



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

SUBJECT GUIDELINES

FITTING AND TURNING

NQF Level 3

September 2007

FITTING AND TURNING – LEVEL 3

CONTENTS

INTRODUCTION

1 DURATION AND TUITION TIME

2 SUBJECT LEVEL FOCUS

3 ASSESSMENT REQUIREMENTS

3.1 Internal assessment

3.2 External assessment

4 WEIGHTED VALUES OF TOPICS

6 PASS REQUIREMENTS

7 SUBJECT AND LEARNING OUTCOMES.

7.1 Grinding tools and drill bits

7.2 Bearings

7.3 Brakes and clutches

7.4 Direct drives

7.5 Dynamic seals in machines and equipment

7.6 Heat exchangers and pressure vessels

7.7 Lubrication systems

8 RESOURCE NEEDS FOR THE TEACHING OF FITTING AND TURNING LEVEL 3.

8.1 Physical resources

8.2 Human resources

8.3 Financial resources

8.4 Learning materials

INTRODUCTION

A. What is Fitting and Turning?

Fitting and Turning is widely applied to engineering technology, such as in machining, maintenance and assembly situations or circumstances. It deals with the various processes involved in making or producing components required in the manufacturing, engineering and technological environment. Fitting and Turning covers land, sea, air and space technology and helps to develop and expand the global economy.

B. Why is Fitting and Turning important in the Engineering and Related Design programme?

Fitting and Turning takes creativity and visionary ideology and makes it a practical reality. Through its application, Fitting and Turning expands new design technology and urges science to create new material compositions.

C. Links between the Fitting and Turning Learning Outcomes and the Critical and Development Outcomes

- **THINKING AND PROBLEM-SOLVING SKILLS:**
Identify and solve problems in which responses display that responsible decisions, using critical and creative thinking, have been made.
 - Use different functions and make corrective adjustments in problematic situations.
- **INDEPENDENCE AND SELF-MANAGEMENT SKILLS:**
Organise and manage oneself and one's activities responsibly and effectively.
 - Plan sequence of operations based on job instructions and adjust equipment appropriately.
- **RESEARCH SKILLS:**
Collect, analyse, organise and critically evaluate information.
 - Examine work piece for machining and non-conformance with specifications.
 - Measure work piece for accuracy.
- **LEARNING SKILLS:**
Reflect on and explore a variety of strategies to learn more effectively.
 - Gain experience and knowledge through application of different machining.
- **EMPLOYMENT SEEKING SKILLS:**
Explore education and career opportunities.
 - Assure the confidence to succeed by understanding the practical application.
- **ENTREPRENEURSHIP:**
Develop entrepreneurial opportunities.
 - Produce a sense of self worth through confidence.

1 DURATION AND TUITION TIME

This is a one year instructional programme comprising 200 teaching and learning hours. The subject may be offered on a part-time basis provided the candidate meets all the assessment requirements.

Course preparation should consider students with special education needs.

2 SUBJECT LEVEL FOCUS

- Describe Fitting and Turning practices and procedures.

3 ASSESSMENT REQUIREMENTS

3.1 Internal assessment (50 percent)

3.1.1 Theoretical components,

The theoretical component will form 40 percent part of internal assessment.

Internal assessment of the theoretical component of Fitting and Turning level 3 will take the form of observation, class questions, group work, (informal group competitions with rewards), individual discussions with students, class, topic and semester tests, internal examinations. Daily observation can be done when marking exercises of the previous day and class questions.

Assignments, case studies and tests can be done at the end of a topic. Tests and internal examinations must form part of internal assessment.

3.1.2 Practical Component

The practical component will form 60 percent part of internal assessment.

Practical components include applications and exercises. All practical components must be indicated in a Portfolio of Evidence (PoE).

Internal assessment of the practical component of Fitting and Turning Level 3 will take the form of assignments, practical exercises, case studies, practical examinations in a simulated business environment.

Student may complete practical exercises on a daily basis. Assignments and case studies can be done at the end of a topic. Practical examination can form part of internal practical assessment.

