education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

SUBJECT GUIDELINES

ENGINEERING FABRICATION

NQF LEVEL 2

September 2007

INTRODUCTION

A. What is Engineering Fabrication?

Engineering Fabrication deals with the various processes involved in making or producing steel components required in the manufacturing, engineering and technological environments. Students are trained to take factors such as safety, planning and preparation for fabricating, choice of tools and equipment and various other factors into account.

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

In this programme, students will be expected to make or produce steel components relating to the requirements of industry. Therefore, Engineering Fabrication will prepare students with the required confidence levels to fabricate components to a high degree of accuracy and efficiency. Students will be required to fully understand the principles of drawing critical to fabrication processes.

In the South African context, sugar mills, oil refineries, mines, harbours and ports and agricultural industries all require various steel components for manufacturing, experimental, maintenance and storage purposes at all times; consequently, students must be trained to fabricate and produce components.

C. The link between the Engineering Fabrication Learning Outcomes and the Critical and Developmental Outcomes

The Learning Outcomes addressed in this subject speak to many of the Critical and Developmental Outcomes as follows:

- Identify and solve problems showing responsible decisions have been taken.
- Work effectively with others in a group or team.
- Organise oneself in a responsible and effective manner.
- Collect, analyse and evaluate information.
- Realise the world is a set of interrelated systems by showing solutions of problems do not exist in isolation.

D. Factors that contribute to achieving the Engineering Fabrication Learning Outcomes

Students should be interested in the interpretation of engineering drawings and appreciate analytical and critical evaluation of processes and systems. Also, students who have a developed sense of creativity will enjoy this subject. Problem-solving skills are an advantage when achieving the Learning Outcomes. Students who have managerial and leadership qualities will also be likely to succeed.

ENGINEERING FABRICATION – LEVEL 2

CONTENTS

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 student meets all the assessment requirements.

Students with special education needs (LSEN) must be catered for in a way that eliminates barriers to learning.

2 SUBJECT LEVEL FOCUS

The student should be able to:

- Produce components with the fabrication processes.
- Identify engineering materials used in the fabrication processes.
- Select, use and care for fabrication machinery.

3 ASSESSMENT REQUIREMENTS

The purpose of assessment is to determine the student's progress in learning and to make a judgment about the student's work. The judgment should be based on sufficient evidence in respect of the Learning Outcomes being considered. Evidence can be collected at different times and places and with the use of various methods, instruments, modes and media. Assessment of learning for promotion or certification in the National Certificates (Vocational) comprises two components. A comprehensive Portfolio of Evidence (PoE) of achievements gathered during the year and an external assessment in the form of a theoretical examination are used to assess students.

Assessment should take place within a framework of good assessment principles that are underpinned by the objectives of the National Qualifications Framework (NQF). These objectives are to:

- Create an integrated national framework for learning achievements.
- Facilitate access to and mobility and progression within education, training and career paths.
- Enhance the quality of education and training.
- Contribute to the full personal development of each student and the social and economic development of South Africa.

3.1 Internal assessment (50 percent)

All internal assessments must be finalised by a certified assessor who has obtained a certificate of competency. All assessment must be moderated according to the internal moderation policy of the Further Education and Training (FET) college, which is a continuous process from planning the assessment methods and instruments to continuous support to the assessors.

Before a lecturer assesses students, it is crucial that the purpose of the assessment is clearly and unambiguously established. The purpose of the assessment must be understood to ensure that an appropriate match exists between the purpose and method of assessment, in order that decisions and conclusions based on the assessment are fair and appropriate for the particular purpose

3.1.1 Theoretical Component

The theoretical component forms 40 percent of the internal assessment mark.

Internal assessment of the theoretical component in Engineering Fabrication Level 2 takes the form of observation, class questions, group work, informal group competitions with rewards, individual discussions with students, class, topic and semester tests and internal examinations. Lecturers can observe students when marking exercises from the previous day and asking class questions.

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

3.1.2 Practical Component

The practical component forms 60 percent of the internal assessment mark.

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

Internal assessment of the practical component in Engineering Fabrication Level 2 takes the form of assignments, practical exercises, case studies and practical examinations in a workshop environment.

Students may complete practical exercises daily. Assignments and case studies can be completed at the end of a topic. Practical examinations can form part of internal practical assessment.

