NATIONAL CERTIFICATE (VOCATIONAL)

ASSESSMENT GUIDELINES

WELDING

NQF LEVEL 3

IMPLEMENTATION: JANUARY 2014
WELDING - LEVEL 3

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SECTION A: PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for the subject Welding Level 3 in the National Certificates (Vocational). It must be read with the National Policy Regarding Further Education and Training Programmes: Approval of the Documents, Policy for the National Certificates (Vocational) Qualifications at Levels 2 to 4 on the National Qualifications Framework (NQF). This assessment guideline will be used for National Qualifications Framework Levels 2-4.

This document explains the requirements for internal and external subject assessment. The lecturer must use this document with the Subject Guidelines to prepare for and deliver Welding Level 3. Lecturers should use a variety of resources and apply a range of assessment skills in the setting, marking and recording of assessment tasks.

SECTION B: ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

1. ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

Assessment in the National Certificates (Vocational) is 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 progression within education, training and career paths.
- Enhance the quality of education and training.
- Redress unfair discrimination and past imbalances and thereby accelerate employment opportunities.
- Contribute to the holistic development of the student by addressing:
  - social adjustment and responsibility;
  - moral accountability and ethical work orientation;
  - economic participation; and
  - nation-building.

The principles that drive these objectives are:

- Integration
  To adopt a unified approach to education and training that will strengthen the human resource development capacity of the nation.

- Relevance
  To be dynamic and responsive to national development needs.

- Credibility
  To demonstrate national and international value and recognition of qualification and acquired competencies and skills.

- Coherence
  To work within a consistent framework of principles and certification.
• **Flexibility**
  To allow for creativity and resourcefulness when achieving Learning Outcomes, to cater for different learning styles and use a range of assessment methods, instruments and techniques.

• **Participation**
  To enable stakeholders to participate in setting standards and co-ordinating the achievement of the qualification.

• **Access**
  To address barriers to learning at each level in order to facilitate students' progress.

• **Progression**
  To ensure that the qualification framework permits individuals to move through the levels of the national qualification via different, appropriate combinations of the components of the delivery system.

• **Portability**
  To enable students to transfer credits of qualifications from one learning institution and/or employer to another.

• **Articulation**
  To allow for vertical and horizontal mobility in the education system when accredited pre-requisites have been successfully completed.

• **Recognition of Prior Learning**
  To grant credits for a unit of learning following an assessment or if a student possesses the capabilities specified in the outcomes statement.

• **Validity of assessments**
  To ensure that assessment covers a broad range of the knowledge, skills, values and attitudes (KSVAs) needed to demonstrate applied competency. This is achieved through:
  - clearly stating the outcome to be assessed;
  - selecting the appropriate or suitable evidence;
  - matching the evidence with a compatible or appropriate method of assessment; and
  - selecting and constructing an instrument(s) of assessment.

• **Reliability**
  To ensure that assessment practices are consistent so that the same result or judgement is arrived at if the assessment is replicated in the same context. This demands consistency in the interpretation of evidence; therefore careful monitoring of assessment is vital.

• **Fairness and transparency**
  To verify that no assessment process or method(s) hinders or unfairly advantages any student. The following could constitute unfairness in assessment:
  - Inequality of opportunities, resources or teaching and learning approaches
  - Bias based on ethnicity, race, gender, age, disability or social class
  - Lack of clarity regarding Learning Outcome being assessed
  - Comparison of students’ work with that of other students, based on learning styles and language
• Practicability and cost-effectiveness
To integrate assessment practices within an outcomes-based education and training system and strive for cost and time-effective assessment.

2. ASSESSMENT FRAMEWORK FOR VOCATIONAL QUALIFICATIONS
The assessment structure for the National Certificates (Vocational) qualification is as follows:

2.1 Internal continuous assessment (ICASS)
Knowledge, skills values, and attitudes (KSVAs) are assessed throughout the year using assessment instruments such as projects, tests, assignments, investigations, role-plays and case studies. The ICASS practical component is undertaken in a real workplace, a workshop or a “Structured Environment”. This component is moderated internally and quality assured externally by Umalusi. All internal continuous assessment evidence is kept in a Portfolio of Evidence (PoE) and must be readily available for monitoring, moderation and verification purposes.

2.2 External summative assessment (ESASS)
The external summative assessment is either a single, or a set of, written paper(s) set to the requirements of the Subject Learning Outcomes. The Department of Higher Education and Training administers the theoretical component according to relevant assessment policies.

A compulsory component of ESASS is the integrated summative assessment task (ISAT). This assessment task draws on the students’ cumulative learning throughout the year. The task requires integrated application of competence and is executed under strict assessment conditions. The task should take place in a simulated or “Structured Environment”. The ISAT is the most significant test of students’ ability to apply their acquired knowledge. The integrated assessment approach allows students to be assessed in more than one subject with the same ISAT.

External summative assessments will be conducted annually between October and December, with provision made for supplementary sittings.

3. MODERATION OF ASSESSMENT

3.1 Internal moderation
Assessment must be moderated according to the internal moderation policy of the Further Education and Training (FET) college. Internal college moderation is a continuous process. The moderator’s involvement starts with the planning of assessment methods and instruments and follows with continuous collaboration with and support to the assessors. Internal moderation creates common understanding of assessment standards and maintains these across vocational programmes.

3.2 External moderation
External moderation is conducted by the Department of Higher Education and Training, Umalusi and, where relevant, an Education and Training Quality Assurance (ETQA) body.
according to South African Qualifications Authority (SAQA) and Umalusi standards and requirements.

The external moderator:
- monitors and evaluates the standard of all summative assessments;
- maintains standards by exercising appropriate influence and control over assessors;
- ensures that proper procedures are followed;
- ensures that summative integrated assessments are correctly administered;
- observes a minimum sample of ten (10) to twenty-five (25) percent of summative assessments;
- gives written feedback to the relevant quality assuror; and
- moderates in case of a dispute between an assessor and a student.

Policy on inclusive education requires that assessment procedures be customised for students who experience barriers to learning, and supported to enable these students to achieve to their maximum potential.

4. PERIOD OF VALIDITY OF ICASS

The period of validity of the internal continuous assessment mark is determined by the National Policy on the Conduct, Administration and Management of the Assessment of the National Certificates (Vocational).

The ICASS must be re-submitted with each examination enrolment for which it constitutes a component.

5. ASSESSOR REQUIREMENTS

Assessors must be subject specialists and competent assessors.

6. TYPES OF ASSESSMENT

Assessment benefits the student and the lecturer. It informs students about their progress and helps lecturers to make informed decisions at different stages of the learning process. Depending on the intended purpose, different types of assessment can be used.

6.1 Baseline assessment

At the beginning of a level or learning experience, baseline assessment establishes the knowledge, skills, values and attitudes (KSVAs) that students bring to the classroom. This knowledge assists lecturers in planning learning programmes and learning activities.