- **Some examples of practical assessments include, but are not limited to:**

- Presentations (lectures, demonstrations, group discussions and activities, practical work, observation, role play, self activity, judging and evaluation).
- Aids
- Exhibitions by students
- Visits undertaken by students based on a structured assignment task
- Research
- Task performance in a simulated / Structured environment

- **Definition of the term “Structured environment”**

“Structured environment” for the purposes of assessment refers to an actual or simulated workplace, or workshop environment.

It is advised that a practicum room is available on each campus for practical assessment.

Evidence of this practical component must be provided in the form of a logbook with a clear listing of the competencies to be assessed. The following information must be contained in the logbook:

- Dates of start and completion
- Project title and nature of work
- Summary of tasks, Duties and Responsibilities
- Number of weeks spent in each category
- Supervisors Name and Signature

An example of a logbook record is as follows:

SCHOOL OF MECHANICAL ENGINEERING

EXPERIENTIAL TRAINING RECORD OF: (Name).....

Dates From: To:	Project title and nature of work	Summary of tasks, Duties and Responsibilities	Number of weeks spent in each category						Supervisors Name and Signature
			A1	B1	C1	D1	E1	F1	
		Total Brought Forward							
		Total Carried Forward							
		Total approved by College							

For the logbook to be regarded as valid evidence it must be signed off by an assigned supervisor:

• **Evidence in practical / application assessments**

All evidence pertaining to evaluation of practical work must reflect in the students' PoE. The tools and instruments constructed and used for the purpose of conducting such assessments must be clearly evident from the PoE.

3.1.3 Processing of internal assessment mark for the year

A year mark out of 100 is calculated by adding the marks of the theoretical component and the practical component of the internal continuous assessment.

3.1.4 Moderation of internal assessment mark

Internal assessment is subjected to both internal and external moderation procedures as contained in the National Examinations Policy for FET College Programmes.

3.2 External assessment (50 percent)

A national examination is conducted annually in October or November by means of a paper set externally and marked and moderated externally.

4 WEIGHTED VALUES OF TOPICS

TOPICS	WEIGHTED VALUES
1. Grinding tools and drill bits	10%
2. Bearings	15%
3. Brakes and clutches	15%
4. Direct drives	15%
5. Dynamics seals in machines and equipment	15%
6. Heat exchangers and pressure vessels	15%
7. Lubrication systems	15%
TOTAL	100

5 CALCULATION OF FINAL MARK

Continuous assessment: Student's mark/100 x 50/1 = a mark out of 50 (a)

Theoretical examination mark: Student's mark/100 x 50/1 = a mark out of 50 (b)

Final mark: (a) + (b) = a mark out of 100

All marks are systematically processed and accurately recorded to be available as hard copy evidence for, amongst others, purpose of moderation and verification, as well as purposes of reporting.

6 PASS REQUIREMENTS

The student must obtain at least fifty (50) percent in ICASS and fifty (50) percent in the examination.

7 SUBJECT AND LEARNING OUTCOMES.

On completion of Fitting and Turning Level 3 the student should have covered the following topics:

- Topic 1: Grinding tools and drill bits.
- Topic 2: Bearings.
- Topic 3: Brakes and clutches.
- Topic 4: Direct drives.
- Topic 5: Dynamic seals in machines and equipment
- Topic 6: Heat exchangers and pressure vessels.
- Topic 7: Lubrication systems.

7.1 Topic 1: Grinding tools and drill bits

7.1.1 Subject Outcome 1: Plan and prepare for tool grinding.

Learning Outcomes:

- Select appropriate grade and shape of grinding stone.
- Establish material to be cut/drill with the tool/drill bit.
- Identify the types of angles (helix, rakes, clearance etc).
- Identify type of material a tool is made of.
- Identify different types of stones and their bonds.

7.1.2 Subject Outcome 2: Prepare site and equipment.

Learning Outcomes:

- Inspect the grinding wheels.
- Dress the grinding wheels.
- Adjust the tool rest.
- Set the gap between the wheel and tool rest.
- Identify damaged or sub-standard components and equipment and take appropriate corrective action
Range: Minimum grinding wheel diameter and thickness, cracks, axel nut and thrust washer, transparent safety glass.
- Identify and remove any flammable materials present which might cause an unsafe working environment.