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

  A. Presentations (lectures, demonstrations, group discussions and activities, practical work, observation, role-play, independent activity, synthesis and evaluation)
  B. Exhibitions by students
  C. Visits undertaken by students based on a structured assignment task
  D. Research
  E. Task performance in a "Structured Environment"

- **Definition of the term "Structured Environment"**

For the purposes of assessment, "Structured Environment" refers to a simulated workplace or workshop environment. Activities in the simulated workplace or environment must be documented in a logbook with a clear listing of the competencies to be assessed. The following information must be contained in the logbook:

- Nature of department or environment in which practical component was achieved
- Learning Outcomes
- Activities in the environment with which to achieve the Learning Outcomes
- Time spent on activities
- Signature of lecturer or supervisor and student

For the logbook to be regarded as valid evidence, it must be signed by an officially assigned supervisor.

- **Evidence in practical assessments**

All evidence pertaining to evaluation of practical work must be reflected in the students' Portfolio of Evidence (PoE). The tools and instruments constructed and used to conduct these assessments must be clear from the evidence contained in the Portfolio of Evidence (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 (40 percent) and the practical component (60 percent) of the internal continuous assessment (ICASS).

3.1.4 Moderation of internal assessment mark

Internal assessment is subjected to internal and external moderation procedures as set out 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(s) set and moderated externally. A practical component will also be assessed.

External assessment details and procedures are set out in the *Assessment Guidelines: Engineering Fabrication* (Level 2).

4 WEIGHTED VALUES OF TOPICS

TOPICS	WEIGHTED VALUE
1. Templating and Patternmaking	15
2. Principles and Techniques of Marking Off and Laying Out	15
3. Forming and Shaping Techniques	15
4. Oxy-Acetylene Cutting	15
5. Power Machine Cutting	15
6. Fabrication of Components by Parallel Line Methods	10
7. Fabrication of Components by Radial Line Methods	10

8. Fabrication of Components by Triangulation	5
TOTAL	**100**

5 CALCULATION OF FINAL MARK

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

Examination mark: Student's mark/100 x 50 = 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, reporting, moderation and verification purposes.

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 the completion of Engineering Fabrication Level 2, the students should have covered the following topics:

Topic 1: Templating and Patternmaking
Topic 2: Principles and Techniques of Marking Off and Laying Out
Topic 3: Forming and Shaping Techniques
Topic 4: Oxy-Acetylene Cutting
Topic 5: Power Machine Cutting
Topic 6: Fabrication of Components by Parallel Line Methods
Topic 7: Fabrication of Components by Radial Line Methods
Topic 8: Fabrication of Components by Triangulation

7.1 Topic 1: Templating and Patternmaking

Subject Outcome 1: Explain the importance of templates in the fabrication process.

Learning Outcomes:

The student should be able to:
- Explain what a template is.
- Understand how the wrong choice of material to make a template can affect the output.
- Explain the various uses of templates.
- Understand the importance of accuracy when templating.

Subject Outcome 2: Demonstrate knowledge of patternmaking by applying development techniques.

Learning Outcomes:

The student should be able to:
- Identify specific shapes of templates.
- Give detailed explanations and descriptions of correct drawing techniques.
- Demonstrate the making of each basic type of template using development techniques.

Subject Outcome 3: Understand how scaling is used in templating.

Learning Outcomes:

The student should be able to:
- Explain what scale is and how it is used.
- Give examples of real-life situations where scaling is used.
- Clearly illustrate scale down and scale up definitions.

Subject Outcome 4: Understand the tolerances used in making templates.

Learning Outcomes:

The student should be able to:

- Explain the importance of tolerance in relation to the type of material used for templating.
- Explain how thickness of the template affects the outcome of the job.
- Understand the physiological and structural changes of a template in relation to its accurateness.
- Explain the meaning of compensation.

7.2 Topic 2: Principles and Techniques of Marking Off and Laying Out

Subject Outcome 1: Prepare for layout and marking off of materials under supervision.

Learning Outcomes:

The student should be able to:

- Identify potential hazards before marking off begins.
- Determine allowance for the marking-off and fabrication process.
- Identify the materials and tools required for marking.
- Determine which development method to use.
- Determine datum points, gradients, angles and other criteria for making the template.

Subject Outcome 2: Make and use templates.