6.2 Diagnostic assessment

This assessment diagnoses the nature and causes of learning barriers experienced by specific students. It is followed by guidance, appropriate support and intervention strategies. This type of assessment is useful for making referrals for students requiring specialist help.
6.3 Formative assessment
This assessment monitors and supports teaching and learning. It determines student strengths and weaknesses and provides feedback on progress. It determines if a student is ready for summative assessment.

6.4 Summative assessment
This type of assessment gives an overall picture of student progress at a given time. It determines whether the student is sufficiently competent to progress to the next level.

7. PLANNING ASSESSMENT
An assessment plan should cover three main processes:

7.1 Collecting evidence
The assessment plan indicates which Subject Outcomes and Assessment Standards will be assessed, what assessment method or activity will be used and when this assessment will be conducted.

7.2 Recording
Recording refers to the assessment instruments or tools with which the assessment will be captured or recorded. Therefore, appropriate assessment instruments must be developed or adapted.

7.3 Reporting
All the evidence is put together in a report to deliver a decision for achievement in the subject.

8. METHODS OF ASSESSMENT
Methods of assessment refer to who carries out the assessment and includes lecturer assessment, self-assessment, peer assessment and group assessment.

<table>
<thead>
<tr>
<th>LECTURER ASSESSMENT</th>
<th>The lecturer assesses students’ performance against given criteria in different contexts, such as individual work, group work, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELF-ASSESSMENT</td>
<td>Students assess their own performance against given criteria in different contexts, such as individual work, group work, etc.</td>
</tr>
<tr>
<td>PEER ASSESSMENT</td>
<td>Students assess another student’s or group of students’ performance against given criteria in different contexts, such as individual work, group work, etc.</td>
</tr>
<tr>
<td>GROUP ASSESSMENT</td>
<td>Students assess the individual performance of other students within a group or the overall performance of a group of students against given criteria.</td>
</tr>
</tbody>
</table>
9. INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

All evidence collected for assessment purposes is kept or recorded in the student’s Portfolio of Evidence (PoE).

The following table summarises a variety of methods and instruments for collecting evidence. A method and instrument is chosen to give students ample opportunity to demonstrate that the Subject Outcome has been attained. This will only be possible if the chosen methods and instruments are appropriate for the target group and the Specific Outcome being assessed.

<table>
<thead>
<tr>
<th>METHODS FOR COLLECTING EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observation-based</strong> (Less structured)</td>
</tr>
<tr>
<td><strong>Assessment instruments</strong></td>
</tr>
<tr>
<td>Observation</td>
</tr>
<tr>
<td>Class questions</td>
</tr>
<tr>
<td>Lecturer, student, parent discussions</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Assignments or tasks</td>
</tr>
<tr>
<td>Projects, investigations or research</td>
</tr>
<tr>
<td>Case studies</td>
</tr>
<tr>
<td>Practical exercises</td>
</tr>
<tr>
<td>Demonstrations</td>
</tr>
<tr>
<td>Role-play</td>
</tr>
<tr>
<td>Interviews</td>
</tr>
<tr>
<td>Examinations</td>
</tr>
<tr>
<td>Class tests</td>
</tr>
<tr>
<td>Practical examinations</td>
</tr>
<tr>
<td>Oral tests</td>
</tr>
<tr>
<td>Open-book tests</td>
</tr>
</tbody>
</table>

10. TOOLS FOR ASSESSING STUDENT PERFORMANCE

**Rating scales** are marking systems where a symbol (such as 1 to 7) or a mark (such as 5/10 or 50%) is defined in detail. The detail is as important as the coded score. Traditional marking, assessment and evaluation mostly used rating scales without details such as what was right or wrong, weak or strong, etc.

**Task lists** and **checklists** show the student what needs to be done. These consist of short statements describing the expected performance in a particular task. The statements on the checklist can be ticked off when the student has adequately achieved the criterion. Checklists and task lists are useful in peer or group assessment activities.

**Rubrics** are a hierarchy (graded levels) of criteria with benchmarks that describe the minimum level of acceptable performance or achievement for each criterion. Using rubrics is
11. SELECTING AND/OR DESIGNING RECORDING AND REPORTING SYSTEMS

The selection or design of recording and reporting systems depends on the purpose of recording and reporting student achievement. Why particular information is recorded and how it is recorded determine which instrument will be used.

Computer-based systems, for example spreadsheets, are cost and time effective. The recording system should be user-friendly and information should be easily accessed and retrieved.

12. COMPETENCE DESCRIPTIONS

All assessment should award marks as evaluation of specific tasks. However, marks should be awarded against rubrics and should not simply be a total of ticks for right answers. Rubrics should explain the competence level descriptors for the skills, knowledge, values and attitudes that a student must demonstrate to achieve each level of the rating scale.

When lecturers or assessors prepare an assessment task or question, they must ensure that it addresses an aspect of a Subject Outcome. The relevant Assessment Standard must be used to create the rubric to assess the task or question. The descriptions must clearly indicate the minimum level of attainment for each category on the rating scale.

13. STRATEGIES FOR COLLECTING EVIDENCE

A number of different assessment instruments may be used to collect and record evidence. Examples of instruments that can be (adapted and) used in the classroom include:

13.1 Record sheets

The lecturer observes students working in a group. These observations are recorded in a summary table at the end of each project. The lecturer can design a record sheet to record observations of students’ interactive and problem solving skills, attitudes towards group work and involvement in a group activity.

13.2 Checklists

Checklists should have clear categories to ensure that the objectives are effectively met. The categories should describe how the activities are evaluated and against which criteria they are evaluated. Space for comments is essential.
ASSESSMENT OF WELDING

LEVEL 3
SECTION C: ASSESSMENT IN WELDING

1. ASSESSMENT SCHEDULE AND REQUIREMENTS

Internal and external assessments are conducted and the results of both contribute to the final mark of a student in the subject.

The internal continuous assessment (ICASS) mark accounts for 50 percent and the external examination mark for 50 percent of the final mark. A student needs a minimum final mark of 50 percent to enable a pass in the subject.

1.1 Internal assessment

Lecturers must compile a detailed assessment plan and assessment schedule of internal assessments to be undertaken during the year in the subject (e.g. date, assessment task or activity, rating code/marks allocated, assessor, moderator.)

All internal assessments are then conducted according to the plan and schedule using appropriate assessment instruments and tools for each assessment task (e.g. tests, assignments, practical tasks/projects and memoranda, rubrics, checklists).

The marks allocated to the minimum number of both practical and written assessment tasks conducted during the internal continuous assessment (ICASS) are kept and recorded in the Portfolio of Evidence (PoE) which is subject to internal and external moderation.

A year mark out of 100 is calculated from the ICASS marks contained in the PoE and submitted to the DHET on the due date towards the end of the year.