7.1.3 Subject Outcome 3: Grind tools and drill bits.

Learning Outcomes:

- Inspect and assess drill bits and tool condition.
- Sharpen the drill bit/tool to manufacturer's specifications and to meet job requirements.
- Determine and complete set up angles using the correct measuring instrument.
- Position the drill bit on the rest.
- Grind/sharpen the drill bit to meet the required angle for different materials.
- Check tool and/drill bits for compliance with specifications and apply further grinding if necessary
- Apply cooling during grinding process to prevent overheating of grinding surface.
- Apply appropriate safety practices during the grinding process.

7.1.4 Subject Outcome 4: Care for and store grinding tools and equipment.

Learning Outcomes:

- Clean grinding tools and equipment.
- Store grinding tools and equipment in a safe place.

7.1.5 Subject Outcome 5: Record information on work completed.

Learning Outcomes:

- Open a new file and name it or use an existing file.
- Accurately record information on completed job.
- Store information in a safe place.

7.1.6 Subject Outcome 6: Explain incidents and problems related to tool grinding.

Learning Outcomes:

- Explain correct sequence of activities to follow during tool grinding
- Describe the implications of incorrect sequence of activities and operations.

7.1.7 Subject Outcome 7: Explain correct safety procedures and care when grinding tools and drill bits

Range: Human beings, machines, equipment, materials and environment.

Learning Outcomes:

- Explain worksite health and safety practices.
- Explain good housekeeping.
- Explain the safety precautions before and after using the grinding machine.
- Explain the importance of a clean working area.
- Describe the necessity of cleaning equipment, materials and machines.
- Identify appropriate safety clothes for a grinding process and explain the importance of it.

7.2 Topic 2: Bearings

7.2.1 Subject Outcome 1: Plan and prepare for bearing replacement.

Learning Outcomes:

- Obtain documents and investigate bearing history.
- Interpret engineering drawings.
- Determine maintenance schedule.
- Identify type of bearing.

Range: Anti-friction bearings include ball (single and double thrust) and roller (needle, spherical, taper) types. Plain bearings include plain, wrapped, flanged, split and thrust types in brass, bronze, white metal, phosphor bronze, aluminium and synthetics.

- Identify appropriate tools and equipment for the job.
- Explain bearing replacement to be completed.

7.2.2 Subject Outcome 2: Prepare site and equipment for bearing replacement.

Learning Outcomes:

- Isolate equipment electrically from other energy sources.
- Isolate equipment mechanically from other energy sources.
- Select appropriate tools and equipment.

7.2.3 Subject Outcome 3: Check bearings.

Learning Outcomes:

- Inspect bearing assemblies for conformance to manufacturer's specifications.
- Check bearing lubrication.
- Check bearing cooling devices.
- Use bearing diagnostic equipment to establish bearing conditions.

7.2.4 Subject Outcome 4: Remove and inspect bearings.

Learning Outcomes:

- Remove bearings and/or assemblies.
- Identify the bearing parts.
- Strip bearing assemblies.
- Clean bearing and associated parts.
- Inspect damage and wear.

7.2.5 Subject Outcome 5: Install bearings to machines and equipment.

Learning Outcomes:

- Select bearing parts.
- Select fitting equipment.
- Install bearing assemblies in accordance with manufacturer specifications.
- Secure locking devices in accordance with machine requirements.

7.2.6 Subject Outcome 6: Check installation for compliance with operational requirements.

Learning Outcomes:

- Check replacement parts.
- Test replacement parts.
- Apply appropriate safety practices during the maintenance process.

7.2.7 Subject Outcome 7: Record information on work completed.

Learning Outcomes:

- Open a new file and name it or use an existing file.
- Accurately record information on completed job.
- Store information in a safe place.

7.2.8 Subject Outcome 8: Explain incidents and problems related to bearing replacement.

Learning Outcomes:

- Explain correct sequence of activities to follow when maintaining bearings
- Create an awareness of possible incorrect decisions that can be taken during the maintaining of bearings.
- Explain and discuss the implications of incorrect sequence of activities and operations.