Learning Outcomes:

The student should be able to:

- Choose the correct type of material to use for the template.
- Establish datum points to begin the template.
- Correctly mark and make structural detail templates according to specifications.
- Produce wrap-around templates using the correct design, tolerance and fitment principles.

Subject Outcome 3: Mark out sections required for use.

Learning Outcomes:

The student should be able to:

- Mark out the appropriate sections using the applied competences.
- Annotate on the template all the relevant details and its purpose during the fabrication process.

Subject Outcome 4: Mark out surface developments.

Learning Outcomes:

The student should be able to:

- Explain and identify the various surfaces to be templated.
- Prepare the surface to be templated by measuring, marking and keeping it free from scale and dust.
- Correctly identify the fabrication tolerances when using the template.

7.3 Topic 3: Forming and Shaping Techniques

Subject Outcome 1: Prepare for forming and shaping of materials.

Learning Outcomes:

The student should be able to:

- Choose the correct types of material and tools for the process.
- Demonstrate the necessary calculations required for the process.
- Plan the sequence of operations carefully.
- Identify hazards before starting any operations.

Subject Outcome 2: Perform forming and shaping of materials.

Learning Outcomes:

The student should be able to:

- Operate the necessary tools and equipment according to safe workshop practices.
- Form materials according to job specifications.

- Shape materials according to job specifications.

7.4 Topic 4: Oxy-Acetylene Cutting

Subject Outcome 1: Describe the oxy-acetylene cutting process.

Learning Outcomes:

The student should be able to:

- Correctly and comprehensively explain the terminologies associated with oxygen-acetylene gas cutting procedures.
- Identify the various cutting pressures and the correct nozzles associated with each in relation to the thickness of material (steel) being cut.
- Correctly explain the actual chemical and mechanical processes that take place during cutting.
- Carry out various pre-operational checks.
- Demonstrate start-up and shut-down procedures

Subject Outcome 2: Cut materials.

Learning Outcomes:

The student should be able to:

- Adhere to all safety precautions according to workshop requirements and the Occupational Health and Safety Act.
- Demonstrate the cutting operation using knowledge and skills attained.
- Apply quality checks to process.

Subject Outcome 3: Care for and store cutting equipment.

Learning Outcomes:

The student should be able to:

- Explain care and storage procedures for tools and equipment according to worksite practices and specifications.
- Dismantle oxyfuel cutting equipment according to workshop procedures.
- Store cylinders, hoses, gauges and torch away neatly and safely in accordance with procedures.

7.5 Topic 5: Power Machine Cutting

Subject Outcome 1: Prepare for mechanical cutting of materials under supervision.

Learning Outcomes:

The student should be able to:

- Identify cutting machines and lubricants used in the operation.
- Select the correct lubricant for the process and the correct personal protective equipment.
- Select the correct power tool and the correct blade, saw or cutter for the operation.
- Inspect the machine for safety hazards or mechanical inconsistencies.
- Adjust the settings to perform optimum cutting operations.
- Identify potential hazards that may render the operation unsafe.
- Explain the reason for maintaining correct posture while cutting.

Subject Outcome 2: Perform mechanical cutting of materials under supervision.

Learning Outcomes:

The student should be able to:

- Cut materials as required safely and accurately.
- Apply lubricants as and when required.
- Smooth out rough edges and burrs.

7.6 Topic 6: Fabrication of Components by Parallel Line Methods

Subject Outcome 1: Explain the factors critical to fabricating components using the parallel line method.

Learning Outcomes:

The student should be able to:

- Explain the parallel line method clearly, correctly and comprehensively.
- Identify potential error-causing factors and compensate for them.
- Identify the reason why no other method will work.
- Demonstrate the techniques involved in applying this method correctly.

Subject Outcome 2: Prepare to fabricate components.

Learning Outcomes:

The student should be able to:

- Obtain the required permission or clearance to enter the work area.
- Demonstrate how personal protective equipment is worn correctly.
- Correctly select the tools and equipment required for fabrication.
- Check all lifting equipment that may be used for mechanical correctness and safety.

Subject Outcome 3: Fabricate the components.

Learning Outcomes:

The student should be able to:

- Examine workplace for safeness and cleanliness.
- Use the parallel line development method and mark out templates.
- Use templates to produce components.
- Place correct components with each other to produce the product.
- Constantly check for correctness by measuring the product and ensure specifications are adhered to.
- Complete the job by checking the quality of the product and maintaining safe and neat working standards.