The following internal assessment units GUIDE the internal assessment of Welding Level 3.

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Time-frame</th>
<th>Type of assessment activity</th>
<th>Minimum time and proposed mark allocation (*can be increased but not reduced)</th>
<th>Scope of assessment</th>
<th>% contribution to the year mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Term 1</td>
<td>Test</td>
<td>1 hour (50 marks)</td>
<td>Topics completed in Term 1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Term 1</td>
<td>Practical Assessment/Assignment</td>
<td>Determined by the scope and nature of the task</td>
<td>One or more of the topics completed as an assignment</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Term 2</td>
<td>Practical Assessment/Assignment</td>
<td>Determined by the scope and nature of the task</td>
<td>One or more of the topics completed as an assignment</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Term 2</td>
<td>Test</td>
<td>1 hour (50 marks)</td>
<td>Topics completed in Terms 1 and 2</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Term 3</td>
<td>Internal Examination*</td>
<td>As per external examinations (P1 &amp; P2 where applicable)</td>
<td>Topics completed to date (P1 = 15 &amp; P2 = 15, where applicable)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>
Specifications for internal assessment may change over time. A separate internal assessment guideline document ‘Guidelines for the Implementation of Internal Continuous Assessment (ICASS) in the NC(V) qualifications at FET Colleges’ has been developed, and is available on the Departmental website. The conduct and administration of internal assessments must always comply with specifications contained in the most current version of the guideline document.

2. RECORDING AND REPORTING

Welding, as is the case for all the other Vocational subjects, is assessed according to five levels of competence. The level descriptions are explained in the following table.

<table>
<thead>
<tr>
<th>RATING CODE</th>
<th>RATING</th>
<th>MARKS %</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Outstanding</td>
<td>80-100</td>
</tr>
<tr>
<td>4</td>
<td>Highly Competent</td>
<td>70-79</td>
</tr>
<tr>
<td>3</td>
<td>Competent</td>
<td>50-69</td>
</tr>
<tr>
<td>2</td>
<td>Not yet competent</td>
<td>40-49</td>
</tr>
<tr>
<td>1</td>
<td>Not achieved</td>
<td>0-39</td>
</tr>
</tbody>
</table>

The planned/scheduled assessment should be recorded in the Lecturer’s Portfolio of Assessment (PoA) for each subject. The minimum requirements for the Lecturer’s Portfolio of Assessment should be as follows:

- Lecturer information
- A contents page
- Subject and Assessment Guidelines
- A subject Year plan /Work scheme/Pace Setter
- A subject assessment plan
- Instrument(s) (tests, assignments, practical) and tools (memorandum, rubric, checklist) for each assessment task
- A completed pre-moderation checklist for each of the ICASS tasks and their accompanying assessment tools
- A completed post-moderation checklist once the task has been administered and assessed
- Subject record sheets per level/class reflecting the marks achieved by students in the ICASS tasks completed
- Evidence of review – diagnostic and statistical analysis, including notes on improvement of the task for future use

The college could standardise these documents.

The minimum requirements for the student's Portfolio of Evidence (PoE) should be as follows:

- Student information/identification
- Declaration of authenticity form – duly completed (signed and dated)
3. INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN WELDING – LEVEL 3

Topic 1: Principles of arc welding

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Explain the basic techniques of welding steel</td>
<td>Steel making processes are explained.</td>
<td>Explain steel making processes</td>
</tr>
<tr>
<td></td>
<td>Continuous casting and hot-working processes are explained.</td>
<td>Explain continuous casting and hot-working processes</td>
</tr>
<tr>
<td></td>
<td>The nature of non-alloy steels is described.</td>
<td>Describe the nature of non-alloy steels</td>
</tr>
<tr>
<td></td>
<td>The differences between non-alloy, stainless steels and other alloy steels are identified.</td>
<td>Identify the differences between non-alloy, stainless steels and other alloy steels.</td>
</tr>
<tr>
<td></td>
<td>The creation of alloys by addition of elements is described.</td>
<td>Describe how addition of elements creates alloys</td>
</tr>
<tr>
<td></td>
<td>The metallic material grouping systems contained in the document ISO (TR) 15608 is explained</td>
<td>Explain the metallic material grouping system as contained in the document ISO (TR) 15608</td>
</tr>
<tr>
<td></td>
<td>The effects of welding on steel are explained.</td>
<td>Explain the effects of welding on steel</td>
</tr>
</tbody>
</table>

ASSESSMENT TASKS OR ACTIVITIES

Assessment for knowledge components
- Processes of making steel
- Continuous casting and hot-working processes
- Nature of non-alloy steels
- Basis of ISO (TR) 15608
- Effects of welding on steel

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 Explain welded joints on plates</td>
<td>Appropriate terminology is used to identify and describe various weld joints.</td>
<td>Use appropriate terminology to identify and describe various welded joints</td>
</tr>
</tbody>
</table>

Range: fillet, butt, T joints
- Characteristics of fillet welds are explained. 
  *Range: leg length; throat thickness; penetration; number of runs, surface finish.* 
- Explain the characteristics of fillet welds

- Characteristics of butt-welds are explained 
- Explain the characteristics of butt-welds

- Different types of joint preparation are explained 
  *Range: single and multi-run welds; excess weld metal; weld profile; penetration; surface finish; permanent and temporary backing.* 
- Explain different types of joint preparation

- Examples are provided of welded joints in typical constructions using plates (e.g. structures, tanks, pressure vessels). 
- Provide examples of weld joints in typical constructions using plates

- Welding calculations are performed 
- Perform welding calculations

### ASSESSMENT TASKS OR ACTIVITIES

**Assessment for knowledge components**
- Terms and definitions
- Identifying weld types
- Different types of weld preparations
- Examples of weld joints in typical construction using plates
- Welding calculations

## SUBJECT OUTCOME

### 1.3 Explain steels in terms of welding capacity

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The concept ‘weld-ability’ is described.</td>
<td>Describe the concept ‘weld-ability’</td>
</tr>
<tr>
<td>Heat input is explained and calculated.</td>
<td>Calculate the heat input and explain its use.</td>
</tr>
</tbody>
</table>
| The effects of composition are described 
  *Range: thickness and temperature (preheat and interpass), carbon equivalent and its use.* | Describe the effects of composition |
| The influence of alloying elements on the properties of weld-able steel are explained | Explain the influence of alloying elements on the properties of weld-able steel |
| The effect of plate thickness on the properties of weld-able steel is described | Describe the effect of plate thickness on the properties of weld-able steel |

### ASSESSMENT TASKS OR ACTIVITIES

**Assessment for knowledge components**
- Concept of weld-ability
- Effects of composition
- Effects of plate thickness
- Calculate heat input

