basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MECHANICAL TECHNOLOGY

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

2017

These guidelines consist of 24 pages.

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1. INTRODUCTION

The 16 Curriculum and Assessment Policy Statements subjects which contain a practical component all include a Practical Assessment Task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- SCIENCES: Computer Applications Technology, Information Technology
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Civil Technology, Electrical Technology, **MECHANICAL TECHNOLOGY** and Engineering Graphics and Design

A PAT allows the teacher to directly and systematically observe applied competence. The PAT comprises the application/performance of the knowledge, skills and values particular to the subject and counts 25% (100 marks) of the total promotion/certification mark out of 400 for the subject.

The PAT is implemented across the first three terms of the school year. It is broken down into different phases or a series of smaller activities that make up the PAT.

Any profession requires a thorough grounding in both practice and theory of its members and Mechanical Technology is no exception. It is emphasised that the goal of the practical assessment task is not to produce a skilled craftsperson but a Mechanical Technology learner in the broadest sense. A nation's true wealth is in its manpower and education should aim to develop the talents of the learner so that he/she can contribute to the well-being of society by using scientific and technological resources with the greatest efficiency and by continuing to develop them.

To prepare a Mechanical Technology learner for one or more of these activities, his/her education should develop in him/her:

- An attitude where the learner can selectively assimilate ideas, gather evidence and facts, draw logical conclusions and put them to good use creatively and with imagination
- A capability to express ideas and information clearly by speech, writing, sketching or drawing
- A willingness and capability to accept and exercise responsibility, to make decisions, and to learn by experience

Attributes such as these cannot all be achieved in a classroom. A sound knowledge of engineering science is essential to equip the Mechanical Technology learner with the necessary practical capabilities for the required processes. There is no substitute for acquiring the feeling of making things on the shop floor. Training in the art of making things is the essential bridge between trade theory and trade practice.

Practical application in the workshop must therefore be made an interesting and challenging experience, mentally and physically, encouraging the learner to use his/her initiative, curiosity and persistence to find out things for himself/herself. Learning by watching should be kept to a bare minimum. Giving some degree of responsibility during practical application is very important as a stimulus and to develop self-confidence.

The first three phases of PAT must not be confused with the capability task (Phase 4) during workshop practice sessions.

2. TEACHER GUIDELINES

2.1 Administration of the PAT

Teachers are requested to make copies of the different **phases** and the assessment criteria of the PAT document. These documents must be distributed to the learners at the beginning of the year. The practical assessment task for Grade 12 is externally set and moderated, but internally assessed.

Teachers must attach due dates for the different phases of the PAT task (refer to the *CAPS* document). In this way learners can easily assess their progress. When formal assessments take place it is the responsibility of the teacher to administer assessment.

The PAT (all phases) should be completed in the first three terms. The PAT should be completed under controlled conditions (refer to the Mechanical Technology *CAPS* Grade 10–12).

2.2 Assessment of the PAT

Frequent and developmental feedback is needed to guide and support the learner to ensure that he/she is on the right track.

Both formal and informal assessment should be conducted in the different phases that constitute the PAT. Informal assessment may be conducted only to monitor progress of the phase in which the learners are engaged. Formal assessment should always be conducted by the teacher and must be recorded.

2.3 Moderation of the PAT

During moderation of the PAT the phase tasks (phases 1–4) will be presented to the moderator with the assessment criteria and marks obtained.

Where required the moderator should be able to call on the learner to explain the function and principles of operation and also request him/her to demonstrate the skills acquired through the capability tasks for moderation purposes.

On completion the moderator will, if necessary, adjust the marks of the group up or downwards depending on the decision reached as a result of moderation.

3. GUIDELINES/INSTRUCTIONS FOR THE LEARNER

3.1 Instructions to the learner

- The practical assessment task (PAT) consists of four phases, one per term during terms 1 to 3. Phase 4 must be started in term 1 and completed in term 3.
- All phases must be completed. In phase 1 learners have to manufacture a cross-peen hammer head. The handle will be manufactured in phase 4 (terms 1 to 3).
- Learners are required to actively engage in all practical assessment tasks.
- Learners who are uncooperative will receive demerits or a zero mark allocation for that particular section of the work.
- Learners who act in an unsafe manner in the workshop and endanger other learners will be removed from the workshop and given additional corrective tasks to improve their safety awareness.