7.7 Topic 7: Fabrication of Components by Radial Line Methods

Subject Outcome 1: Explain the factors critical to fabricating components using the radial line method

Learning Outcomes:

The student should be able to:

- Explain the radial line method clearly, correctly and comprehensively.
- Identify potential error-causing factors and compensate for them.
- Identify the reason why no other method will work.
- Demonstrate the techniques involved in applying this method correctly.

Subject Outcome 2: Prepare to fabricate components.

Learning Outcomes:

The student should be able to:

- Obtain the required permission or clearance to enter the work area.
- Demonstrate how personal protective equipment is worn correctly.
- Correctly select the tools and equipment required for fabrication.
- Check all lifting equipment that may be used for mechanical correctness and safety.

Subject Outcome 3: Fabricate the components.

Learning Outcomes:

The student should be able to:

- Examine workplace for safeness and cleanliness.
- Use the radial line development method and mark out templates.
- Use templates to produce components.
- Place correct components with each other to produce the product.
- Constantly check for correctness by measuring the product and ensure specifications are adhered to.
- Complete the job by checking the quality of the product and maintaining safe and neat working standards.

7.8 Topic 8: Fabrication of Components By Triangulation

Subject Outcome 1: Explain the factors critical to fabricating components using triangulation.

Learning Outcomes:

The student should be able to:

- Explain triangulation clearly, correctly and comprehensively.
- Identify potential error-causing factors and compensate for them.
- Identify the reason why no other method will work.
- Demonstrate the techniques involved in applying this method correctly.

Subject Outcome 2: Prepare to fabricate components.

Learning Outcomes:

The student should be able to:

- Obtain the required permission or clearance to enter the work area.
- Demonstrate how personal protective equipment is worn correctly.
- Correctly select the tools and equipment required for fabrication.
- Check all lifting equipment that may be used for mechanical correctness and safety.

Subject Outcome 3: Fabricate the components.

Learning Outcomes:

The student should be able to:

- Examine workplace for safeness and cleanliness.
- Use the triangulation development method and mark out templates.
- Use templates to produce components.
- Place correct components with each other to produce the product.
- Constantly check for correctness by measuring the product and ensure specifications are adhered to.
- Complete the job by checking the quality of the product and maintaining safe and neat working standards.

8 RESOURCE NEEDS FOR THE TEACHING OF ENGINEERING FABRICATION – LEVEL 2

8.1 Physical resources

- Light steel fabrication workshops
- Computer-equipped drawing rooms
- Computers with internet access
- Hand and power tools, as per topics
- Marking and measuring tools, as per topics
- Cutting equipment for light engineering fabrication

8.2 Human resources

- Certificated lecturer with at least a National Professional Diploma in Education
- Preferably a trade-tested lecturer with competencies in this field
- Assessor and moderator competencies
- Workshops, courses and other upskilling activities

8.3 Other resources

- Welding electrodes (2mm/12 gauge wire for 3mm plate)
- Cutting nozzles (0,8 mm nozzles)
- Extension cables (20 metre)
- Grinding discs (115mm and 230mm)
- Steel cutting discs (115mm and 230mm)
- Principles of developments (handbook for boilermakers)
- Annexure A where applicable

ANNEXURE A: RESOURCE NEEDS FOR ENGINEERING FABRICATION – LEVEL 2

Per every 20 students:

DESCRIPTION	TYPE
Adaptor: *Head stock – Dashin*	Dead centre MT3-2
Reducing sleeve	40XMT3 X Dia 40 ISO 40
Reducing plain	40xMT3 ISO 40
Reducing plain	40xMT2 ISO 40
Arbour: Facing – Rose cutter	R8 FMA32
Facing – Rose cutter	R8 Spigot threaded
Drill chuck	3MT-DIN B22
Drill chuck – keyless	3MT-DIN B16
Drill chuck	2MT-DIN B22
Drill chuck	B16-R8
Angle plate: Eron	Series: E118 305 x 229
Eron	E128 600 x 600
Analyser	Gas
Anvil-blacksmith	90kg
Balancing wheel	Hoffman Geodyna
Box spanner set	6mm Drive-Gedore
Box spanner set	12mm Drive Gedore
Boring: Head	Model BC3
Buff-and-polisher machine	DIA 250 Wheel
Bender – pipe	Ram Dia 50mm Stroke length 140 mm
Band saw – vertical	FuHo VBS 16
Band saw – horizontal	GB 4025 Semi-Automatic
Chuck:	
Chuck:	
Drilling	Porta Agip 1/16 -1/2
Drilling	Volidus 3-16mm
Drilling	B22 5-20mm
Milling	Clarkson Model SY 3405-R8
Milling	Clarkson Model SY 3407-ISO 40
Charger (battery)	Hawkins 6/60G
Centre: Dead	MT 3-2
Dead	MT 4-3
Clamping: Amco kit	M12x1,5
‘‘G’’	25mm Groz
‘‘G’’	50mm Groz
‘‘G’’	75mmGroz
‘‘G’’	150mm
Sash	1m (Heavy Duty)
Sash	1.5m (Heavy Duty)
Sash	2m (Heavy Duty)
Carver	75mm (medium throat)
Carver	150mm (medium throat)
Carver	200mm (medium throat)
Collets milling set	Dia 3-20mm R8
Calliper: Jenny	150mm

DESCRIPTION	TYPE
Inside	150mm
Cleaner (engine)	Wap Model DX 8005
Crane	Overhead (2 ton)
Compressor:	
Airline	270 L 5,5 HP 380 Volt 21,8CFM
Coil Spring	(With accessories)
Dividers:	
Spring bow	50mm
Spring bow	75mm
Spring bow	150mm
Drill:	
Sleeves	MT 2-1
Sleeves	MT 3-2
Sleeves	MT 4-3
Sleeves	MT 3-2 R8
Dividing head:	
Semi universal	Homge BS -1 (with accessories)
Drilling machine:	
Radial	Mao-Ming Model K.M.R-700 DS
Pedestal	Strands S-68
Pedestal	200F (380 Volt)
Hand	Metabo SB 650 / 2S
Deburring:	Blade type:
Tool	BS 1010
Tool	BS 1012
Tool	BS 2010
Tool	BS3010
Tool	BS 6010
Handel	NB 100
Electrical:	
Extension	7,5 Meters
Extension	15 Meters
Extension	30 Meters
Extractor screw kit	Rigid Set No 10 No 35583
Extractor:	
Tap	M3
Tap	M4
Tap	M5
Tap	M6
Tap	M7-8
Tap	M9-10
Tap	M12
Gauge:	
Thread	Whitworth
Thread	Metric
Feeler	Omni 25 Blade
Slip	Mitutoyo MSG 1120
Telescopic	Series 155
Surface	Base 82x63x25
Height	Dial Double Column 600mm
Dial magnetic base	Kanet MB-FX
Grinder:	
Pedestal	Dia 250 Wheel Marpol CE 98
Pedestal	Dia 150 Wheel Marpol (MBG 200/380)
Angle	Metabo W7-115
Angle	Metabo W?-230
Orbital (die)	Metabo GE 700

DESCRIPTION	TYPE
Dresser	Diamond 0,5 Carat
Dresser	No 1 Dia 35 Wheel
Guillotine	Heli CS 7 x 2550
Gun:	
Grease	Cylinder pump action
Oil	Cylinder pump action
Spray	Devilbus gravity feed
Air	Blow off
Holder:	
Lathe tool	6x6mm cutter
Lathe tool	8x8mm cutter
Lathe tool	10x10mm cutter
Lathe tool	12x12mm cutter
Hammer:	
Dead blow	Dia 54mm Face
Dead blow	Dia 65 mm Face
Ball pein	500gram
Ball pein	900 gram
Club	2kg
Hack saw:	
Hand	300mm blade capacity
Power machine	Model Carif 240
Hone	Amco Model 500
Harnesses	Safety
Helmut arc welding:	
Standard	Gardwell – Tufflite
Electronic	F 11 Protection 0-175 Amp
Inflator (tyre)	Vehicle
Jack:	
Trolley	5 ton
Bottle	3 ton
Scissors	3 ton
Pipes	N/A
Stands	3 ton
Stands	5 ton
Jumper cables	Vehicle
Key set:	
Allen	Metric 1,5-20mm
Allen	Imperal 1/16''- 1/2''
Torx	Multi Splined T 10-T50
Knurling tool:	
Revolving head	Type 8143
Swivel head	Type 8140
Lathe:	
Machine	Dashin Prince Swing 160 mm Bed 1m
Machine	Tezsan Model Cayirovo/G.E.B.Z.E.
CNC lathe	Alpha Plus 400S
Ladder:	
Aluminium	1,5m
Aluminium	6m
Aluminium	9m
Lead (light)	10 meter cord
Line (chalk)	10 meter
Lifter:	
Valve	Medium
Valve	Large