## SUBJECT OUTCOME

### 1.4 Explain shrinkage, residual stresses and distortion and the reduction of these during the welding process

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal cycle in welding is described</td>
<td>Describe the thermal cycle during welding.</td>
</tr>
<tr>
<td>The development and significance of residual stresses due to solidification, cooling and</td>
<td>Explain the development of residual stress due to solidification, cooling and shrinkage</td>
</tr>
</tbody>
</table>
shrinkage are explained.  
- Explain the significance of residual stresses caused by solidification, cooling and shrinkage
- The main causes of weld shrinkage are described.  
- Describe the main causes of weld shrinkage
- Distortion resulting from shrinkage is explained.  
- Explain the process whereby distortion results from shrinkage
- Measures to minimise distortion are explained.  
- Explain how to minimise distortion
- Pre-heating and post-heating are explained.  
- Explain pre-and post-heating
- The relationship between heat input and shrinkage, residual stress and distortion is explained.  
- Explain the relationship between heat input and shrinkage, residual stress and distortion
- The development of distortion, the effect of heat input, weld size, penetration, number of runs in single and double-sided fillet welded joints are explained.  
- Explain the development of distortion, the effect of heat input, weld size and number of runs in single and double-sided fillet welded joints
- The development of distortion, the effect of heat input, weld size, penetration, number of runs in butt welds are explained.  
- Explain the development of distortion, the effect of heat input, weld size and number of runs in butt welds
- Procedures and techniques of welding for corrective measures are explained.  
- Explain procedures and techniques of welding for corrective measures
- Joint preparation and pre-setting for corrective measures are described.  
- Describe joint preparation and pre-setting for corrective measures
- Correction of distortion after welding is explained.  
- Explain how to correct distortion

**ASSESSMENT TASKS OR ACTIVITIES**

Assessment for knowledge components
- Safety considerations
- Residual stress
- Concepts of shrinkage, distortion, solidification, cooling, pre- and post heating
- Techniques for corrective measures (including joint preparation and pre-setting)

**SUBJECT OUTCOME**

1.5 Identify and explain imperfections in welds

*Range: Imperfections include gas pores, incomplete penetration, lack of fusion and cracks*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weld defects are identified.</td>
<td>Identify welding defects</td>
</tr>
<tr>
<td>The causes of weld imperfections are explained.</td>
<td>Explain the causes of weld imperfections</td>
</tr>
<tr>
<td>The influence of weld imperfections on product performance is explained</td>
<td>Explain the influence of welding imperfections on product performance</td>
</tr>
</tbody>
</table>

**ASSESSMENT TASKS OR ACTIVITIES**

Assessment for knowledge components
- Identification of weld imperfections
- Causes of weld imperfections
SUBJECT OUTCOME

1.6 Explain fusion welding processes

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The manual metal arc (MMA) welding process is explained.</td>
<td>• Explain the manual metal arc (MMA) welding process.</td>
</tr>
<tr>
<td>• The metal inert gas and the metal active gas (MIG/MAG) welding processes are explained.</td>
<td>• Explain the metal inert gas and the metal active gas (MIG/MAG) welding processes.</td>
</tr>
<tr>
<td>• The tungsten inert gas (TIG) welding process is explained.</td>
<td>• Explain tungsten inert gas (TIG) welding.</td>
</tr>
<tr>
<td>• The plasma arc welding process is explained.</td>
<td>• Explain the plasma arc welding process.</td>
</tr>
<tr>
<td>• The submerged arc welding process is explained.</td>
<td>• Explain the submerged arc welding process.</td>
</tr>
</tbody>
</table>

ASSESSMENT TASKS OR ACTIVITIES

Assessment for knowledge components
• MMA
• MIG
• TIG
• Plasma arc welding
• Submerged arc welding

SUBJECT OUTCOME

1.7 Explain the function of quality assurance (QA) in welding

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The need for quality assurance in welding is explained with examples.</td>
<td>• Explain the need for quality assurance in welding.</td>
</tr>
<tr>
<td>• The standards for welders and welding procedures are explained in terms of quality assurance processes.</td>
<td>• Explain the standards for welders and welding procedures in terms of quality assurance.</td>
</tr>
</tbody>
</table>

ASSESSMENT TASKS OR ACTIVITIES

Assessment for knowledge components
• Quality assurance
• Standards for welders

Topic 2: Shielded metal arc welding (all positions)

SUBJECT OUTCOME

2.1 Describe the shielded metal arc welding (SMAW) process

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Generally accepted terms and definitions associated with shielded metal arc welding procedures are described and used.</td>
<td>• Describe and use terms and definitions associated with shielded metal arc welding procedures.</td>
</tr>
<tr>
<td>• Actual chemical and mechanical processes that take place during shielded metal welding are explained.</td>
<td>• Explain the actual chemical and mechanical processes that take place during welding of shielded metal.</td>
</tr>
</tbody>
</table>
- Components of SMAW equipment and their functions are identified and explained.

- The importance of the correct setting of the power source, choice of electrode and the consequences of incorrect selection are explained.
  
  **Range:** The thickness of materials, in relation to size and type of welding electrode used, and the influence of electrode manipulation during the welding process.
  
  **Range:** Welding consumables include misuse; mishandling; baking procedures.

- Explain the functions of the components of SMAW equipment.

- Explain the correct setting of the power source.

- Explain the correct choice of electrode.

- Explain the consequences of incorrect selection of electrode.

- Explain the welding characteristics of low carbon steel.

- Explain the safety considerations associated with low carbon steel.

- Explain the shielded metal arc welding (SMAW) process (all positions).

- Identify the various welding parameters, in relation to the thickness of materials (steel) being welded.

---

**ASSESSMENT TASKS OR ACTIVITIES**

**Assessment for knowledge components**

- Safety considerations for welding with low carbon steel
- Terms and definitions associated with the SMAW procedures
- Welding characteristics of low carbon steel
- Components of SMAW equipment
- Choice of electrodes
- Correct settings
- Welding parameters

---

**SUBJECT OUTCOME**

**2.2 Plan and prepare for the welding process**

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding hazards are identified and eliminated in accordance with standard working practices. <strong>Range:</strong> Hazards include fire, electrocution; incorrect set-up procedures and unsafe use of power tools.</td>
<td>Identify and eliminate welding hazards in accordance with standard working practices</td>
</tr>
<tr>
<td>Shielded metal arc welding equipment is selected, verified and prepared as specified in the welding procedure.</td>
<td>Select, verify and prepare SMAW equipment</td>
</tr>
<tr>
<td>Work-pieces are prepared prior to welding as specified on drawings and working practices.</td>
<td>Interpret work instruction sheet and drawing requirements</td>
</tr>
<tr>
<td>Prepared work piece is inspected</td>
<td>Prepare the work piece prior to welding using tack welding</td>
</tr>
</tbody>
</table>

---
- Task dimensions and work piece are aligned and checked as specified on drawing
- Align task dimensions and work piece as per drawing

### ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components / project-based / task-based evidence of knowledge component
  - Safety considerations and welding hazards
  - Planning and preparation of equipment
  - Interpreting a drawing
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Preparation of equipment
  - Tack welding
  - Inspection of work piece prior to welding

Range: Parts include: Suitable power source, earth clamp, electrode holder and welding cable. Material type to be used: May be selected from the range of carbon steels (plate only), applicable to the material group 1 (according to ISO (TR) 15608). Material thickness: 5 mm – 16 mm
- Despite the minimum material thickness as specified, students must display sufficient competency to prepare the groove prior to welding.