3.2 PHASE 1: TERM 1: CROSS-PEEN HAMMER HEAD

The hammer handle is done during phase 4 because of the availability of machinery. For example, there may be too few lathes for the number of learners. It gives the learners the opportunity to work on the machinery throughout the year.

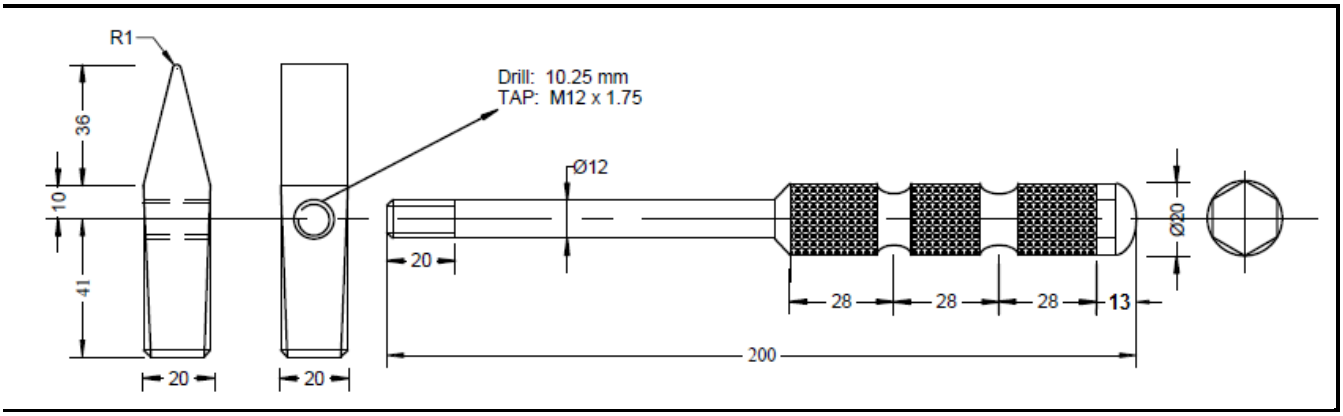

FIGURE 1: CROSS-PEEN HAMMER HEAD

3.2.1 Phase 1: Specifications

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1	Cross-peen hammer head	Any of the following: • Aluminium • Mild steel	20 x 20 x 90 mm	1

3.2.2 Phase 1: Processes

- File the sides square and mark off the hole and the sides.
- Drill the 10,25 mm hole and tap to M12 x 1,75.
- Mill the cross-peen sides of the head.
- File the cross peen and polish.

3.2.3 Phase 1: Time frame

- Commencement date: January 2017
- Completion date: March 2017

3.2.4 Phase 1: Assessment

- Mark sheet: TABLE 1
- Rubric: ANNEXURE A

SUBJECT: MECHANICAL TECHNOLOGY																SCHOOL:
YEAR: 2017																TEACHER:
GR: 12																NUMBER OF LEARNERS:
DATE STARTED:																DATE COMPLETED:
PROJECT: PHASE 1: CROSS-PEEN HAMMER HEAD																PAGE: OF
NAMES OF LEARNERS																
FACETS	MARKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
File one end and one side flat	5															
Mark off the hole to be drilled and the profile of the cross peen	10															
Drill hole and tap to fit handle	10															
Set up in milling machine	10															
Mill the cross peen	5															
Mark off and file the bottom and sides according to drawing	5															
Finishing	5															
TOTAL	50															
SIGNATURE OF TEACHER:																
SIGNATURE OF HEAD OF DEPARTMENT:																
SIGNATURE OF PRINCIPAL:																
SIGNATURE OF MODERATOR:																

TABLE 1: MARK SHEET – CROSS-PEEN HAMMER HEAD

3.3 PHASE 2: TERM 2: TRESTLE

The following details of the motor trestle are given. As a result of the different needs of the learners and the availability of material the design of the trestle is left to the learners and teachers.

