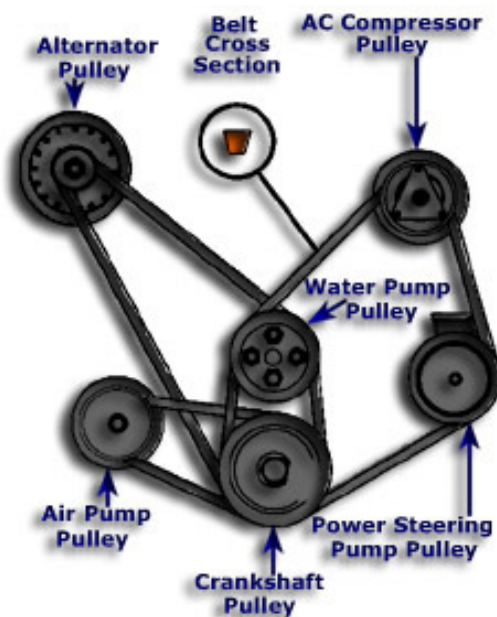
- Belt drives can be used to drive a single part or a combination of parts. V-belts are typically used to drive a single component.



Adopted from Ribbens, W. B. (1998). Understanding Automotive Electronics (5th Edition), Butterworth, Heinemann Woburn.

Belt Drive

- Belt drives have been used for many years. V-belts and V-ribbed (serpentine belts are used to drive water pumps, power steering pumps, air-conditioning compressors, generators, and emission control pumps.

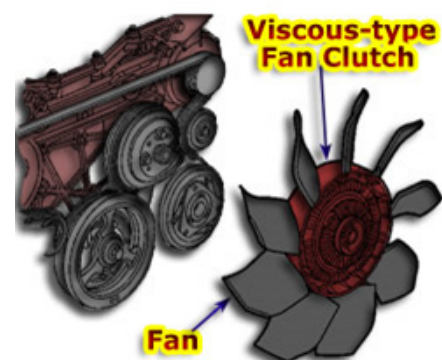


Most late model vehicles use a serpentine belt to drive accessories. Serpentine belts are used to drive all or most accessories

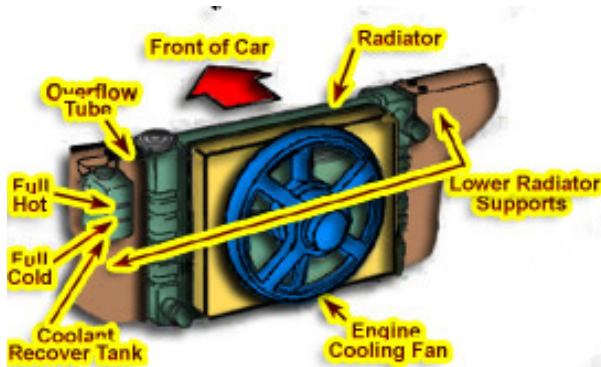
Cooling Fans

- At highway speeds, the ram air through the radiator should be sufficient to maintain proper cooling of the engine. However, at low speeds and idle, the system needs additional air. This air is delivered by fan. The fan may be driven by the engine, via a belt, or by an electric motor. To eliminate power drain during time when fan operation is not needed. This is accomplished by a fan clutch

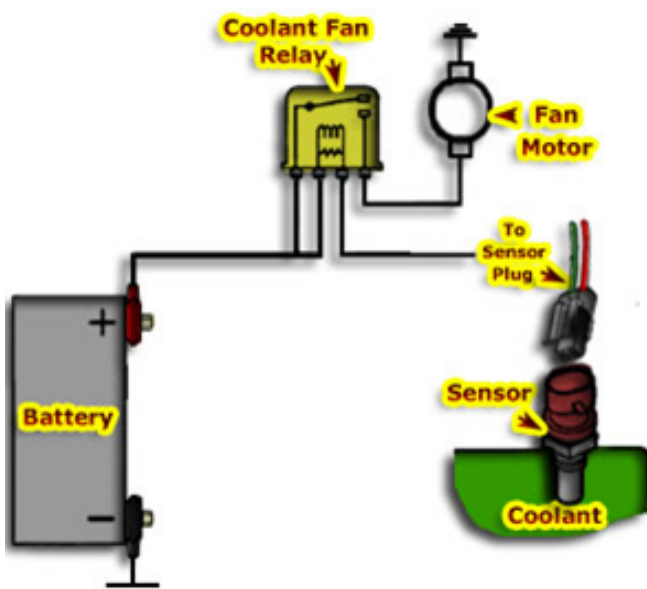
- Because the belts are flexible, they absorb some shock loads and cushion shaft bearing from excessive loads.