### SUBJECT OUTCOME

#### 2.3 Weld materials

Range:
Weld positions to include:
- Fillet welding: Flat/Horizontal, Vertical
- Groove welding: Flat/Horizontal, Vertical
Material type to be used:
- May be selected from the range of carbon steels (plate only), applicable to the material group 1 (according to ISO (TR) 15608).
- Material thickness: minimum – 16 mm
Resources include:
- Welding equipment, tools, protective clothing and equipment, welding procedure specification, materials as specified on drawings and weld filler material.
Welded joints acceptance criteria to be in accordance with a national and/or international welding standard.

### ASSESSMENT STANDARDS

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding of the work-piece material is carried out in accordance with work instruction sheet and drawing requirements.</td>
<td>Interpret work instruction sheet and drawing requirements</td>
</tr>
<tr>
<td>Safety precautions (applicable to the SMAW process) are applied and adhered to in accordance with OHS Act. Range: Hazards include fire, electrocution; incorrect set-up procedures and unsafe use of power tools are explained.</td>
<td>Adhere to safety precautions and OHS Act while performing welding</td>
</tr>
<tr>
<td>Quality checks are applied to welded materials.</td>
<td>Apply quality checks to welding</td>
</tr>
<tr>
<td>The end product is inspected to conform to specifications as reflected on drawing or job requirement.</td>
<td>Inspect the end product to ensure conformance to specifications</td>
</tr>
</tbody>
</table>
- Welding defects are identified and corrective action is taken.  
  Range: Defects include excessive slag, spatter and irregular weld finish (bead).

- Identify welding defects
- Take corrective action for welding defects

---

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Safety considerations for performing welding
  - Identifying welding defects
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student's abilities in the following:
  - SMAW process
  - Adherence to safety precautions and OHS Act while performing welding
  - Applying quality checks to welding
  - Inspecting the end product
  - Identifying welding defects
  - Taking corrective action for welding defects

---

**SUBJECT OUTCOME**

2.4 Inspect welded work-piece for defects and apply quality checks  
*Range: Testing to include at least two appropriate methods*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality checks are applied on welded materials.</td>
<td>Apply quality checks on welded materials</td>
</tr>
</tbody>
</table>
| Welding defects are identified and explained  
  *Range: Defects include: slag, spatters and irregular weld finish (bead)* | Identify and explain welding defects |
| The end product is inspected to conform to specifications as reflected on drawing or job requirement. | Inspect the end product |
| Destructive and non-destructive methods of testing welds are explained | Explain and perform destructive and non-destructive methods of testing welds |
| Destructive and non-destructive methods of testing welds are performed |  |
| Welding defects are identified and corrective action is taken. | Correct all welding defects |

---

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Welding defects
  - Destructive and non-destructive testing methods
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student's abilities in the following:
  - Perform destructive and non-destructive tests
  - Corrective action for welding defects
  - Perform visual inspection of welds
SUBJECT OUTCOME

2.5 Care and storage of welding equipment

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The proper care and storage of tools and equipment is explained in accordance with worksite practices.</td>
<td>• Explain proper care and storage of tools and equipment in accordance with worksite practices.</td>
</tr>
<tr>
<td>• Shielded metal arc welding equipment is dismantled and stored in accordance with manufacturer’s specifications and requirements, and according to workshop procedures</td>
<td>• Dismantle and store welding equipment in accordance with worksite practices, specifications and requirements</td>
</tr>
<tr>
<td>• Tools, welding equipment and consumables are treated with proper care in accordance with worksite practices, specifications and requirements</td>
<td>• Care for tools, welding equipment and consumables in accordance with worksite practices, specifications and requirements</td>
</tr>
<tr>
<td>• The welding equipment, hand tools and consumables, are packed away neatly and safely in accordance workshop procedures</td>
<td>• Store tools, welding equipment and consumables in accordance with worksite practices, specifications and requirements</td>
</tr>
<tr>
<td>• Faults on welding equipment are reported according to worksite practice</td>
<td>• Report faults on welding equipment</td>
</tr>
</tbody>
</table>

ASSESSMENT TASKS OR ACTIVITIES

• Assessment for knowledge components
  ▪ Care and storage of equipment and consumables
  ▪ The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
    ▪ Dismantling of welding equipment

Topic 3: Oxy-acetylene gas welding (all positions)

SUBJECT OUTCOME

3.1 Describe the oxy-acetylene welding process

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Terms and definitions consistent with generally accepted gas welding procedures are explained</td>
<td>• Explain the terms and definitions associated with oxy-acetylene gas welding procedures.</td>
</tr>
<tr>
<td>• Welding consumables are classified in terms of thickness of materials Range: Material type to be used: May be selected from the range of carbon steels (plate only), applicable to the 1 (according to ISO (TR) 15608). Material thickness: 1.6 mm – 3 mm Despite the minimum material thickness as specified, students have to display sufficient competency to prepare the groove prior to welding.</td>
<td>• Classify welding consumables in terms of types and thickness of materials</td>
</tr>
</tbody>
</table>
- Gas welding equipment and components of the oxy-acetylene welding equipment are identified and described.  
  Range: Parts include: oxygen, acetylene gas; hoses; nozzles; suitable welding torch; gas welding electrodes; personal protective equipment

- The importance of correct setting of welding pressures, and the consequences of incorrect settings, are explained.

- The size and type of welding nozzles is explained and demonstrated in relation to fuel gas used.

- The effect of welding torch manipulation during the welding process is explained and demonstrated.

- The functions of the various components of the oxy-acetylene welding equipment are explained.

- Gas welding characteristics of low carbon steel are identified and explained.

- The gas welding method (all positions) is explained.