7.2.9 Subject Outcome 9: Explain correct safety procedures and care when maintaining bearings in machines and equipment.

Learning Outcomes:

- Explain worksite health and safety practices.
- Explain the importance of a clean working area.
- Explain good housekeeping.
- Explain the safety precautions before and after replacing bearings.
- Describe the necessity of correct tools, equipment and cleaning materials.
- Describe the importance of and identify the appropriate safety clothes.

7.3 Topic 3: Brakes and clutches

7.3.1 Subject Outcome 1: Plan and prepare for brake and clutch maintenance.

Learning Outcomes:

- Read and interpret job card.
- Obtain documents.
- Interpret engineering drawings.
- Schedule maintenance procedures.
- Select appropriate tools and equipment.
- Clean and inspect the complete assembly.
- Identify the wear on the linings and score marks on the friction surface.

7.3.2 Subject Outcome 2: Prepare site and equipment for brake and clutch maintenance.

Learning Outcomes:

- Isolate equipment electrically from other energy sources.
- Isolate equipment mechanically from other energy sources.
- Support the load before the brake or clutch is released, removed, adjusted, lowered or worked on.

7.3.3 Subject Outcome 3: Check brakes and clutches in situ.

Learning Outcomes:

- Identify types of brakes and clutches.
- Inspect assemblies for conformance to manufacturer's specifications.
- Measure the air gaps according to manufacturer's specifications.
- Inspect the hydraulic systems for leaks.
- Inspect the friction area for wear.
- Measure and adjust brakes and clutches according to manufacturer's specifications.
- Apply appropriate safety practices during the process.

7.3.4 Subject Outcome 4: Remove and maintain brakes and clutches.

Learning Outcomes:

- Strip brake and clutch.
- Identify brake and clutch parts.
- Remove brake and clutch assemblies.
- Inspect parts for non-conformances.
- Clean parts.
- Assemble brake and clutch components.
- Apply appropriate safety practices during the process.

7.3.5 Subject Outcome 5: Install brakes and clutches to machines and equipment.

Learning Outcomes:

- Secure locking devices in accordance with machine requirements.
- Check replacement parts.
- Test replacement parts.
- Identify non-conformance of parts.
- Take appropriate corrective action.
- Install brake and clutch correctly according to manufacturer's specifications.
- Apply appropriate safety practices during the process.

7.3.6 Subject Outcome 6: Check installation for compliance with operational requirements.

Learning Outcomes:

- Identify replacement brake and clutch components from manufacturer markings and parts publications.
- Check replacement parts.
- Test replacement parts.

7.3.7 Subject Outcome 7: Record information on work completed.

Learning Outcomes:

- Open a new file and name it or use an existing file.
- Accurately record information on completed job.
- Store information in a safe place.

7.3.8 Subject Outcome 8: Take care of brake and clutch maintenance tools and equipment and store it safely.

Learning Outcomes:

- Clean and maintain brake and clutch equipment and tools.
- Store brake and clutch equipment and tools in a safe place.

7.3.9 Subject Outcome 9: Explain incidents and problems related to brake and clutch maintenance.

Learning Outcomes:

- Explain the correct sequence of activities to follow when maintaining brakes and clutches.
- Create an awareness of possible incorrect decisions that can be taken while working on and maintaining brakes and clutches.
- Explain and discuss the implications of incorrect sequence of activities and operations.
- Explain appropriate safety practices during the process.

7.3.10 Subject Outcome 10: Explain correct safety procedures and care during the removal, replacement and maintenance of brakes and clutch systems.

Range: Human beings, machines, equipment, materials and environment.

Learning Outcomes:

- Explain worksite health and safety practices during brake and clutch maintenance
- Explain good housekeeping.
- Explain the importance of a clean working area.
- Describe the necessity of appropriate cleaning materials.

Range: Water for hydraulic systems

- Identify the appropriate safety clothes and masks and explain its importance.

