



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MECHANICAL TECHNOLOGY (WELDING AND METALWORK)

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 12

2023

These guidelines consist of 29 pages.

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1. INTRODUCTION

The 18 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, Technical Sciences, Technical Mathematics
- **SERVICES:** Consumer Studies, Hospitality Studies, Tourism
- **TECHNOLOGY:** **Mechanical Technology**, Civil Technology, Electrical Technology, and Engineering Graphics and Design

A practical assessment task (PAT) mark is a compulsory component of the final promotion mark for all candidates offering subjects that have a practical component and counts 25% (100 marks) of the final promotion mark at the end-of-year. The PAT is implemented across the first three terms of the school year. This is broken up into different phases or a series of smaller activities that make up the PAT. The PAT allows for candidate to be assessed on a regular basis during the school year and it also allows for the assessment of skills that cannot be assessed in a written format, e.g., test or examination. It is therefore important that schools ensure that all candidates complete the practical assessment tasks within the stipulated period to ensure that candidate are resulted at the end of the school year. The planning and execution of the PAT differs from subject to subject.

The 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 that subject and counts 25% 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.

Any profession requires of its members a thorough grounding in both theory and practice and MECHANICAL TECHNOLOGY is no exception. It is emphasized that the goal of the practical assessment task is to produce a skilled candidate in each specialisation field. A nation's true wealth is in its manpower and education that should aim to develop the talents of a candidate so that he/she can contribute to the well-being of the society by using and developing scientific and technological resources.

To prepare a candidate in MECHANICAL TECHNOLOGY specialisation fields, one must focus on the following:

- An attitude where the candidate can selectively use ideas, gather evidence and facts, to drawing logical conclusions to put them to good use creatively and with imagination
- A capability to express ideas and information clearly by speech, writing, drawing and manufacturing
- 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 sciences is essential to equip the MECHANICAL TECHNOLOGY candidate with the necessary practical capabilities for the required processes. Practical training is the application of acquiring essential skills to bridge the gap between trade theory and practice.

Practical application in the workshop must therefore be made an interesting and challenging experience to develop the candidates both physically and mentally. The candidates must show his/her initiative, curiosity and persistence in learning. In order to stimulate and develop self-confidence the granting of some degree of responsibility during the practical application is very important.

2. TEACHER GUIDELINES

2.1 Administration of the PAT

Teachers are requested to make copies of the different specialisation PAT documents. These documents need to be handed out to the candidates at the beginning of the year. The Practical Assessment Task for Grade 12 is externally set, internally assessed and externally moderated.

Teachers must attach due dates for the different facets of the PAT (*refer to the CAPS document*). In this manner, candidates can easily assess their progress. Instances where formal assessments take place, it is the responsibility of the teacher to administer assessment.

The PAT should be completed within the first three terms. The PAT should be completed under controlled conditions (*refer to Mechanical Technology SPECIALISATION: CAPS Grades (10–12)*).

Teachers MUST build a prototype of the task to be able to demonstrate to the candidates what the final product will look like. It will guide the candidates with visual presentation. It provides the teacher with insight into possible challenges regarding machines, equipment or material and what possible manufacturing procedures he/she needs to follow in the workshop in order to complete the PAT.

2.2 Assessment of PAT

Frequent and developmental feedback is needed to ensure necessary guidance and support to the candidates.

Both formal and informal assessment should be conducted to ensure that the embedded skills are developed. Informal assessment can be conducted only to monitor progress of the candidates. Formal assessment should always be conducted and recorded by the candidates.

On completion of each phase in each term, the marks for the completed phase need to be recorded onto the school administration system.

2.3 Moderation of PAT

The tasks, projects, assessment criteria as well as the mark sheets must be presented to the moderator during moderation of the PAT.

The moderator should be able to call on a candidate to explain and demonstrate the functions, principles and skills during the moderation process.

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

Task must be clearly marked with the correct initials and surname of each candidate.

2.4 Consequences of absence/non-submission of tasks

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

A candidate'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 candidate 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. If any tasks are still outstanding, the candidate runs the risk of not being resulted at the end of the year.

2.5 Declaration of authenticity

NAME OF THE SCHOOL:

NAME OF CANDIDATE:

(FULL NAME(S) AND SURNAME)

NAME OF TEACHER:

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

SCHOOL STAMP

3. CANDIDATE GUIDELINES

Instructions to the candidates

- The practical assessment task (PAT) consists of a specialisation task in **Welding and Metalwork**. The practical work is spread over three terms, as set out in this document (see *CAPS document*).
- All tasks must be completed according to the time frames set out in each of the tasks.
- Candidates are requested to actively engage in all practical assessment tasks.
- Candidates who are uncooperative will receive demerits or a zero mark for that particular section of the work.
- Candidates who act unsafely in the workshop and place other learners in danger, will be given additional corrective tasks to improve their safety awareness.
- Your task must be fully completed by end of August 2023 in order to be ready for provincial and/or national moderation.
- Your task needs to be **clearly marked** with your name and surname.
- Each term must have a completed phase in order to enter marks on the working mark sheet and School Administration and Management System (**SA-SAMS**).

4. WELDING AND METALWORK (SPECIFIC)**TASK: ROCKET STOVE**

Term: 1 to 3

Starting date: January 2023

Completion date: August 2023

Criteria and standards

- The design of the rocket stove is shown in the given figures.
- Keep affordability in mind (standard dimensions of sheet metal).
- The cooking frame is according to design. Make drawings and templates.
- The base supports [1] can either be 25 x 25 x 3 mm angle iron OR 25 x 25 x 1,6 square tube – whichever is more cost-effective and available to the school.
- Charge pipe flap hinge supports [8] can either be 20 x 3 mm flat bar OR cut out of 2 mm flat sheet off-cut sheet metal – whichever is more cost-effective and available to the school.
- Screw thread must be cut on the outside end of the butterfly hinge [10].
- The butterfly knob [10] must be drilled and tapped.
- Measurements must be within ± 2 mm of the required measurement.
- Tools and equipment must not be damaged.
- All appropriate safety procedures must be adhered to.
- Welded joints must be cleaned of all slag (assess welds before grind finish).
- Record marks after all dimensions have been marked out.
- Remove all burrs from all edges.
- The project must be well presented.

RESOURCES REQUIRED FOR PAT

	COMPONENTS	MATERIAL	DIMENSIONS	QUANTITY
1	Base supports	25x25x3 mm angle iron OR 25 x 25 x 1,6 mm square tube	350 mm	2
2	Horizontal pipe	100 x 100 x 2 mm square tube	387 mm	1
3	Inside grid support	Expanded metal OR holes	100 x 100 mm 16 x Ø10 mm	1
4	Vertical pipe	100 x 100 x 2 mm square tube	400 mm	1
5	Charge pipe	100 x 100 x 2 mm square tube	300 mm	1
6	Transition piece	2 mm sheet metal	According to template	4
7	Cooking top	20 x 3 flat bar	1 800 mm	1
8	Cover flap	2 mm sheet metal	100 x 120 mm	1
	Cover flap hinge	Ø8 mm round bar	115 mm	1
	Hinge support	20 x 3 mm flat bar OR 2 mm sheet metal	45 x 20 x 3 mm 45 x 20 x 2 mm	2
9	Fixed cover	2 mm sheet metal	100 x 100 mm	1
10	Butterfly	2 mm sheet metal	96 x 96 mm	1
	Butterfly hinge	Ø8 mm round bar	125 mm	1
	Butterfly hinge handle	Ø16 mm round bar	20 mm	1
	Butterfly hinge flange	Flat washers	25 x 8 x 3 mm	2

ROCKET STOVE CONCEPT DESIGNS

NOTE: These examples are only illustrations for perception only to illustrate the concept of the design of the stove. The candidate must adhere to the design specifications in the figures provided.