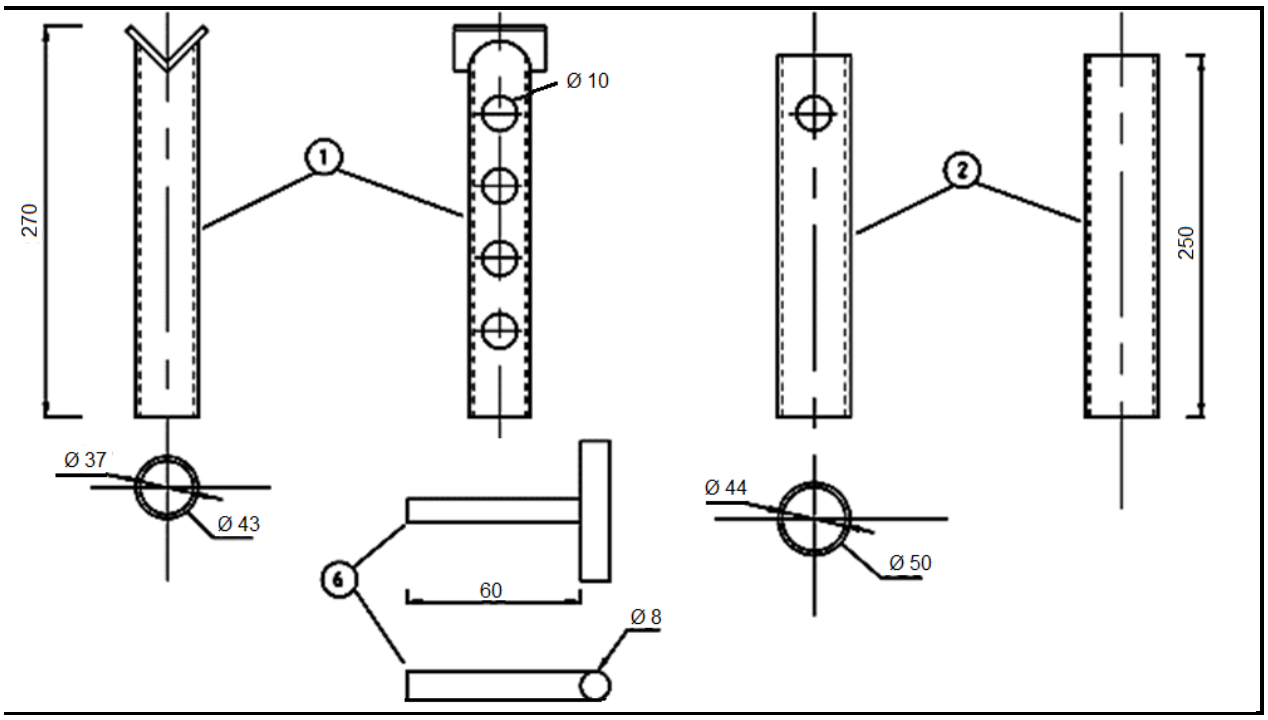

FIGURE 2: TRESTLE

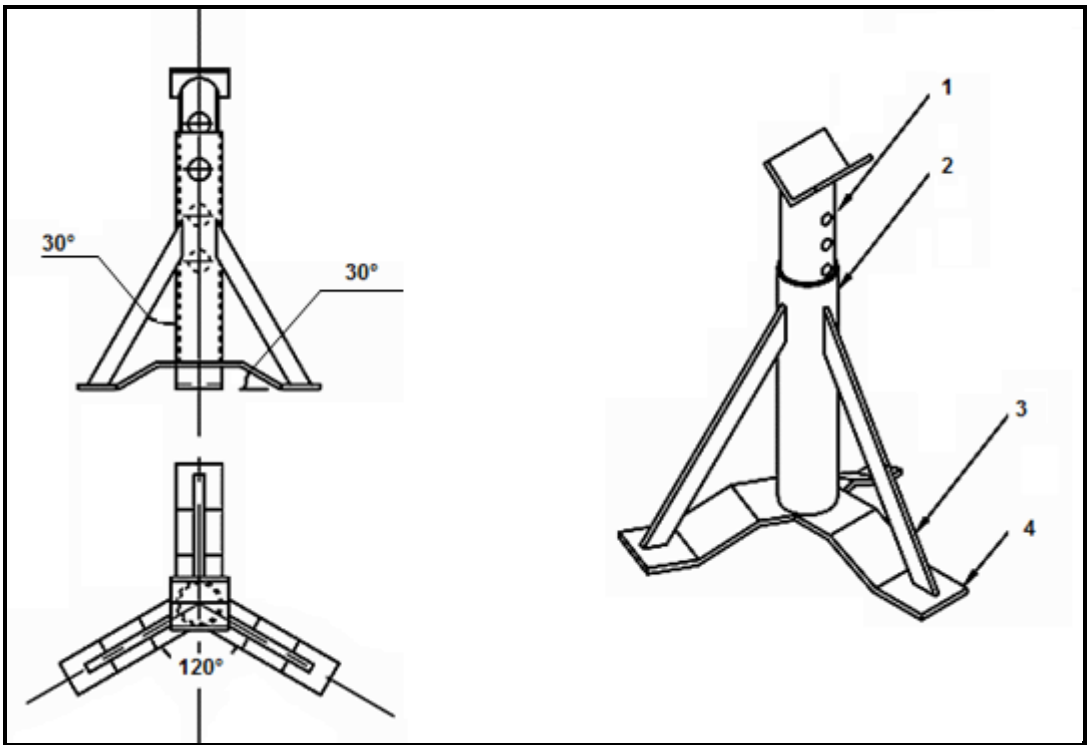

FIGURE 3: TRESTLE

3.3.1 Phase 2: Specifications

Tools and equipment needed

- MIG/MAG welding machine
- Drill press
- Drill bit
- Ball-peen hammer
- Centre punch
- Engineering square
- Steel rule
- Scriber
- Marking blue
- Grinder
- Guillotine
- Wire brush
- File
- Safety accessories

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1	Motor trestle	Mild steel	Ø32 x 270 x 1,6 inner pipe	1
			Ø38 x 250 x 2 outside pipe	1
			70 x 50 x 3 flat bar for V-piece (no.1)	1
			150 x 50 x 3 flat bar for base (no. 5)	3
			200 x 25 x 3 flat bar for outer pipe support (no. 4)	3
			Height adjustment pin Ø 8 x 60	1

3.3.2 Phase 2: Time frame

- Commencement date: April 2017
- Completion date: June 2017

3.3.3 Phase 2: Assessment

- Mark sheet: TABLE 2
- Rubric: ANNEXURE A

SUBJECT: MECHANICAL TECHNOLOGY	SCHOOL:
YEAR: 2017	TEACHER:
GR: 12	NUMBER OF LEARNERS:
DATE STARTED:	DATE COMPLETED:
PROJECT: PHASE 2: TRESTLE	PAGE: OF

NAMES OF LEARNERS																
FACETS	**MARKS**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Preparation of the material of the pipes	20															
Drilling of holes on the pipes	20															
Preparation of the sides	10															
Preparation of the base	10															
Tack welding of the sides and base to the main pipe	10															
Bend and tack weld the top of the adjustable pipe	10															