- In most cars of today, to save power and reduce the noise level, the conventional belt-driven, water pump mounted engine-cooling fan has been replaced with an electrically driven fan. The fan is mounted to the radiator shroud and is not connected mechanically or physically to the engine.



- An engine coolant temperature switch or sensor and the air-conditioner switch electrically control the 12 volt motor driven fan. In most new cars, it is controlled by the engine control computer.



Modern cooling systems are relatively trouble free, however, they can develop problems, and especially if they are neglected replacement will usually reveal cooling system problems before reach the serious damage.

Checking Procedures:

- a. Checking coolant level and condition of water

should be clean and no leakage

- b. Checking fan belt condition and tension.
 - First twist the belt and look for cracks or cuts on the Vee-section that touches the pulley. If damaged fit a new belt;
 - If the belt is sound, check for its tension as it mentioned on owner's handbook.

STEPS IN ADJUSTING FAN BELT

- Where the alternator tensions the belt, use two spanners to loosen the hinge fixing and slacken off the chapping bolts.
- Swing the alternator away from the engine to tension the belt. Use a wooden lever between the alternator and engine block to get the right tension
- While the belt is held under tension, tighten the clamp bolt. Recheck the tension and if it is correct retighten the hinge fixing.

NOTE: Proper tension is important, over tight belt will put too much strain on the bearings of the water pump and alternator, while a loose belt will slip in time the battery will go flat because alternator will go fast.

DRAINING COOLANT

It is advisable to check the water-cooling time to time, remove any dead insects or dirt blocking the airflow through the radiator fins and inspect hoses for cracks.

- Carefully remove the radiator pressure cap especially when the engine coolant is hot.
- Remove the radiator drain plug or tap if fitted;
- If water trickles slowly from a tap or plug it is probably blocked by a sediment which can normally be dislodged by prodding with a piece of wire;

SAFETY PRECAUTIONS:

- Use extreme caution when removing system pressure caps when coolant level is hot.

This will cause serious burns and pains to your body Refilling.

- Make sure the drain plugs are closed and all hoses are properly tightened
- If there is an expansion tank, fill this one-third full, or to the level marked on the side.
- Top up radiator with clean water, run the engine to normal temperature and check for leaks;

6.2 LUBRICATION SYSTEM

The lubrication system makes sure that every moving part in the engine gets oil so that it can move easily. The two main parts needing oil are the pistons (so they can slide easily in their cylinders) and any bearings that allow things like the crankshaft and camshafts to rotate freely. In most cars, oil is sucked out of the oil pan by the oil pump, run through the oil filter to remove any grit, and then squirted under high pressure onto bearings and the cylinder walls. The oil then trickles down into the sump, where it is collected again and the cycle repeats.

CHANGING THE OIL

- The oil must be drained when the engine is warm to ensure complete draining. The low viscosity of the warm oil facilitates the draining and brings the impurities out at the same time. So, if the engine is cold, run it to bring it up to the normal operating temperature.
- The vehicle must be on a level surface while the oil is being drained, filled or checked. Preferably, it should be on a lift or over a lubricating pit.
- A container large enough to accommodate the drained oil must be placed under the engine.
- Identify the oil-draining plug on the oil pan (crankcase). It is located in the lowest part (the oil sump) on cars with a combined engine/gearbox drive unit it is essential not to mix up the plugs.
- If you are not sure of the location of engine oil draining plug, check with the Owner's manual or workshop manual.

- The drain plug is loosened with a universal drain plug wrench or even better, use the correct socket with flexible handle

CHECK THE OIL LEVEL

- a. Let the oil flow down to the oil pan for a couple of minutes.
 - then take out the dipstick;
 - wipe it off;
 - replace it in the engine and then leave it in position for a few seconds;
 - now remove the dipstick and check the oil level against the indicator marks.
- b. Start the engine and run it for some minutes at fast idling speed the engine and check carefully for leakage at the oil-draining plug (and the oil filter). There must not be the slightest sign of oil leakage. A record of the servicing must always be kept in order to have a continuous follow of the maintenance schedules. So, write in the maintenance/service book what kind of service has been done, the type and grade of oil used, distance covered and date,
- c. Ensure that no stains or fingerprints from your work are left anywhere on the car