7.4 Topic 4: Direct drives

7.4.1 Subject Outcome 1: Plan and prepare site and equipment for direct drive maintenance.

Learning Outcomes:

- Determine the maintenance schedule.
- Prepare site to ensure a hazardous free work area.
- Identify appropriate tools and equipment to complete direct drive maintenance.
- Identify different types of couplings available.
- Acquire lubricants and cleaning agents in the required quantities.

7.4.2 Subject Outcome 2: Service and maintain a direct drive.

Learning Outcomes:

- Isolate direct drive in accordance with worksite procedures.
- Check components according to maintenance schedule and determine services required to components.
- Service components.
- Check loose bolts, pins and links.
- Check safety covers for steadiness.
- Verify completion of maintenance.

7.4.3 Subject Outcome 3: Replace components on direct drives.

Learning Outcomes:

- Identify components to be replaced.
- Select appropriate tools to replace components.
- Remove components requiring service.
Range: Bearings, couplings, rubber bands, fluids
- Select suitable components for the task.
- Carefully replace components to prevent damage.
- Replace protective guards.
- Verify replacement of components

7.4.4 Subject Outcome 4: Align direct drives after replacement of coupling and/components.

Learning Outcomes:

- Set direct drive gap within manufacturer specified tolerance.
- Set axial alignment within manufacturer specified tolerance.
- Set radial alignment within manufacturer specified tolerance.

7.4.5 Subject Outcome 5: Apply quality checks and post-maintenance activities on work completed.

Learning Outcomes:

- Carry out a visual inspection on direct drive to ensure conformance to manufacturer specifications.
- Confirm direct drive performance.
- Confirm that maintenance activities meet customer requests and manufacturer's specifications.

7.4.6 Subject Outcome 6: Take care of direct drive maintenance tools and equipment and store it safely.

Learning Outcomes:

- Clean direct drive maintenance equipment.
- Store direct drive maintenance equipment according to workshop procedures.

7.4.7 Subject Outcome 7: Report on system condition.

Learning Outcomes:

- Compile an accurate condition report on direct drive and components services and maintenance completed.
- Process direct drive and components service report timeously.

7.4.8 Subject Outcome 8: Explain principles, incidents and problems related to direct drive maintenance.

Learning Outcomes:

- Explain working principles and components of direct drives.
- Explain correct sequence of activities to follow when maintaining direct drives.
- Discuss the implications of incorrect sequence of activities and operations.

7.4.9 Subject Outcome 9: Explain correct safety procedures and care while maintaining direct drives.

Range: Human beings, machines, equipment, materials.

Learning Outcomes:

- Explain the importance of a clean working area.
- Explain the correct disposal of waste materials.
- Explain appropriate safety covers for direct drives.
Range: Functions, importance, dimensions, materials used for drives.
- Explain the correct displays of safety instructions for direct drive installations.

7.5 Topic 5: Dynamic seals in machines and equipment

7.5.1 Subject Outcome 1: Plan and prepare for dynamic seal replacement.

Learning Outcomes:

- Obtain documents and investigate seal replacement history.
- Interpret engineering drawings.
- Determine maintenance schedule.
- Identify type of seals.
- Identify appropriate tools and equipment for the job.
- Explain seal replacement to be completed.
- Select protective safety equipment.

7.5.2 Subject Outcome 2: Prepare site and equipment for seal replacement.

Learning Outcomes:

- Prepare site to ensure a hazardous free work area.
- Identify and select appropriate tools and equipment to complete the task.
- Acquire lubricants and cleaning agents in the required quantities.
- Isolate system.
- Depressurise system.
- Ensure system is safe to work on.

7.5.3 Subject Outcome 3: Maintain dynamic seals.

Learning Outcomes:

- Identify the specific seals used in the machine or equipment.
- Inspect the working condition of seals and seal assembly to determine deterioration and compare to manufacturer's specifications.
- Remove seal assembly in correct sequence from machine.
- Identify worn seals and assembly parts to be replaced.
- Carefully handle and install seals and seal assembly to machines or equipment.
- Apply appropriate lubrication to seals and seal assembly according to manufacturer's specifications.
- Test seal assembly to ensure there are no leaks or overheating.