Do permanent welding of all the items	5															
Accuracy – base, sides and working	5															
Finishing	10															
TOTAL	**100**															

SIGNATURE OF TEACHER:	
SIGNATURE OF HEAD OF DEPARTMENT:	
SIGNATURE OF PRINCIPAL:	
SIGNATURE OF MODERATOR:	

TABLE 2: MARK SHEET – TRESTLE

3.4 PHASE 3: TERM 3: COMPRESSION AND CYLINDER LEAKAGE TESTS

3.4.1 Introduction

The teacher must explain to the learners which knowledge and skills will be assessed during this phase as well as the time to complete this phase.

Activity outcome:

- Learners apply theoretical knowledge in practice
- Safety, tools, maintenance and systems and control
- Correct use of tools and equipment
- Use equipment to diagnose low compression or other faults in the engine cylinder

NOTE:

- These tasks must be done under the supervision of the teacher and the learner should be assessed while he/she performs these tasks.
- The learner should answer questions, record findings and give reasons for certain actions on the work sheet provided while performing this task.

3.4.2 Phase 3: Compression test – questions

- Answer the questions on **WORK SHEET 1**.

3.4.3 Phase 3: Compression test – procedure

- Use the specification booklets to obtain readings for the engine that you are using.
- Do a dry compression test on a four-cylinder, four-stroke petrol engine and record the findings on **WORK SHEET 2**.
- **NOTE:** The learner must record and give reasons for certain actions when he/she completes this task.