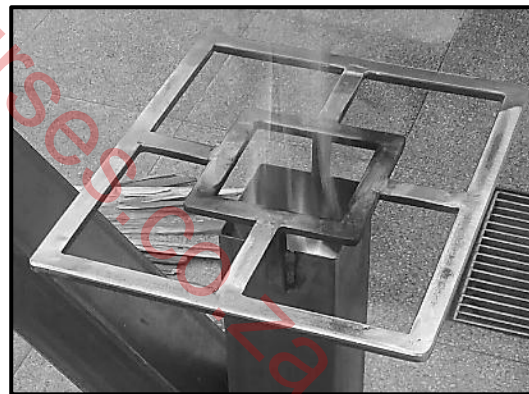
EXAMPLE 1: BODY DESIGN



EXAMPLE 2: BUTTERFLY DESIGN

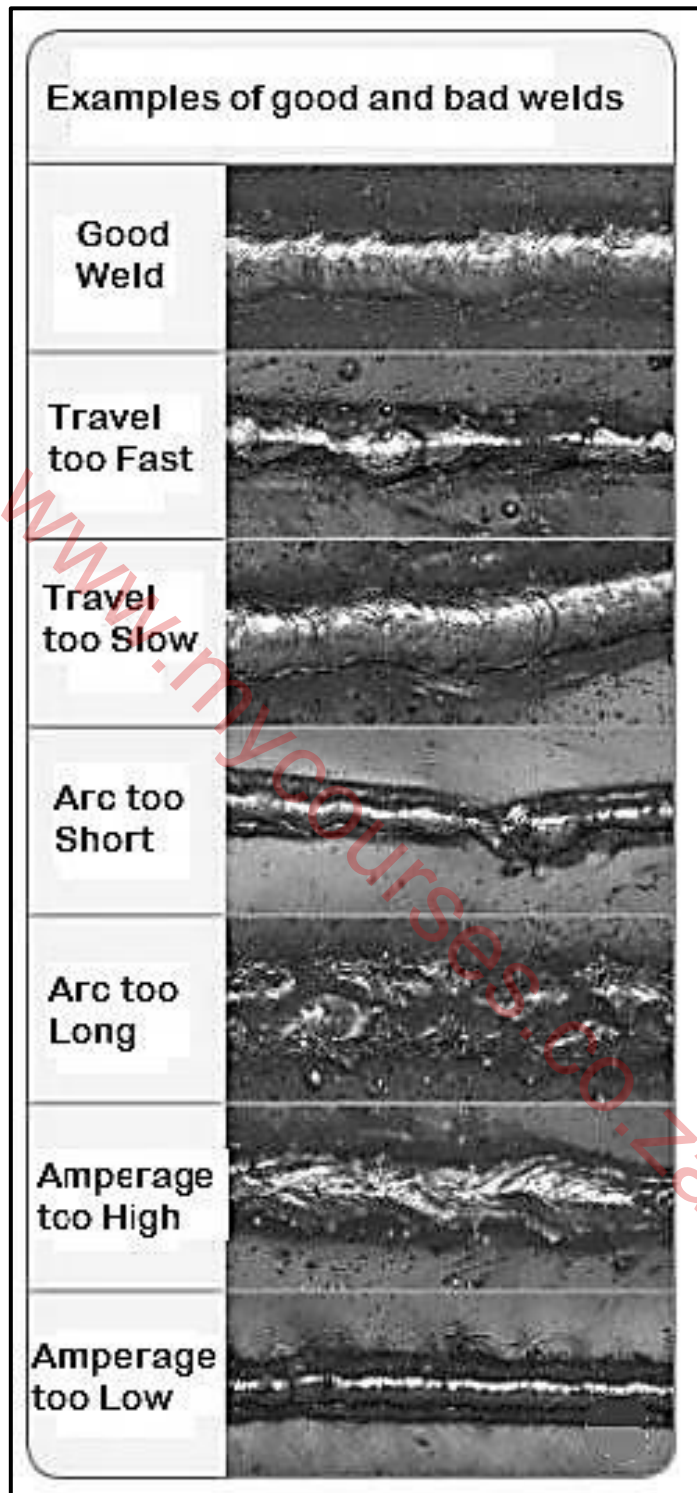


EXAMPLE 3: HOPPER DESIGN



EXAMPLE 4: GRID DESIGN

EXAMPLES OF QUALITY OF WELDS



EXAMPLE 4

RUBRIC FOR MARKING, CUTTING, DRILLING, WELDING, FINISHING AND PRESENTATION

CATEGORY	Excellent (5)	Good (4)	Average (3)	Poor (2)	Incomplete (1)
MARKING OF PARTS	All parts marked and accurate according to dimensions. ± 1 mm deviation from required dimensions.	Nearly all parts marked and accurately dimensions obtained. ± 2–3 mm deviation from required dimensions.	Most parts marked and most accuracy obtained. ± 4 mm deviation from required dimensions.	Some parts partially marked/some accuracy obtained. ± 5 mm deviation from required dimensions.	Poor and wrongly marked/inaccurate. ± 6 mm deviation from required dimensions.
CUTTING AND DRILLING	All parts cut/drilled accurately according to dimensions. ± 1 mm deviation.	Nearly all parts cut/drilled accurately. ± 2–3 mm deviation	Most parts marked and cut/drilled accurately. ± 4 mm deviation	Some accuracy obtained with some deviation from dimensions. ± 5 mm deviation	Section poorly cut/drilled inaccurately or wrong dimensions. ± 6 mm deviation
WELDING QUALITY	No welding defects visible. Beading neat and complete fusion of metals achieved. All slag is removed.	Neat welding done. Good beading with some minor defects visible. Good fusion achieved. All slag is removed.	Some beading visible. Presence of some welding defects. Not complete fusion achieved. Slag is partially removed.	Poor welding done. Lot of welding defects visible. Poor or no fusion achieved. Some burning through metal occurred.	Bad welding. Lot of welding defects with no fusion and holes burned through.
FINISHING AND PRESENTATION	Weld areas are cleanly finished, ground and painted. Project excellent presented. Excellent functionality obtained.	Nearly all welded areas are cleanly finished, ground and painted. Project well presented. Will function well.	Most welded areas are cleanly finished, ground and painted. Average presentation. Project will function.	Some welded areas are cleanly finished, ground and painted. Poor presentation with limited functionality.	No welded areas cleanly finished, ground and painted. No complete assembly. Bad presentation with no functionality.