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Safety considerations while welding
  - Terms and definitions
  - Chemical and mechanical processes during welding
  - Correct pressure settings
  - Choice of nozzles
  - Functions of various components of oxy-acetylene welding equipment
  - Characteristics of low carbon steel
  - Manipulation of the gas torch
  - Gas welding method

- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Demonstrate the impact of welding torch manipulation during the welding process
  - Students must request all the necessary equipment they require to set up the welding equipment correctly. If anything is left out they should be penalised and the lecturer should note this down
  - Using knowledge and skills acquired, the equipment is set up correctly and checked by the lecturer before any welding operations begin

**SUBJECT OUTCOME**

3.2 Plan and prepare for the gas welding process

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety hazards relating to the welding process are identified, explained and eliminated in</td>
<td>Identify and explain safety hazards in relation to the oxy-acetylene gas welding process</td>
</tr>
</tbody>
</table>
accordance with standard working practices. • Eliminate safety hazards related to the oxy-acetylene gas welding process

- Oxy-acetylene gas welding equipment is selected and verified as specified in the welding procedure. • Select oxy-acetylene gas welding equipment

- Equipment, the work environment and work-piece/s are prepared prior to welding as specified on drawing and working practices. • Prepare the welding equipment

- Prepare the work piece prior to welding

- Prepare the welding environment

- Correct start up and shut down procedures are explained and demonstrated • Explain and demonstrate correct start up and shut down procedures

- The consequences of incorrect start up and shut down procedures is explained. • Explain the consequences of incorrect start up and shut down

- The task dimensions and work piece alignment are checked as specified on drawing • Check task dimensions and work piece alignment as per drawing specifications

- Work piece is inspected prior to welding • Inspect work piece prior to welding

ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Safety hazards and elimination thereof
  - Selection of oxyacetylene equipment
  - Explain correct start up and shut down procedures

- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Prepare welding equipment
  - Prepare welding environment
  - Demonstrate correct start up and shut down procedures
  - Alignment of task dimensions and work piece

SUBJECT OUTCOME

3.3 Weld materials

Range:
- Material type to be used: May be selected from the range of carbon steels (plate only), applicable to the material group 1 (according to ISO (TR) 15608).
- Material thickness: 1.6 mm – 3 mm
- Resources include: Welding equipment, tools, protective clothing and equipment, welding procedure specification, materials as specified on drawings and weld filler material.
- Weld positions to include:
  - Fillet welding: Flat/Horizontal, Vertical, Overhead
  - Groove welding: Flat/Horizontal, Vertical, Overhead
- Welded joints acceptance criteria to be in accordance with a national and/or international welding standard.

ASSESSMENT STANDARDS

- Relevant safety precautions are described and adhered to in accordance with OHS Act.
- Safety hazards are avoided.
  - Describe and adhere to all safety precautions according to workshop requirements and OHS Act
  - Avoid safety hazards

Range: Hazards include flash backs, fire, electrocution; incorrect set-up procedures and unsafe use of power tools are explained.
Welding Level 3 Assessment Guidelines (January 2014) National Certificate (Vocational)

- Oxy-acetylene gas welding of material is demonstrated in accordance with correctly interpreted work instruction sheets and drawing requirements.
- Quality checks are conducted on the welded materials.
- Interpret work instruction sheet and drawing requirements
- Perform oxy-acetylene gas welding processes
- Conduct quality checks

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Safety hazards and the prevention thereof
  - Interpreting work instruction sheet and drawing requirements
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Demonstrate gas welding process
  - Conduct quality checks
- Observations applicable to the welding process: Information on heat input range, electrode diameter, filler, Heat input, metal transfer mode, electrode size, joint preparation, welding technique, consumable usage, handling and gas shielding.

**SUBJECT OUTCOME**

3.4 Inspect work piece

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The end product is inspected and conforms to specifications as reflected on the drawing or job requirement.</td>
<td>Inspect end product</td>
</tr>
<tr>
<td>Weld-defects are identified and corrected</td>
<td>Ensure conformance to drawing or job requirements</td>
</tr>
<tr>
<td>Range: Defects include but not limited to undercut, reinforcement, root penetration (lack of), weld run width, surface porosity</td>
<td>Identify welding defects</td>
</tr>
<tr>
<td></td>
<td>Take corrective action on welding defects</td>
</tr>
</tbody>
</table>

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Identify welding defects
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Inspect work piece for defects
  - Take corrective action

**SUBJECT OUTCOME**

3.5 Care for and store welding equipment

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The proper care and storage procedures for tools and equipment is explained and demonstrated according to worksite practices.</td>
<td>Explain proper care and storage procedures for tools and equipment</td>
</tr>
</tbody>
</table>
- The oxy-acetylene welding equipment is dismantled and stored in accordance with manufacturer’s specifications and requirements according to workshop procedures.
- Cylinders, hoses, gauges and torch are packed away neatly and safely in accordance with workshop procedures.

### ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Correct care and storage procedures for equipment and consumables
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Conduct dismantling and storage of equipment
  - Storing consumables

### Topic 4: Tungsten gas arc welding (all positions)

#### SUBJECT OUTCOME

4.1 Describe the gas tungsten arc welding (GTAW or TIG) process

*Range: Parts include suitable power source, earth clamp, gas cylinders, welding torch, pressure regulator flow meter, torch liner, gas diffuser, contact tips and gas nozzles.*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding characteristics of different materials are identified.</td>
<td>Identify the welding characteristics of different materials</td>
</tr>
<tr>
<td>The implications for unsafe conditions are explained in regard to each of the different types of materials.</td>
<td>Explain safety concerns related to each of the different types of materials</td>
</tr>
<tr>
<td>Terms and definitions consistent with generally accepted welding terminology as recorded in national and international welding standards are used and explained.</td>
<td>Use and explain the terms and definitions associated with the gas tungsten arc welding process.</td>
</tr>
<tr>
<td>The actual chemical and mechanical processes that take place during welding are explained.</td>
<td>Explain the actual chemical and mechanical processes that take place during welding.</td>
</tr>
<tr>
<td>The functions of various components of GTAW equipment are explained.</td>
<td>Explain the functions of various components of GTAW equipment</td>
</tr>
<tr>
<td>The importance of the correct equipment assembly, setting of the power source, and choice of electrode and the consequences of incorrect selection are explained.</td>
<td>Explain the assembly of equipment for GTAW</td>
</tr>
<tr>
<td>The thickness of materials is explained in relation to size and type of welding electrode used, and the effect of electrode manipulation during the welding process is explained and demonstrated.</td>
<td>Explain the correct setting of power source for GTAW</td>
</tr>
<tr>
<td>Explain the choice of electrode</td>
<td>Explain the consequences of incorrect selection of electrode</td>
</tr>
<tr>
<td></td>
<td>Explain the size and type of electrode in relation to the thickness of the materials</td>
</tr>
<tr>
<td></td>
<td>Explain the effect of electrode manipulation during the welding process</td>
</tr>
<tr>
<td></td>
<td>Demonstrate the effect of electrode manipulation during the welding process</td>
</tr>
</tbody>
</table>
- The down-hand gas tungsten arc welding (GTAW) method (down hand position) is explained.
- The various welding parameters are identified in relation to the thickness of materials (steel) being welded.
- Setting up procedures is demonstrated.
- Explain the down-hand gas tungsten arc welding (GTAW) method (down hand position)
- Identify the various welding parameters, in relation to the thickness of materials (steel) being welded.
- Demonstrate setting up procedures

### ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Safety considerations in relation to different materials
  - Welding characteristics of different materials
  - Terms and definitions
  - Chemical and mechanical processes
  - Functions of components of GTAW equipment
  - Assembly of GTAW equipment
  - Setting of power source
  - Choice of electrode
  - Electrode manipulation
  - Welding parameters
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Electrode manipulation
  - Assembly of equipment
  - Setting up procedures

### SUBJECT OUTCOME

4.2 Plan and prepare for the gas tungsten arc welding (GTAW or TIG) process

**Range:**
- **Welding positions:** Fillet Weld
- **Material type to be used:** May be selected from the range of carbon steels (plate only), applicable to the material group 1 (according to ISO (TR) 15608). Material thickness: minimum –1.6 mm
- **Resources include:** tools, protective clothing and equipment, materials as specified on drawings and weld filler material.