DESCRIPTION	TYPE
Lift:	
Car	4 post
Car	2 post
Media components:	
CPU	Diskette and CD writer
	Stored programmes: Word Excel Cad
Screen	
Keyboard	Colour tone
Mouse	
Memory stick	
Diskette	
CD	
Printer	
Fax	
Photocopier	
Telephone	
Micrometer:	Mitutoyo:
Outside	0 -25
Outside	25 -50
Outside	50-75
Outside	75-100
Depth	Series 129-111 0-100mm
Inside	50-300 mm
Milling machine:	
Pinnacle	Table 920x220 Model PK – 1 1/4M
Universal	Table 1100x300 Model X6125 A
Power transmissions:	
Clutches:	(Training models)
Friction	(Training models)
Centrifugal	(Training models)
Hydraulic	(Training models)
Chain Drives	(Training models)
Belt Drives	(Training models)
Gear Drives	(Training models)
Couplings:	(Training models)
Flexible	(Training models)
Fixed	(Training models)
Self Aligning	(Training models)
Punch:	
Centre	100mm length
Pin (set)	Dia 3 – 10mm
Letter (set)	6mm
Letter (set)	10mm
Number (set)	6mm
Number (set)	10mm
Pliers:	
Combination	200mm
Long Nose	200mm
Side Cutters	200mm
Circlip Outside	170mm bend
Circlip Outside	170mm Straight
Circlip Inside	170mm Bend
Circlip Inside	170mm Straight

DESCRIPTION	TYPE
Puller Set	Sykes - Piacavant
Press:	
Hydraulic	33 Tone
Eccentric	Dirinler CD/P300
Break	Heli PT 50 x 2500 + Accessories
Rollers:	
Pinch	Horizontal
Pinch	Vertical
Ruler:	
Steel	150mm
Steel	300mm
Steel	1000mm
Repair kit	Tubeless tyre
Reamer set (adjustable)	Set P-45 B 4412 No 5028
Slotting machine	TS – 200K
Square:	
Combination	Mitutoyo 300mm
Engineer	75mm
Engineer	180mm
Stock die and tap set	Metric Course M6-M24
Stock die and tap set	Metric Fine M6-M24
Stands	Mitutoyo Magnetic
Scraper:	
Engineer	200mm
Tape:	
	5 meter
	10 meter
Table:	
Steel	1220 x 610
Steel	1810 x 910
Wood	750 x 450
Marking off	500400
Tester:	
Rockwell (hardness)	RHTC
Multi-tester	Fluke
Battery	Vehicle
Compression	Vehicle
Training units:	
Hydraulic	(Standard)
Pneumatic	(Standard)
ART (motor display unit)	(Interior mechanism exposure)
Tool box (complete)	Geodore (Motor mechanics)
Tool box (complete)	Boiler maker
Tool post:	
Quick change	Type A
Quick change	Type B
Tyre changer	N/A
Tirfors	N/A
Tail stock dial holder	N/A
Vice:	
Magnetic	Walker Hagou BV Mod 20
Machine	Swivel - 160 Jaw (6537)
Drilling	150 Jaw GS-106A
Engineer	105mm
Engineer	150mm
Grip	250mm

DESCRIPTION	TYPE
Vernier:	
Calliper	150mm
Calliper	200mm
Calliper	300mm
Calliper	Mitutoyo Absolute 500-151 CD-15C
Bevel protractor	BP300
Wrench:	
Tapping	M 2-4.5
Tapping	M 5-10
Torque	10 -160 nm
Welding units:	
Oxygen and Acetylene	Oxygen 9Kg, Acetylene 7Kg
Arc	21-335 amps
Profile cutting	N/A
Straight line cutting	N/A
Plasma cutting	N/A
AC/DC	N/A