FIGURE 1 SHOWS THE COMPLETE VIEW OF THE ROCKET STOVE

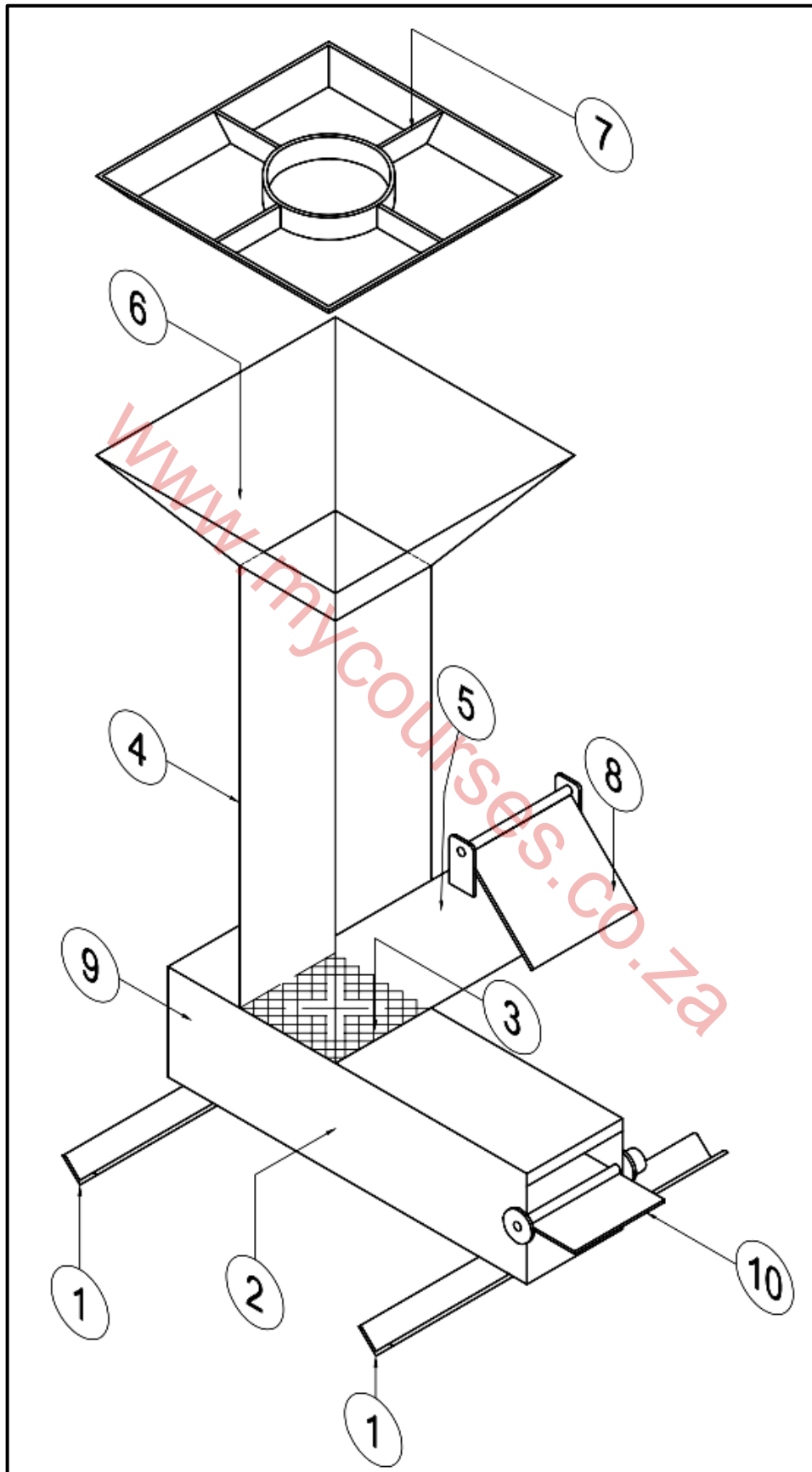


FIGURE 1

PHASE 1: HORIZONTAL PIPE (2) AND BASE SUPPORTS (1)
January–March 2023

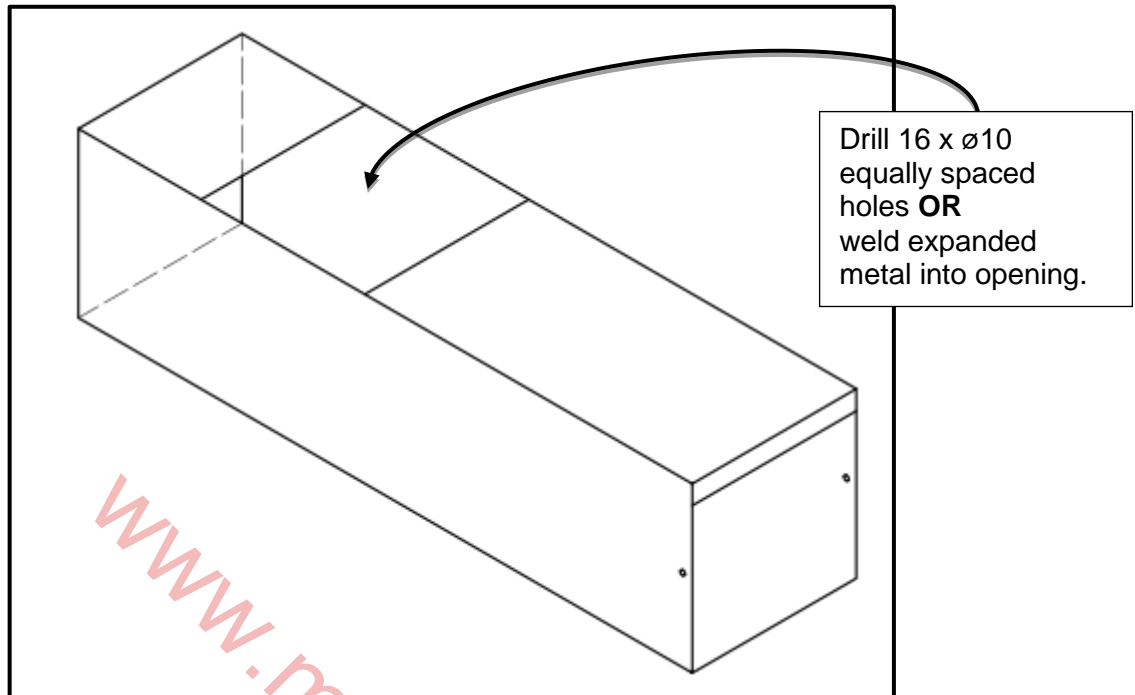


FIGURE 2

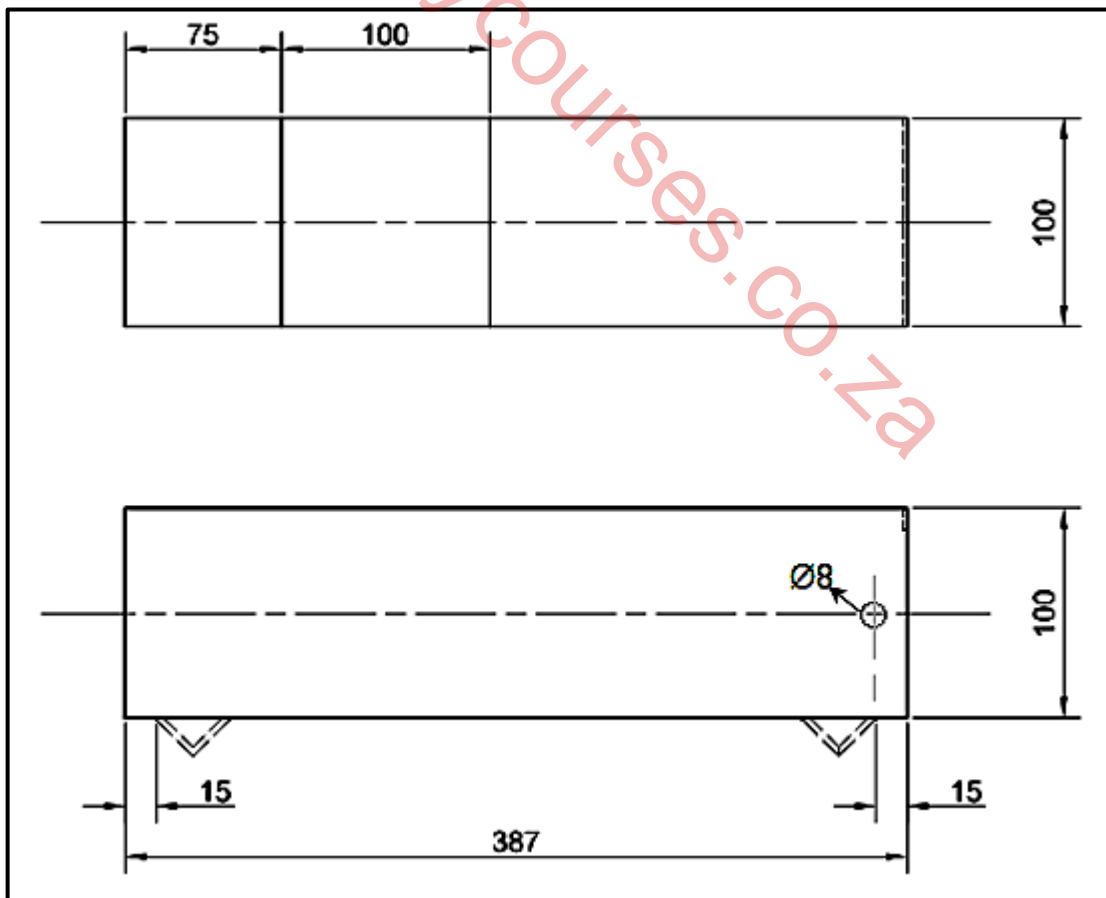


FIGURE 3:
HORIZONTAL PIPE

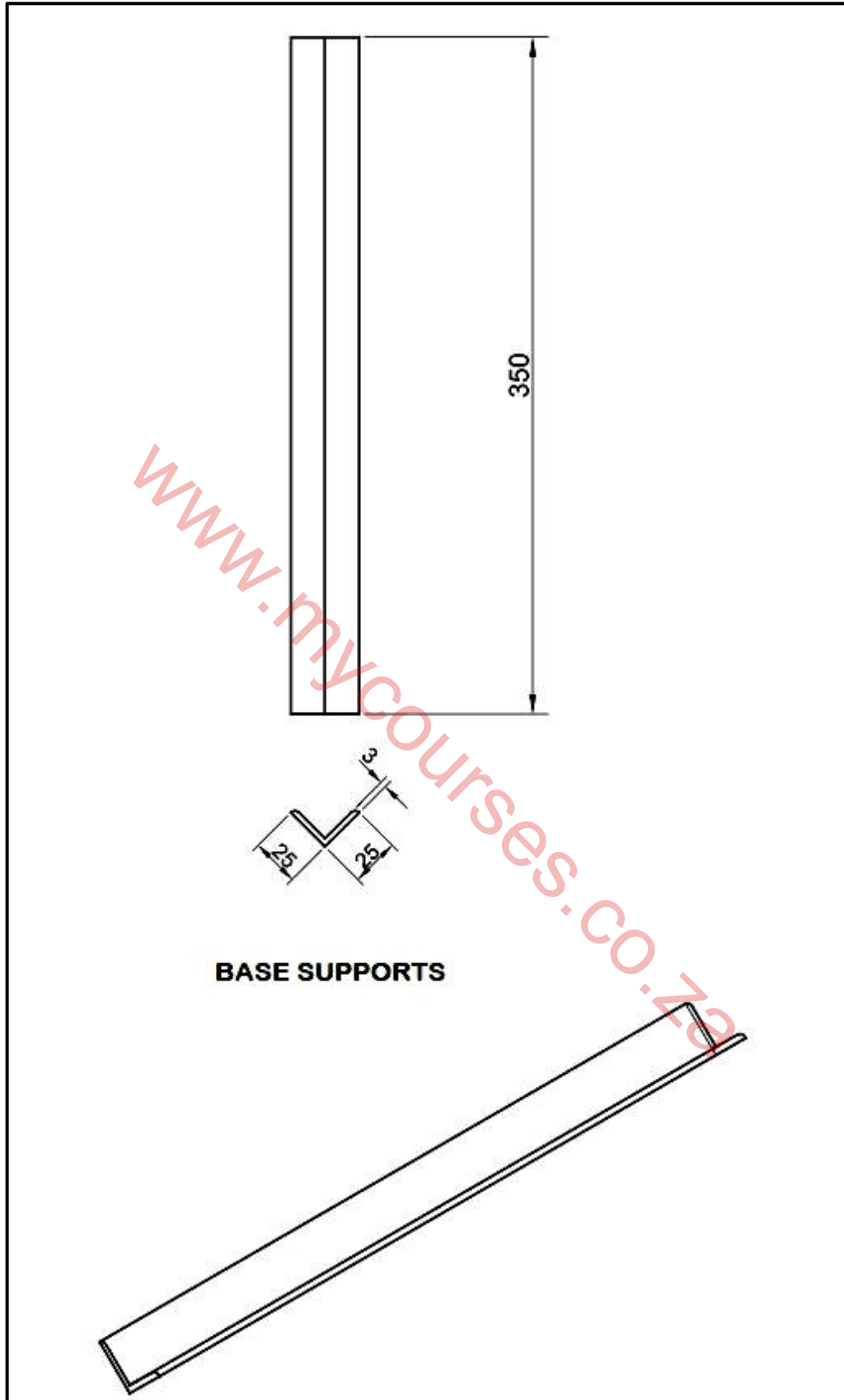


FIGURE 4

MECHANICAL TECHNOLOGY												
WELDING AND METALWORK												
MARK SHEET – BASE SUPPORTS AND HORIZONTAL PIPE – PHASE 1												
GRADE		12	DATE									
PROJECT		ROCKET STOVE										
FACETS			CANDIDATES									
			MARKS									
		1		2	3	4	5	6	7	8	9	10
BASE SUPPORTS	Cut angle iron OR square tubing 350 mm		5									
	Clean burrs		5									
HORIZONTAL PIPE	Measure and mark 387 mm		5									
	Cut 387 mm		5									
	Mark and punch butterfly holes (2 x 5)		10									
	Drill 2 x Ø8 mm holes		10									
	Mark and punch 16 x holes OR mark and cut 100 x 100 expanded metal		10									
	Drill 16 x Ø10 holes OR weld expanded metal		10									
	Weld base supports (2 x 5)		10									
Subtotal:			70									
TOTAL:			50									
NAME AND SIGNATURE OF TEACHER												
NAME AND SIGNATURE OF DEPARTMENTAL HEAD												
NAME AND SIGNATURE OF SUBJECT MODERATOR												