3.4.4 Phase 3: Cylinder leakage test

- Use the specification booklets to obtain readings for the engine that you will be using.
- Perform the experiment/simulation and record the findings on **WORKSHEET 3**.
- **NOTE:** The learner must record and give reasons for certain actions when he/she completes this task.

WORK SHEET 1:

PHASE 3: COMPRESSION TEST – QUESTIONS

NAME: _____

EXAMINATION NUMBER: _____

QUESTION	ANSWER	MARK	TOTAL
1. What is engine compression and how does it work?		**4**	
2. What may be the effect of low and high compression in an engine?		**4**	
3. When should the compression in an engine be checked and why?		**4**	
4. State the TWO compression tests carried out on petrol engines.		**2**	
5. What is the purpose of squirting oil in the cylinder?		**2**	
	TOTAL – Compression test – questions	**16**	

WORK SHEET 2:

PHASE 3: COMPRESSION TEST –PROCEDURE

NAME: _____

EXAMINATION NUMBER: _____

PROCEDURE	REASON	MARK	TOTAL
Get engine to running temperature		**2**	
Remove spark plugs		**2**	
What action should take place before spark plugs are removed?		**2**	
Remove air filter		**2**	
Remove HT lead from coil		**2**	
Fully open accelerator		**2**	
Do compression test on each cylinder and record reading		**4**	
Compare with manufacturer's specifications		**2**	
What is the difference between a compression test and a leakage test?		**2**	
	TOTAL – Compression test – procedure	**20**	

WORK SHEET 3:

PHASE 3: CYLINDER LEAKAGE TEST – PROCEDURE:

NAME: _____

EXAMINATION NUMBER: _____

PROCEDURE	REASON	MARK	TOTAL
Turn engine to TDC No. 1 cylinder firing		**2**	
Connect leakage tester pipe to cylinder		**2**	
Open compressed air		**2**	
Take reading from gauges		**2**	
Listen at air intake		**2**	
Listen at exhaust		**2**	
Listen at oil filler hole		**2**	
	TOTAL – Cylinder leakage test –procedure	**14**	

TOTAL – Compression test – questions (WORK SHEET 1)	**16**	
TOTAL – Compression test – procedure (WORK SHEET 2)	**20**	
TOTAL – Cylinder leakage test – procedure (WORK SHEET 3)	**14**	
GRAND TOTAL	**50**	

3.4.5 Phase 3: Tools and equipment

- Hand tools
- Four-cylinder, four-stroke petrol and diesel engine
- Compression tester
- Cylinder leakage tester
- Oil and oil can
- Manufacturer's specifications for the engine

3.4.6 Phase 3: Time frame

- Commencement date: July 2017
- Completion date: August 2017

3.4.7 Phase 3: Assessment

- Mark sheet: TABLES 3, 4 and 5
- Rubric: ANNEXURE A

SUBJECT: MECHANICAL TECHNOLOGY	SCHOOL:
YEAR: 2016	TEACHER:
GR: 12	NUMBER OF LEARNERS:
DATE STARTED:	DATE COMPLETED:
PROJECT: PHASE 3 : COMPRESSION TEST	PAGE: OF

NAME OF LEARNER																
FACETS	**MARKS**															
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
COMPRESSION TEST – QUESTIONS																
What is engine compression and how does it work?	**4**															
What may be the effect of low and high compression in an engine?	**4**															
When should the compression in an engine be checked and why?	**4**															
State the TWO methods used to carry out compression tests on petrol engines.	**2**															
What is the purpose of squirting oil in the cylinder?	**2**															
TOTAL	**16**															

TABLE 3: MARK SHEET – COMPRESSION TEST – QUESTIONS

NAME OF LEARNER																
FACETS	**MARKS**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
COMPRESSION TEST - PROCEDURE																
Get engine to running temperature	**2**															
Remove spark plugs	**2**															
What action should take place before spark plugs are removed?	**2**															
Remove air filter	**2**															
Remove HT lead from coil	**2**															
Fully open accelerator	**2**															
Do compression test on each cylinder and record reading	**4**															
Compare to manufacturer's specifications	**2**															
What is the difference between a compression test and a cylinder leakage test?	**2**															
TOTAL	**20**															