### ASSESSMENT STANDARDS

| Safety aspects are explained, and welding hazards are identified and eliminated in accordance with standard working practices. | Explain and implement the safety aspects of gas tungsten arc welding (GTAW) in the fabrication workshop. |
| Gas tungsten arc welding equipment is identified, selected and prepared as specified in the welding procedure, and the work piece/s prepared. | Prepare the gas tungsten arc welding (GTAW) equipment for the welding process, and prepare the work piece/s for gas tungsten arc welding |
| The welding environment and the work-piece/s is prepared prior to welding as specified on drawing and working practices (including groove preparation) | Prepare the welding environment. |
| Pre-operational checks are performed in accordance with manufacturer’s specifications. | Perform pre-operational checks in accordance with manufacturer’s requirements |
| The consequences of not performing pre- | Explain the consequences of not performing |
operational checks are explained. | pre-operational checks
---|---
• Task dimensions and work-piece alignment are checked as specified on drawing. | • Align task dimensions and work piece as per drawing specifications
• Work piece is tack welded into position as specified as per drawing. | • Tack weld work piece into place

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Safety considerations of GTAW welding
  - Terms and definitions
  - Tungsten gas welding equipment and preparation
  - Pre-operational checks
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Prepare the gas tungsten arc welding (GTAW) equipment for the welding process, and prepare the work piece/s for gas tungsten arc welding
  - Prepare the welding environment
  - Perform pre-operational checks in accordance with manufacturer requirements.

**SUBJECT OUTCOME**

**4.3 Weld and inspect a work piece using the gas tungsten arc welding process (GTAW/TIG)**

*Range:*
- **Welding positions: Fillet Weld**
- **Material type to be used:** May be selected from the range of carbon steels (plate only), applicable to the material group 1 (according to ISO (TR) 15608). Material thickness: minimum –1.6 mm
- **Resources include:** tools, protective clothing and equipment, materials as specified on drawings and weld filler material.

**ASSESSMENT STANDARDS** | **LEARNING OUTCOMES**
---|---
• Welding consumables are selected and GTAW welding performed as per requirements for welding carbon steel, aluminium and stainless steel plate | • Perform GTAW welding on a work piece as per requirements for carbon steel, aluminium and stainless steel plate
• The work-piece material is welded in accordance with work instruction sheet and drawing requirements. | • Interpret working instruction sheet and drawings
• Appropriate inspection methods are selected | • Select appropriate inspection methods
• The end product is inspected to conform to specifications as reflected on drawing or job requirement. | • Inspect welded work pieces for defects
• Quality checks are made on welded materials. | • Perform quality checks on the welding process
• Safety precautions are observed and adhered to in accordance with OHS Act (applicable to the GTAW process). | • Adhere to safety requirements while welding
  *Range: Hazards include fire, electrocution; incorrect set-up procedures and unsafe use of power tools are explained.
• Welding defects are identified and corrective action is taken. | • Identify welding defects
  • Take corrective action
Range: Defects include excessive slag, spatter and irregular weld finish (bead).

- Work pieces are cleaned after welding as per worksite practices.
- Post-cleaning of welded joint is performed.
- Clean work piece after welding

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Safety considerations associated with GTAW
  - Inspection methods
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Perform GTAW welding on a work piece as per requirements for carbon steel, aluminium and stainless steel plate
  - Inspect welded work pieces for defects
  - Perform quality checks on the welding process
  - Adhere to safety requirements while welding
  - Identify welding defects
  - Take corrective action

**SUBJECT OUTCOME**

4.4 Care for and store welding equipment

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The proper care and storage of tools, equipment and consumables is explained in accordance with worksite practices.</td>
<td>• Explain the care and storage procedures for tools and equipment in accordance with worksite practices and specifications.</td>
</tr>
<tr>
<td>• Gas tungsten arc welding equipment is dismantled and stored according with manufacturer’s specifications and requirements.</td>
<td>• Dismantle and store the gas tungsten arc welding equipment in accordance with manufacturer’s specifications and requirements.</td>
</tr>
<tr>
<td>• The welding equipment, hand tools and consumables, are packed away neatly and safely in accordance with laid down procedures</td>
<td>• Welding equipment, hand tools and consumables are stored</td>
</tr>
</tbody>
</table>

**ASSESSMENT TASKS OR ACTIVITIES**

- Assessment for knowledge components
  - Care and storage
  - Dismantling of equipment
  - Storage of equipment, hand tools and consumables
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Care and storage
  - Dismantling of equipment
  - Storage of equipment, hand tools and consumables
## Topic 5: Metal Inert Gas (MIG) welding (all positions)

### SUBJECT OUTCOME

#### 5.1 Describe the MIG welding process.

*Range: Welding equipment includes: Constant voltage power source, earth clamp, welding cable, shielding gas, flow meter regulator, hose clamps and welding consumables as specified.*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Welding terms and definitions used are consistent with generally accepted welding terminology as recorded in international welding standards.</td>
<td>• Acquire and use correct MIG welding terms and definitions in accordance with international welding standards</td>
</tr>
<tr>
<td>• The importance of correct assembly of the MIG welding equipment, and the consequences of incorrect assembly, are explained with reference to the manufacturer’s requirements.</td>
<td>• Explain the importance of correct assembly of MIG equipment in accordance with manufacturer’s requirements</td>
</tr>
<tr>
<td>• Basic and major components of the MIG equipment are identified and their function and purpose is explained in terms of manufacturer’s requirements and standards.</td>
<td>• Explain the consequences of incorrect assembly</td>
</tr>
<tr>
<td>• Parts and components of MIG are correctly identified and the implications for incorrect identification are explained.</td>
<td>• Identify components of MIG equipment and explain their function and purpose</td>
</tr>
</tbody>
</table>

### ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Safety considerations of MIG welding
  - Terms and definitions
  - Function and purpose of components of MIG equipment
  - Assembly of MIG equipment
  - MIG method of welding