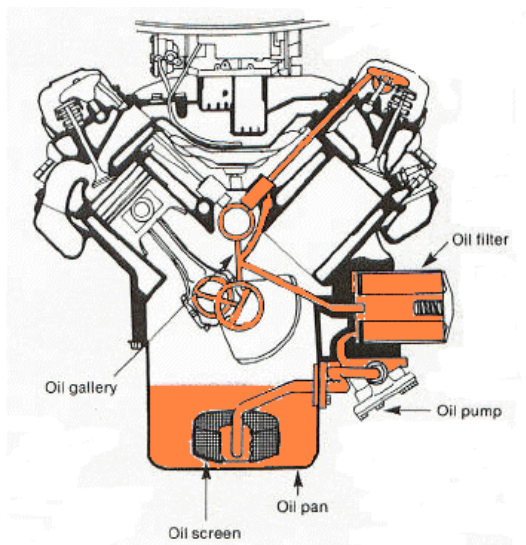
ENGINE LUBRICATION SYSTEM

Introduction:

- i. Why it Matters
- ii. What does oil actually do?
- iii. Oil Pump, Oil Seals, Oil Dip Stick, Oil Filler Cap, Oil Filter, Oil Passages, Oil Pan
- iv. Choosing the right oil for your vehicle
- v. Which oil do I choose?
- vi. Which one is better?
- vii. Why are there different weights of motor oil?
- viii. What about own-brands?
- ix. Why so many oils?



- x. What is the difference between synthetic and regular motor oil?
- xi. Premium Conventional Oil, Full Synthetic Oil , Synthetic Blend Oil, Higher Mileage Oil, Viscosity Index
- xii. Flushing oils
- xiii. Engine Additives
- xiv. Should I use an oil additive servicing and checking



The image above shows the route taken by the oil within an engine. The oil pump draws oil from the oil pan, then forces it through the filter, into the crankshaft passage, through the connecting rods to the pistons and rings. Oil is pushed through the lifters and pushrods, and covers the rocker arms. It then flows back down into the pan to complete the cycle.

WHY IT MATTERS

Keeping your engine properly lubricated reduces friction, heat buildup, and wear. This means that good engine lubrication maintenance will help your engine run better and last longer.

What price do you put on the oil in your car's sump? After all, it is the lifeblood of your car's engine.

Is oil really the lifeblood of an engine? That's a long-popular analogy, but it's really not an accurate description. Blood carries nutrients to cells, but it's air that carries fuel - the "nutrition" - for an engine. However, without oil to lubricate and cool moving parts, keep them clean and help to seal the pistons in the cylinders, the engine would run for only a matter of seconds . . . then seize! So, yes, oil is important.

In the mid-80 to mid-90 there was a mini revolution in car engine oil. All oils are no longer the same. Thanks to the increased popularity of sporty GTi's, 16 valve engines and turbos, the days of one oil catering for everyone are over.

Take Castrol for example. They led the field for years with GTX. This was surpassed a few years back by semi-synthetic and fully synthetic oils, including GTX2 and GTX3 Lightec. Now, that's been surpassed by Formula SLX. And most recently, Castrol GTX Mag-natec which is muscling in on the hitherto separate world of friction reducers.



WHAT DOES OIL ACTUALLY DO?

Engine oil's job is primarily to stop all the metal surfaces in your engine from grinding together and tearing themselves apart (and that is the last thing we 'want!'). But it has to dissipate the heat generated from this friction also. It also transfers heat away from the combustion cycle. Another function is that a good engine oil must be able to hold in suspension the nasty by-products of fuel combustion, such as silica (silicon oxide) and acids, while also cleaning the engine of such mean, ugly, nasty things. In addition, it must do all of these things under tremendous heat and pressure without succumbing to fatigue - the ultimate engine destroyer.

The primary functions of oil are listed below:

- Provide a barrier between moving parts to reduce friction, heat buildup, and wear.
- Disperse heat. Friction from moving parts and combustion of fuel produce heat that must be carried away.
- Absorb and suspend dirt and other particles. Dirt and carbon particles need to be carried by the oil to the oil filter where they can be trapped.
- Neutralize acids that can build up and destroy polished metal surfaces.
- Coat all engine parts. Oil should have the ability to leave a protective coating on all parts when the engine is turned off to prevent rust and corrosion.
- Resist sludge and varnish buildup. Oil must be able to endure extreme heat without changing in physical properties or breaking down.
- Stay fluid in cold weather; yet remain thick enough to offer engine protection in hot weather.

NOTE: It is a good habit to keep engine running idle for few minutes after it is started.