TABLE 4: MARK SHEET: COMPRESSION TEST – PROCEDURE

NAME OF LEARNERS																
FACETS	**MARKS**															
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CYLINDER LEAKAGE TEST – PROCEDURE																
Turn engine to TDC No. 1 cylinder firing	**2**															
Connect leakage tester pipe to cylinder	**2**															
Open compressed air	**2**															
Take reading from gauges	**2**															
Listen at air intake	**2**															
Listen at exhaust	**2**															
Listen at oil filler hole	**2**															
TOTAL	**14**															
GRAND TOTAL	**50**															

SIGNATURE OF TEACHER:	
SIGNATURE OF HEAD OF DEPARTMENT:	
SIGNATURE OF PRINCIPAL:	
SIGNATURE OF MODERATOR:	

TABLE 5: MARK SHEET – CYLINDER LEAKAGE TEST – PROCEDURE

3.5 PHASE 4: TERMS 1–3: CROSS-PEEN HAMMER HANDLE

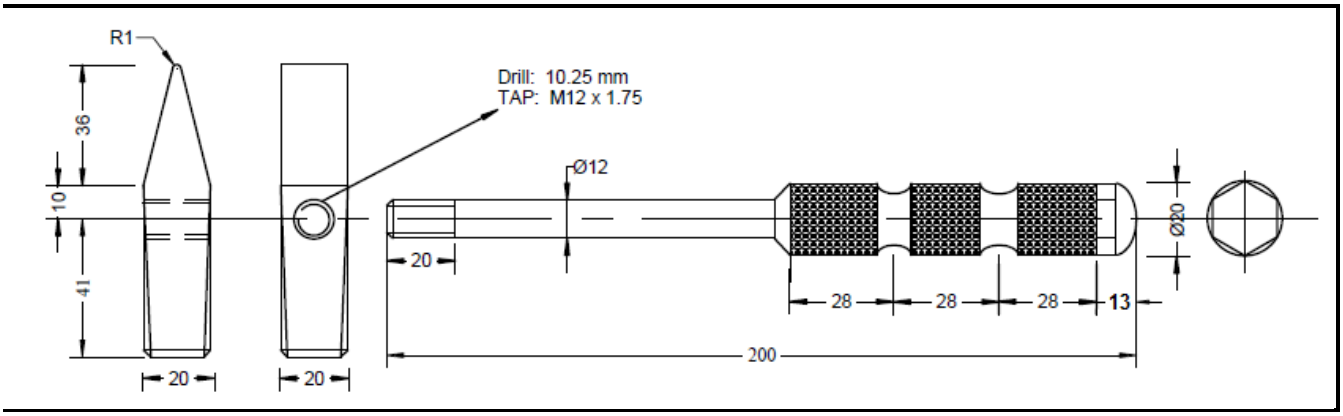

FIGURE 4: CROSS-PEEN HAMMER HANDLE

3.5.1 Phase 4: Specification

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1	Cross-peen hammer handle	Any of the following: • Aluminium • Mild steel	Ø 20 x 200 mm	1

3.5.2 Phase 4: Processes

- Face both ends of the shaft
- Centre drill both ends
- Turn to required diameters
- Mill hexagon on one end
- Knurl, taper turn and cut threads according to drawing

3.5.3 Phase 4: Time frame

- Commencement date: January 2017
- Completion date: August 2017

3.5.4 Phase 4: Assessment

- Mark sheet: TABLE 6
- Rubric: ANNEXURE A

SUBJECT: MECHANICAL TECHNOLOGY	SCHOOL:
YEAR: 2017	TEACHER:
GR: 12	NUMBER OF LEARNERS:
DATE STARTED:	DATE COMPLETED:
PROJECT: PHASE 4 : CROSS PEEN HAMMER HANDLE	PAGE: OF

NAME OF LEARNER																
FACETS	**MARKS**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Facing and centre drill	5															
Diameter turning	15															
Round nose cutting	5															
Knurling	15															
Calculate thread depth M12 x 1.75	5															
Cut M12 x 1.75 thread on center lathe	15															
Calculate indexing	5															
Calculate depth of cut	10															
Cut hexagon	15															
Assembly	10															
TOTAL	**100**															

SIGNATURE OF TEACHER:	
SIGNATURE OF HEAD OF DEPARTMENT:	
SIGNATURE OF PRINCIPAL:	
SIGNATURE OF MODERATOR:	

TABLE 6: MARK SHEET: PHASE 4: CROSS-PEEN HAMMER HANDLE

4. ABSENCE/NON-SUBMISSION OF TASKS

If a learner's practical assessment task is incomplete or unavailable for a valid reason, the learner will be given three weeks before the commencement of the final end-of-year examinations to submit the outstanding task. Should a learner fail to fulfil the outstanding PAT requirement such a learner will be awarded a zero (0) for that PAT component.