PHASE 2: VERTICAL PIPE (4) AND CHARGE PIPE (5)
April–June 2023

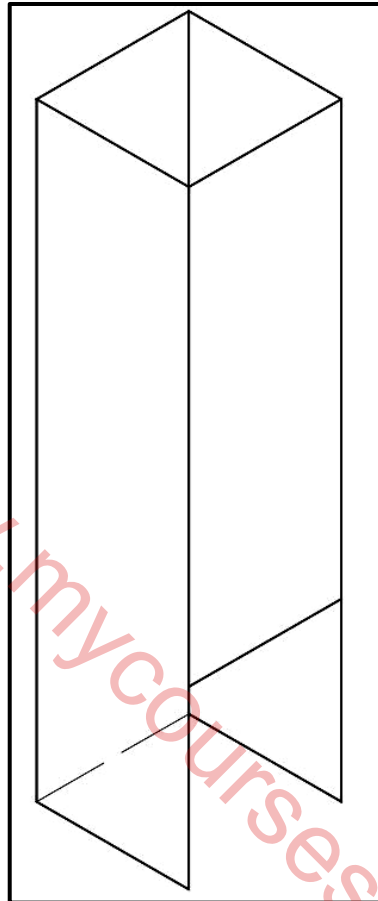


FIGURE 5

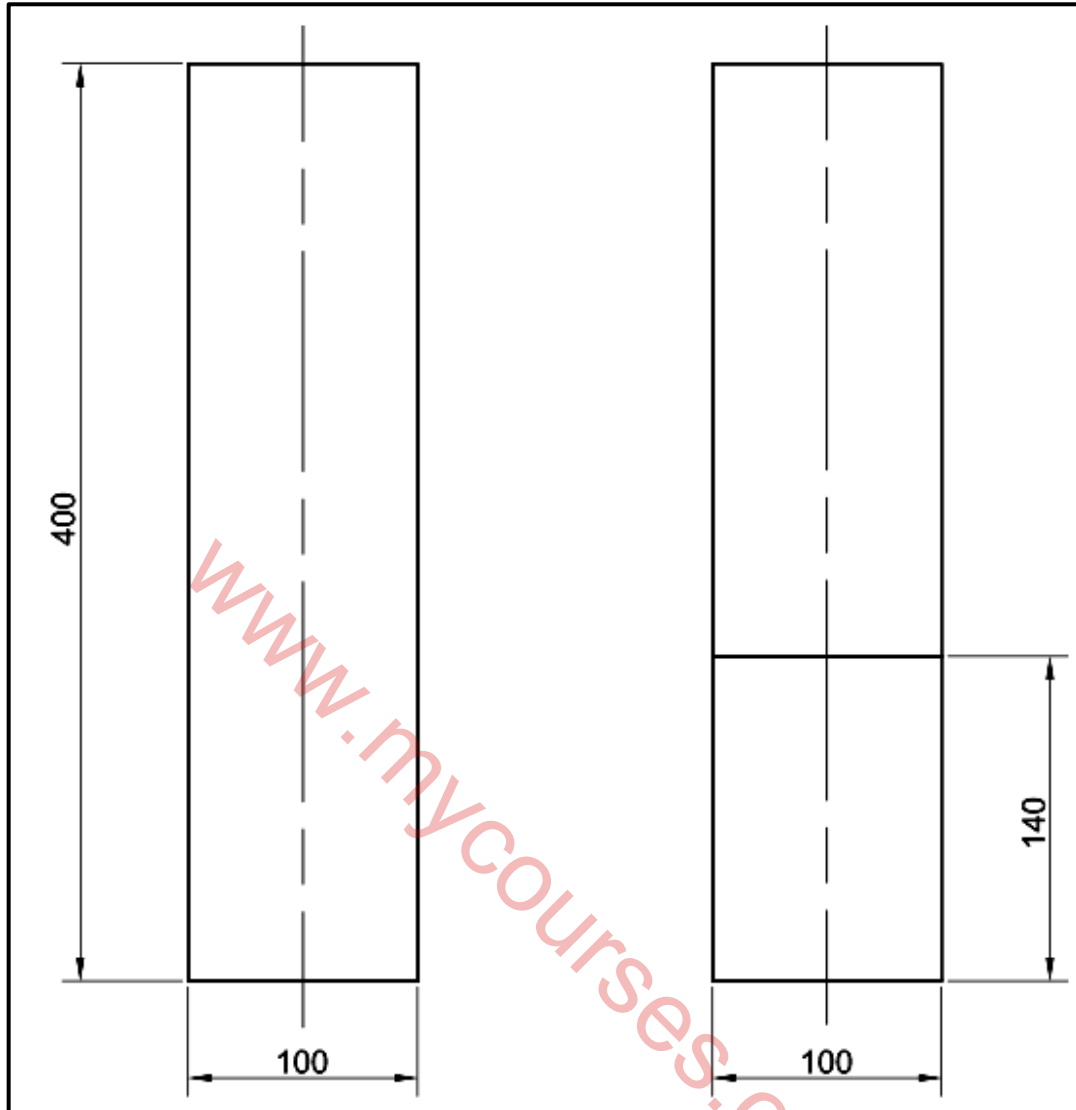


FIGURE 6

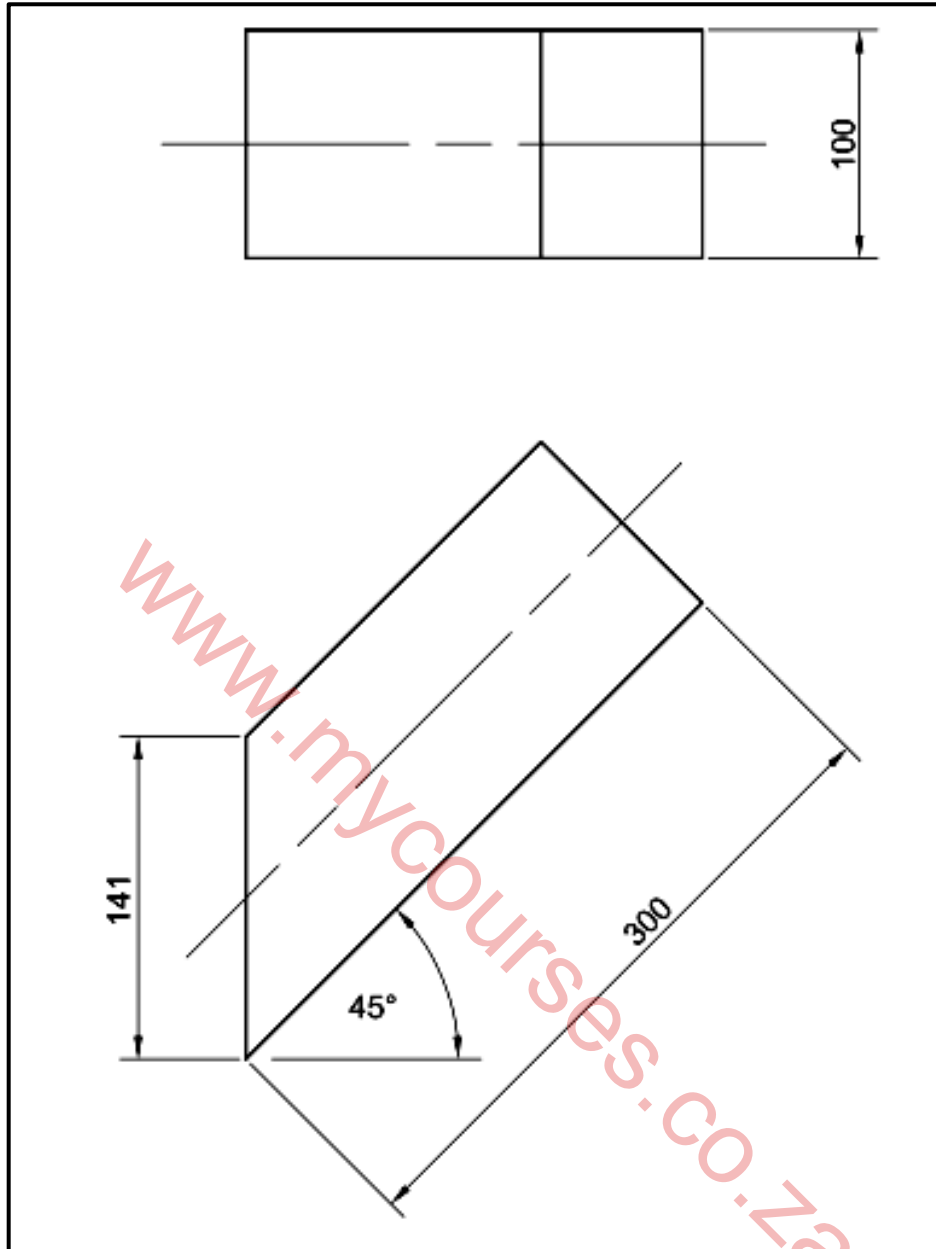


FIGURE 7

MECHANICAL TECHNOLOGY												
WELDING AND METALWORK												
MARK SHEET – VERTICAL PIPE AND CHARGE PIPE – PHASE 2												
GRADE		12		DATE								
PROJECT		ROCKET STOVE										
FACETS			CANDIDATES									
			MARKS									
		1		2	3	4	5	6	7	8	9	10
VERTICAL PIPE	Measure and mark 400 mm	5										
	Measure and mark 140 mm opening	5										
	Cut 400 mm	5										
	Cut 140 x 100 mm opening	5										
	File all burrs	5										
CHARGE PIPE	Measure and mark 300 mm	5										
	Measure and mark 45°	5										
	Cut 300 mm	5										
	Cut 45°	5										
	File all burrs	5										
	Weld vertical pipe to charge pipe (3 sides x 5)	15										
Subtotal:		65										
TOTAL:		50										
NAME AND SIGNATURE OF TEACHER												
NAME AND SIGNATURE OF DEPARTMENTAL HEAD												
NAME AND SIGNATURE OF SUBJECT MODERATOR												