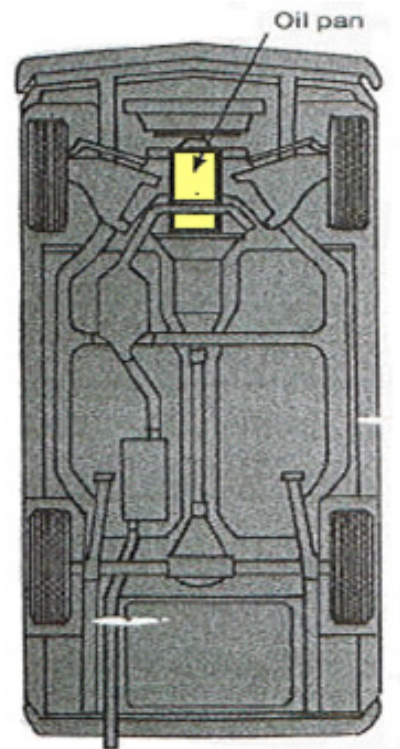
NEVER rev the engine. Letting it idle allows the oil to flow all over the moving parts before any load is placed on the engine. Remember, the maximum wear and tear of the engine takes place when it is started for the first time of the day.

Oil Pump

The oil pump is mounted at the bottom of the engine in the oil pan and is connected by a gear to either the crankshaft or the camshaft. This way, when the engine is turning, the oil pump is pumping.

There is an oil pressure sensor near the oil pump that monitors pressure and sends this information to a warning light or a gauge on the dashboard. When you turn the ignition key on, but before you start the car, the oil light should light, indicating that there is no oil pressure yet, but also letting you know that

the warning system is working. As soon as you start cranking the engine to start it, the light should go out indicating that there is oil pressure.



WHAT IF IT DOES NOT GO OFF?

The oil pump is used to force pressurized oil to the various parts of the engine. Gear and rotary pumps are the most common types of pumps. The gear pump consists of a driven spur gear and a driving gear that is attached to a shaft driven by the camshaft. The two gears are the same size and fit snugly in the pump body. Oil is carried from the inlet to the delivery side of the pump by the opposite teeth of both gears. Here it is forced into the delivery pipe. It cannot flow back, because the space between the meshing gear teeth is too tight.

The rotary pump is driven by the camshaft. The inner rotor is shaped like a cross with rounded points that fit into the star shape of the outer rotor. The inner rotor is driven by a shaft turned by the camshaft. When it turns, its rounded points “walk” around the star shaped outer rotor and force the oil out to the delivery pipe.

Oil Seals

Oil seals are rubber and metal composite items. They are generally mounted at the end of shafts. They are used to keep fluids, such as oil, transmission fluid, and power steering fluid inside the object they are sealing. These seals flex to hold a tight fit around the shaft that comes out of the housing, and do not allow any fluid to pass. Oil seals are common points of leakage and can usually be replaced inexpensively. However, the placements of some seals make them very difficult to access, which makes for a hefty labor charge!

Engine Oil Dip Stick

The engine oil dipstick is a long metal rod that goes into the oil pump. The purpose of the dipstick is to engine. The dipstick is held in a tube; the end of the tube extends into the oil sump. It has measurement markings on it. If you pull it out, you can see whether you have enough oil, or whether you need more by the level of oil on the markings.

[How to correctly find the dipstick and what its markings mean](#)

Oil Filler Cap

The oil filler cap is a plastic or metal cap that covers an opening into the valve cover. It allows you to add oil when the dipstick indicates that you need it. Some cars have the crankcase vented through the filler cap. Oil which is added through the filler passes down through openings in the head into the oil sump at the bottom of the engine.

[How to locate the oil fill cap](#)

Oil Filter

Oil filters are placed in the engine's oil system to strain dirt and abrasive materials out of the oil. The oil filter cannot remove things that dilute the oil, such as gasoline and acids. Removing the solid material does help cut down on the possibility of acids forming. Removing the "grit" reduces the wear on the engine parts.

Modern passenger car engines use the "full flow" type of oil filters. With this type of filter, all of the oil passes through the filter before it reaches the engine bearings. If a filter becomes clogged, a bypass valve allows oil to continue to reach the bearings. The most common type of oil filter is a cartridge type. Oil filters are disposable; at prescribed intervals, this filter is removed, replaced and thrown away.

CHANGING YOUR OIL FILTER

Most states now require that oil filters be drained completely before disposal, which adds to the cost of an oil change, but helps to reduce pollution.

Oil Passages

Within the engine is a variety of pathways for oil to be sent to moving parts. These pathways are designed to deliver the same pressure of fresh lubricating oil to all parts. If the pathways become clogged, the affected parts will lock together. This usually destroys parts that are not lubricated, and often ruins the entire engine.

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