7.5.4 Subject Outcome 4: Take care of system maintenance tools and equipment and store safely.

Learning Outcomes:

- Clean dynamic seal maintenance equipment.
- Store dynamic seal maintenance equipment according to workshop procedures.

7.5.5 Subject Outcome 5: Record information on work completed.

Learning Outcomes:

- Open a new file and name it or use an existing file.
- Accurately record information on completed job.
- Store information in a save place.

7.5.6 Subject Outcome 6: Explain principles, incidents and problems related to dynamic seals in machines and equipment.

Learning Outcomes:

- Explain working principles and types of dynamic seals
- Explain correct sequence of activities to follow when maintaining dynamic seals.
- Discuss the implications of incorrect sequence of activities and operations.

7.5.7 Subject Outcome 7: Explain correct safety procedures and care while maintaining dynamic seals drive.

Range: Human beings, machines, equipment, materials.

Learning Outcomes:

- Explain the importance of a clean working area.
- Explain the correct disposal of waste materials.
- Explain health and safety procedures while completing work in accordance to schedules and manufacturer's specifications.

7.6 Topic 6: Heat exchangers and pressure vessels

7.6.1 Subject Outcome 1: Plan and prepare for heat exchanger and pressure vessel maintenance and pressure testing.

Learning Outcomes:

- Identify type of heat exchangers and pressure vessels.
- Obtain documents and investigate history of maintenance schedule on a heat exchanger and a pressure vessel.
- Carefully inspect a heat exchanger and pressure vessel and identify possible faults and parts to be replaced.
- Identify appropriate tools and equipment for the job required.
- Select protective safety equipment.

7.6.2 Subject Outcome 2: Prepare site and equipment.

Learning Outcomes:

- Prepare site to ensure a hazardous free work area.
- Depressurise and cool down the system.
- Isolate electrical and mechanical energy.
- Acquire lubricants and cleaning agents in the required quantities.
- Ensure system is safe to work on.

7.6.3 Subject Outcome 3: Complete a visual and certified inspection and assessment of the heat exchanger and pressure vessel condition.

Learning Outcomes:

- Carry out a visual inspection to determine the overall condition of the pressure vessel or heat exchanger.
Range: Valves, cracks, corrosion, gauges and instruments.
- Document and report outcome of the assessment.
- Check heat exchanger for compliance with operational requirements.
- Blank off equipment for pressure testing.
- Calibrate pressure test equipment and set pressure not to exceed safe maximum working pressure.
- Fill pressure vessel with water.
- Apply pressure to maximum pressure levels using certified pressure test equipment.
- Read gauges and record pressure readings and other details necessary for certification.
- Witness a pressure test conducted by an approved inspection officer of a statutory authority if required.
- Issue a certificate.

7.6.4 Subject Outcome 4: Maintain and care for heat exchanger and pressure vessels.

Learning Outcomes:

- Adjust and secure safe maximum working pressure of heat exchangers and pressure vessels.
- Replace worn seals where necessary.
- Run a full operational test to identify problems and determine working condition of automatic controls.
- Adjust control points on heat exchangers and pressure vessels according to operational requirements.
- Select and replace maintenance parts, consumables or components which are not adjustable.
- Clean heat exchanger and pressure vessel maintenance equipment according to workshop procedures.
- Store equipment used for maintenance according to workshop procedures.

7.6.5 Subject Outcome 5: Record information on work completed.

Learning Outcomes:

- Open a new file and name it or use an existing file.
- Accurately record information of work done on heat exchanger and pressure vessel.
- Store information in a save place.

7.6.6 Subject Outcome 6: Explain principles, incidents and problems related to heat exchangers and pressure vessels.

Learning Outcomes:

- Explain working principles and types of heat exchangers and pressure vessels.
- Explain correct sequence of activities to follow when maintaining heat exchangers and pressure vessels.
- Indicate the implications of incorrect sequence of activities and operations.

7.6.7 Subject Outcome 7: Explain correct safety procedures and care while maintaining heat exchangers and pressure vessels.

Range: Human beings, machines, equipment, materials, environment.