PHASE 3: DEVELOPMENT – SQUARE-TO-SQUARE ON-CENTRE HOPPER (6)
July–August 2023

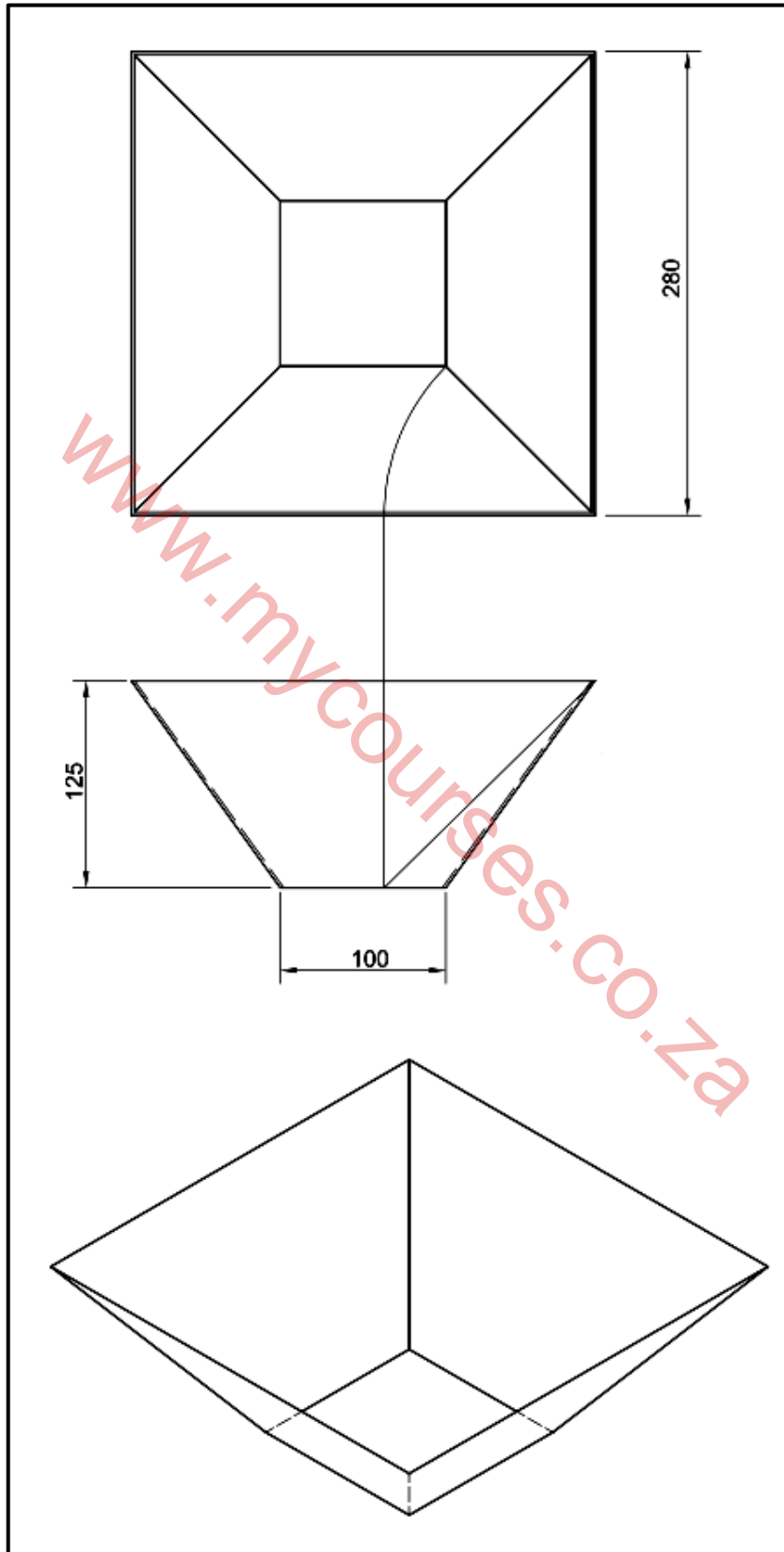


FIGURE 8

MECHANICAL TECHNOLOGY											
WELDING AND METALWORK											
MARK SHEET – SQUARE-TO-SQUARE ON-CENTRE HOPPER – PHASE 3											
GRADE		12	DATE								
PROJECT		ROCKET STOVE									
		CANDIDATES									
FACETS	MARKS										
		1	2	3	4	5	6	7	8	9	10
Template calculation – true length (Worksheet 3.1)	5										
Marking of template	5										
Cutting of template	5										
Transfer of template to sheet metal	5										
Cutting hopper parts (4 sides x 5)	20										
Weld of hopper (4 corners x 5)	20										
Weld of hopper to vertical pipe (4 sides x 5)	20										
Weld of vertical pipe to horizontal pipe. (4 sides x 5)	20										
Subtotal:	100										
TOTAL:	50										
NAME AND SIGNATURE OF TEACHER											
NAME AND SIGNATURE OF DEPARTMENTAL HEAD											
NAME AND SIGNATURE OF SUBJECT MODERATOR											