### SUBJECT OUTCOME

#### 5.2 Select, set up and conduct pre-operational checks.

*Range: Resources to include: manufacturer’s operational manual, worksite practices and safety and environmental issues.*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MIG equipment is identified and selected according to work-site practice.</td>
<td>• Identify and select MIG equipment</td>
</tr>
<tr>
<td>• Hazards related to the MIG process are identified and rectified in accordance with standard work site practices.</td>
<td>• Identify and eliminate hazards related to the MIG process</td>
</tr>
<tr>
<td>• Pre-operational checks are carried out in accordance with manufacturer’s specifications.</td>
<td>• Perform pre-operational checks in accordance with manufacturer’s specifications</td>
</tr>
</tbody>
</table>
ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Safety considerations
  - Identification and selection of MIG equipment
  - Preoperational checks
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Perform preoperational checks

SUBJECT OUTCOME

5.3 Prepare work pieces prior to welding

Range:

- Resources include - Worksite procedures, tools, equipment, safety requirements, and materials.
- Material type to be used: May be selected from the range of carbon steels (plate only), applicable to the material groups 1 (according to ISO (TR) 15608).
- Material thickness: minimum – 6 mm
- Resources include: Welding equipment, tools, protective clothing and equipment, welding procedure specification, materials as specified on drawings and weld filler material.
- Weld positions to include:
  - Fillet welding: Flat/Horizontal, Vertical
  - Groove welding: Flat/Horizontal, Vertical

ASSESSMENT STANDARDS | LEARNING OUTCOMES
--- | ---
- Work pieces are prepared prior to welding as specified on drawing and worksite procedures. | - Prepare work pieces as per drawings and worksite procedures
- Dimensions and alignment are checked as specified on drawing. | - Check dimensions and alignment
- Work piece is tack-welded in position as per drawing specifications. | - Tack weld work piece in position as per drawing specifications
- Safety precautions are adhered to. | - Adhere to safety precautions while preparing work pieces prior to welding
- Work piece is inspected prior to welding | - Inspect work piece prior to welding

ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Safety considerations while preparing work piece prior to welding
  - Interpreting drawing specifications
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Checking dimensions and alignment
  - Tack welding
  - Inspect work piece prior to welding
- Welded joints acceptance criteria to be in accordance with a national and/or international welding standard.
SUBJECT OUTCOME

5.4 Weld work pieces.

Range:
- **Heat input, electrode manipulation, electrode size, joint preparation, welding technique, consumable handling.**
- **Resources include:** Welding equipment, tools, protective clothing and equipment, welding procedure specification, materials as specified on drawings and weld filler material.
- **Material type to be used:** To be selected from the range of carbon steels (plate only), applicable to the material groups 1 (according to ISO (TR) 15608).
- **Material thickness:** Minimum – 6 mm.
- **Welding positions include:** Fillet welding, Flat/Horizontal, Vertical; Groove welding: Flat/Horizontal, Vertical.

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety precautions are adhered to during welding process.</td>
<td>Adhere to safety precautions during welding process</td>
</tr>
<tr>
<td>Welding consumables are selected as per welding procedure specification.</td>
<td>Select welding consumables as per welding procedure specifications</td>
</tr>
<tr>
<td>Work piece is welded in position</td>
<td>Weld work piece in position</td>
</tr>
<tr>
<td>Work piece is cleaned and spatter and slag are removed after welding as per worksite practices.</td>
<td>Clean work piece and remove spatter and slag after welding</td>
</tr>
<tr>
<td>Defective equipment is reported</td>
<td>Report defective equipment</td>
</tr>
</tbody>
</table>

ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Safety precautions during welding process
  - Selecting welding consumables
  - Reporting defective equipment
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student’s abilities in the following:
  - Safety precautions during welding process
  - Selecting welding consumables
  - Perform welding
  - Perform post welding cleaning

SUBJECT OUTCOME

5.5 Inspect welded work piece for defects.

Range:
- **Procedures include:** Worksite practices, inspection methods, and cleaning procedures.
- **Welded joints acceptance criteria to be in accordance with a national and/or international welding standard.**

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection methods and procedures are identified and explained</td>
<td>Identify and explain inspection methods</td>
</tr>
<tr>
<td>Welded work piece is inspected as per job specifications.</td>
<td>Inspect work piece as per work specifications</td>
</tr>
<tr>
<td>Documentation is completed as reflected in worksite practices.</td>
<td>Complete documentation as per worksite practices</td>
</tr>
</tbody>
</table>
### ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Safety considerations
  - Selecting and explaining inspection methods
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student's abilities in the following:
  - Inspect work piece
  - Completing documentation

### SUBJECT OUTCOME

5.6 Care for and store welding consumables and equipment

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding equipment is correctly dismantled</td>
<td>Dismantle welding equipment</td>
</tr>
<tr>
<td>Tools and equipment are cared for as per manufacturer's specifications and stored as per worksite practices.</td>
<td>Care for and store equipment as per manufacturer’s specifications and worksite practices</td>
</tr>
<tr>
<td>Tools and equipment are cared for and stored as per manufacturer's specifications and worksite practices.</td>
<td>Care for and store tools as per manufacturer’s specifications and worksite practices</td>
</tr>
<tr>
<td>Welding consumables are stored in accordance to worksite practices.</td>
<td>Store welding consumables in accordance with worksite practices.</td>
</tr>
</tbody>
</table>

### ASSESSMENT TASKS OR ACTIVITIES

- Assessment for knowledge components
  - Care and storage of equipment, tools and consumables
- The knowledge components of this topic must be integrated with a practical assignment or task which may be demonstrated as a product of the student's abilities in the following:
  - Dismantle welding equipment
  - Care and storage of equipment, tools and consumables
4. SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN SUBJECT WELDING – LEVEL 3

4.1 Integrated summative assessment task (ISAT)

A compulsory component of the external assessment (ESASS) is the integrated summative assessment task (ISAT). The ISAT draws on the students’ cumulative learning achieved throughout the year. The task requires integrated application of competence and is executed and recorded in compliance with assessment conditions.

Two approaches to the ISAT may be as follows:

The students are assigned a task at the beginning of the year which they must complete in phases throughout the year to obtain an assessment mark. A final assessment is made at the end of the year when the task is completed.

OR

Students achieve the competencies throughout the year but the competencies are assessed cumulatively in a single assessment or examination session at the end of the year.

The ISAT is set by an externally appointed examiner and is conveyed to colleges in the first quarter of the year.

The integrated assessment approach enables students to be assessed in more than one subject with the same ISAT.

4.2 National Examination

A National Examination is conducted annually in October or November by means of a paper(s) set and moderated externally. The following distribution of cognitive application should be followed:

<table>
<thead>
<tr>
<th>LEVEL 3</th>
<th>KNOWLEDGE</th>
<th>COMPREHENSION AND APPLICATION</th>
<th>ANALYSIS, SYNTHESIS AND EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30%</td>
<td>50%</td>
<td>20%</td>
</tr>
</tbody>
</table>