Learning Outcomes:

- Explain the importance of a clean working area.
- Explain the correct disposal of waste materials.
- Explain safe working procedures according to schedules and manufacturer's specifications.
- Explain safe maximum working pressure of heat exchangers and pressure vessels.
- Explain personal health and safety while working on pressure vessels and heat exchangers.

7.7 Topic 7: Lubrication systems

7.7.1 Subject Outcome 1: Plan maintenance on lubrication systems.

Learning Outcomes:

- Investigate service history through collection of information from documents and data plate
- Determine appropriate lubricants from machine/equipment records and manuals.
- Determine filtration components to be replaced.
- List appropriate tools and equipment required for maintenance.

7.7.2 Subject Outcome 2: Prepare site and equipment.

Learning Outcomes:

- Identify type of lubrication system.
- Prepare site to ensure a hazardous free work area.
- Collect appropriate tools and equipment to complete the task.
- Acquire lubricants and cleaning agents in the required quantities.
- Isolate system.

7.7.3 Subject Outcome 3: Inspect and assess the functioning of the lubrication system.

Learning Outcomes:

- Inspect the working condition of the lubrication system to determine deterioration and compare to manufacturer's specifications.

Range: Pressure or gravity test, dynamic and static.

- Diagnose system fault(s).

7.7.4 Subject Outcome 4: Rectify lubrication system faults.

Learning Outcomes:

- Determine components or parts in need of a service and components or parts to be replaced.
- Remove serviceable components or parts, service and replace.
- Remove unserviceable components or parts and fit new parts.
- Adjust components or parts on lubrication system where needed.

7.7.5 Subject Outcome 5: Check system operation for compliance with operational requirements.

Learning Outcomes:

- Select testing tools and equipment.
- Test lubricating system.
- Run a full operational test to confirm working of lubrication system is in accordance to the manufacturer's operational specifications.

7.7.6 Subject Outcome 6: Record information on work completed.

Learning Outcomes:

- Open a new file and name it or use an existing file.
- Accurately record information on completed job.
- Store information in a save place.

7.7.7 Subject Outcome 7: Discuss and explain incidents and problems related to maintaining lubrication systems.

Learning Outcomes:

- Explain working principles and types of lubrication systems.
- Explain correct sequence of activities to follow when maintaining lubrication systems.
- Discuss the implications of incorrect sequence of activities and operations.

7.7.8 Subject Outcome 8: Explain correct safety procedures and care while maintaining lubrication systems.
Range: Human beings, machines, equipment, materials, environment.

Learning Outcomes:

- Explain the importance of a clean working area.
- Explain the correct disposal of waste materials.
- Explain safe working procedures according to schedules and manufacturer's specifications.
- Explain personal health and safety while working on lubrication systems.

8 RESOURCE NEEDS FOR THE TEACHING OF FITTING AND TURNING LEVEL 3.

8.1 Physical resources

- Store room-consumable
- Tool room.
- Lecture room(s)
- Training area-work area
- Ablution facilities

8.2 Human resources

The educator for Fitting and Turning Level 3 must be:

- A subject matter expert
- Certificated as an assessor with ETDP SETA
- Registered with an ETQA or SETA
- A life-long learner
- Qualified Fitter and Turner Artisan.
- Computer literate.
- Conversant with OBE methodologies
- Instructor qualified in the field of study
- Have skills in facilitating learning programmes development.

It is of paramount importance that educators working in this environment attend seminars and upgrading workshops in order to be updated/re-skilled with the latest developments in technology.

8.3 Financial resources

Funds, from learning provider or funding bodies for the procurement of consumables tools and equipment are readily made available for the effective operation of a workplace involved in a training programme and learners individually equipped with necessary tools.

8.4 Learning materials

Learning materials must conform to approved training and industrial standard requirements and articulate to Higher Education. The following is required:

- Learning material literature necessary to fully address the task.
- Learning materials using projection equipment.
- Promotion of opportunities to research information.
- Educational tours to relevant learning venues.
- Educational and motivational talks from industry.
- Visual and audio-visual material
- Workshop manuals and documentation for the theoretical knowledge.
- Models and demonstrations.