PHASE 4: FIXED COVER (9), BUTTERFLY (10), CHARGE PIPE COVER (8) AND COOKING FRAME (7)
January–August 2023

4.1 Charge Pipe Cover (8)



EXAMPLE – CHARGE PIPE COVER

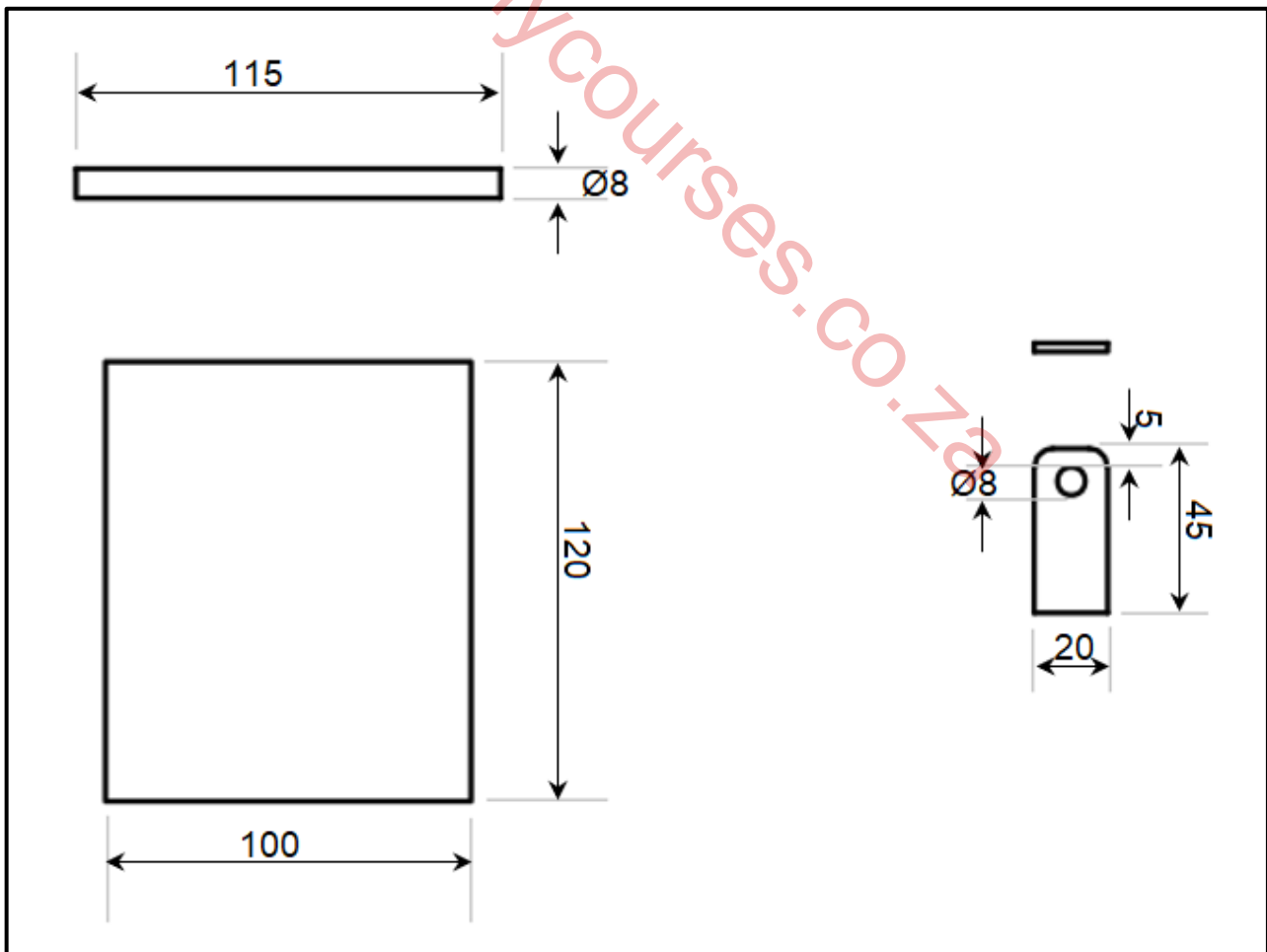


FIGURE 9

4.2 Horizontal Pipe Fixed Cover (9)

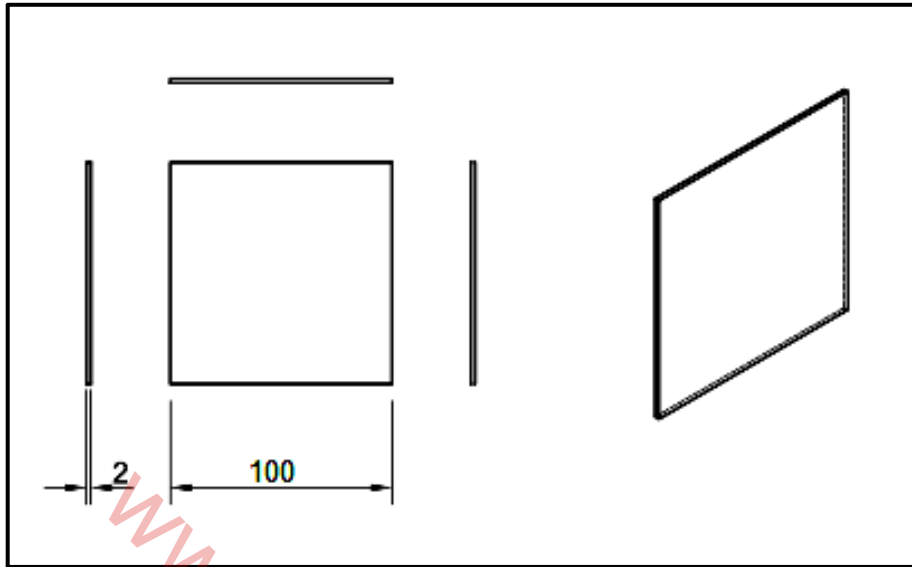


FIGURE 10

4.3 Horizontal Pipe Butterfly (10)

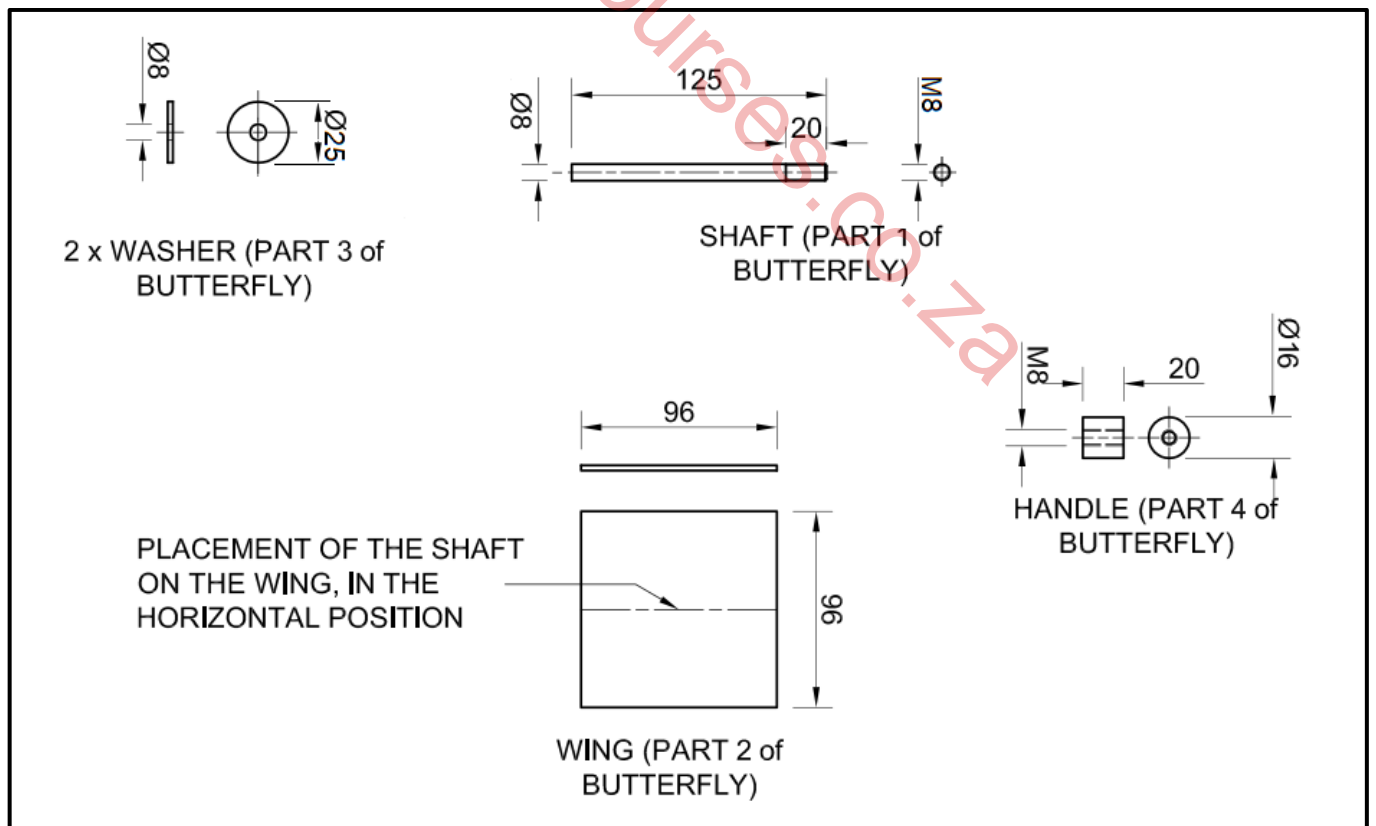


FIGURE 11

4.4 Cooking Frame (11)

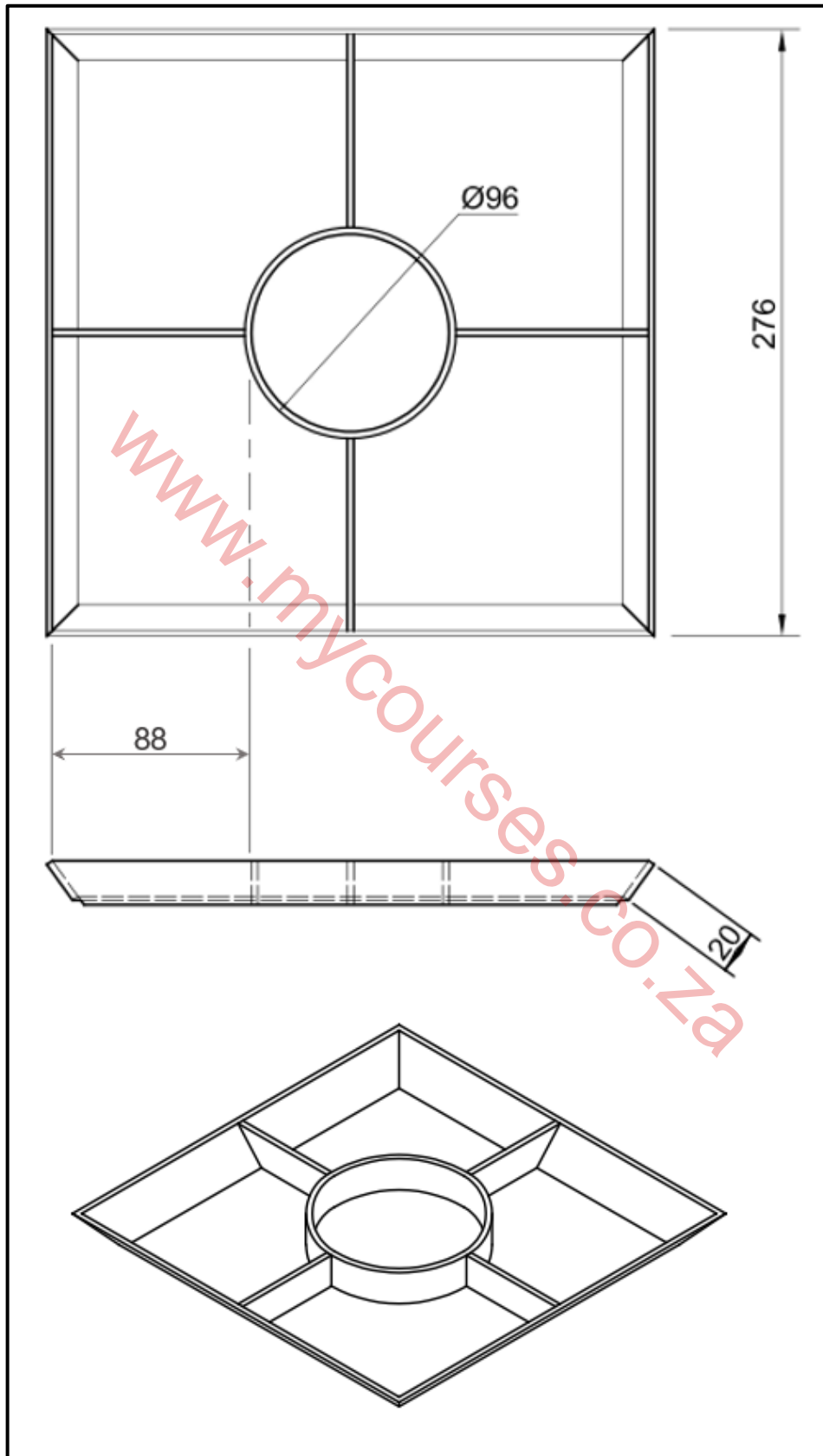


FIGURE 12

MECHANICAL TECHNOLOGY															
WELDING AND METALWORK															
MARK SHEET 4.1 – BUTTERFLY AND COOKING FRAME – PHASE 4															
GRADE		12	DATE												
PROJECT		ROCKET STOVE													
FACETS					CANDIDATES										
					MARKS										
						1	2	3	4	5	6	7	8	9	10
HORIZONTAL PIPE BUTTERFLY	Cut Ø8 mm shaft to 125 mm		5												
	Tap 20 mm to M8 x 1,25 screw thread		5												
	Cut wing 96 x 96 mm		5												
	Weld washer 1 to end of shaft		5												
	Tack weld washer to threaded end (<i>AFTER shaft has been inserted into pipe!</i>)		5												
	Cut handle Ø16 x 20 mm		5												
	Drill tap hole Ø6,8 mm		5												
	Tap handle M8 x 1,25 screw thread		5												
	Weld wing to shaft (positioning = 5 + weld = 5)		10												
Horizontal pipe butterfly: Subtotal:			50												
SUBTOTAL 1:			20												
COOKING FRAME	Calculate angle of ends of frames (Worksheet 4.1)		5												
	Cut frame sides 276 mm (4 sides x 5)		20												
	Cut centre supports 88 mm (4 supports x 5)		20												
	Calculate true length of circular centre support in frame (Worksheet 4.2)		5												
	Cut circular centre support to length		5												
	Roll circular centre support		5												
	Weld circular centre support		5												
	Weld frame corners (4 corners x 5)		20												
	Weld 4 supports to frame and circular centre support (8 welds x 5)		40												
	Frame corners 90° (4 corners x 5)		20												
Frame fits in hopper		5													
Cooking frame: Subtotal:			150												
SUBTOTAL 2:			50												
NAME AND SIGNATURE OF TEACHER															
NAME AND SIGNATURE OF DEPARTMENTAL HEAD															
NAME AND SIGNATURE OF SUBJECT MODERATOR															

MECHANICAL TECHNOLOGY												
WELDING AND METALWORK												
MARK SHEET 4.2 – COVERS, BUTTERFLY AND COOKING FRAME – PHASE 4												