A learner's results are regarded as incomplete if he/she does not offer any component of the PAT task. He/She will be given another opportunity based on the decision of the Head of the Assessment Body.

Should the learner fail to fulfil the outstanding PAT requirement, the marks for these components will be omitted and the final mark for Mechanical Technology will be adjusted for promotion purposes in terms of the completed tasks.

5. TIMEFRAMES

January:	Phase 1:	Start the manufacturing task (terminology)
	Phase 4:	Although Phase 1 task the hammer head forms part of the Phase 4 PAT, it will only be assessed once, in Term 1 for 50 marks.
March:	Phase 1:	Complete the manufacturing task at the end of Term 1
April:	Phase 2:	Start the welding task (joining)
	Phase 4:	Project under construction
June:	Phase 2:	Complete the welding task at the end of second term
July:	Phase 3:	Start the maintenance task
	Phase 4:	Project under construction
August:	Phase 3:	Complete the maintenance task at the end of third term
	Phase 4:	Complete at the end of Term 3

6. DECLARATION OF AUTHENTICITY

NAME OF THE SCHOOL: ……..

NAME OF LEARNER: ……..……...
(FULL NAME(S) AND SURNAME)

EXAMINATION NUMBER: …….…….

NAME OF TEACHER: …….

SCHOOL STAMP

I hereby declare that the project submitted for assessment is my own original work and has not been previously submitted for moderation.

_____ _____
SIGNATURE OF CANDIDATE DATE

As far as I know the above declaration by the candidate is true and I accept that the work offered is his or her own.

_____ _____
SIGNATURE OF TEACHER DATE

7. LIST OF RESOURCES

7.1 Book

Goodwin, C, Lategan, A & Meyer, D. 2013. *Mechanical Technology Grade 12*. Future Managers: Cape Town.

7.2 Equipment and machines

- Lathe
- Milling
- Drilling
- MIG welder
- Arc welder
- Power saw
- Grinding
- Four-stroke petrol engine
- Guillotine
- Angle grinder
- Air compressor
- Air gun
- Safety equipment

7.3 Tools

- Hand tools
- Marking-off tools
- Compression tester
- Cylinder leakage tester
- Precision measuring tools (micrometer; vernier; dial gauge indicator)
- Taps and dies
- Milling cutters
- Lathe tools

7.4 Material list

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1.	Cross-peen hammer head	Any of the following: • Aluminium • Mild steel	20 x 20 x 75 mm	1
2.	Cross-peen hammer handle	Any of the following: • Aluminium • Mild steel	Ø 20 x 200 mm	1

8. CONCLUSION

On completion of the practical assessment task, learners should be able to demonstrate their understanding of the industry, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real world challenges. The PAT furthermore develops learner's life skills and provides opportunities for learners to engage in their own learning.

ANNEXURE A

RUBRIC (TOLERANCES)

		TURNING		FILING Measured at 4 places	MILLING Measured at 4 places for flat surfaces
TOLERANCE		DIAMETER	LENGTH		
		+ 0,03	+ 0,09	+ 0,09	+ 0,09
		- 0,03	- 0,09	- 0,09	- 0,09
DEVIATION	7	0,03 = 100%	0,09 = 100%	0,09 = 100%	0,09 = 100%
	6	0,06 = 80%	0,18 = 80%	0,18 = 80%	0,18 = 80%
	5	0,09 = 70%	0,22 = 70%	0,22 = 70%	0,22 = 70%
	4	0,12 = 60%	0,27 = 60%	0,27 = 60%	0,27 = 60%
	3	0,18 = 40%	0,36 = 40%	0,36 = 40%	0,36 = 40%
	2	0,21 = 20%	0,45 = 20%	0,45 = 20%	0,45 = 20%
	1	0,24 = 0%	0,54 = 0%	0,54 = 0%	0,54 = 0%