GRADE		12	DATE									
PROJECT		ROCKET STOVE										
FACETS					CANDIDATES							
					MARKS							
		1	2	3		4	5	6	7	8	9	10
CHARGE PIPE COVER	Cut cover 100 x 120 mm		5									
	Cut Ø8 mm shaft 115 mm		5									
	Cut out hinge supports – 20 x 45 mm (2 supports x 5)		10									
	Drill Ø8 mm holes in hinge supports (2 holes x 5)		10									
	Weld cover plate to hinge 3 x 10 mm beads (3 runs x 5)		15									
	Weld hinge supports to charge pipe 2 x welds per support (4 welds x 5)		20									
	Supports 45° to charge pipe (2 supports x 5)		10									
Charge pipe cover: Subtotal:			75									
SUBTOTAL 3:			15									
HORIZONTAL PIPE COVER	Cut cover 100 x 100 mm		5									
	Weld cover in place to horizontal pipe (4 welds x 5)		20									
	Cover 90° in place to pipe		5									
Horizontal pipe cover: Subtotal:			30									
SUBTOTAL 4:			5									
Finishing (grinding-finish and painting)			5									
Presentation (functionality)			5									
SUBTOTAL 1:			20									
SUBTOTAL 2:			50									
SUBTOTAL 3:			15									
SUBTOTAL 4:			5									
TOTAL:			100									
NAME AND SIGNATURE OF TEACHER												
NAME AND SIGNATURE OF DEPARTEMENTAL HEAD												
NAME AND SIGNATURE OF SUBJECT MODERATOR												

WORKSHEET 4: COOKING FRAME CALCULATIONS.

CANDIDATE NAME:

4.1 Calculate corner angle and length of cooking frame sides.

(5)

4.2 Calculate true length of circular centre support.

(5)

NOTE: This worksheet **MUST** be evident in the candidate's portfolio of evidence.

MECHANICAL TECHNOLOGY											
WELDING AND METALWORK											
MARK SHEET – TOTALS											
GRADE		12	DATE								
PROJECT		ROCKET STOVE TOTALS									
		CANDIDATES									
FACETS	MARKS										
		1	2	3	4	5	6	7	8	9	10
PHASE 1	50										
PHASE 2	50										
PHASE 3	50										
PHASE 4	100										
TOTAL:	250										
PAT Mark Total:	100										
NAME AND SIGNATURE OF TEACHER											
NAME AND SIGNATURE OF DEPARTMENTAL HEAD											
NAME AND SIGNATURE OF PRINCIPAL											
NAME AND SIGNATURE OF SUBJECT MODERATOR											

5. CONCLUSION

On completion of the practical assessment task candidates 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 candidate's life skills and provides opportunities for candidates to engage in their own learning.

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