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NATIONAL CERTIFICATE (VOCATIONAL)

ASSESSMENT GUIDELINES

WELDING

NQF LEVEL 4

IMPLEMENTATION: JANUARY 2015

WELDING – LEVEL 4

CONTENTS

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 *Welding Level 4* 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: Welding Level 4* to prepare for and deliver Welding. 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 resources 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 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 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 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 (SKVAs) are assessed throughout the year using assessment instruments such as projects, tests, assignments, investigations, role-play and case studies. The internal continuous assessment (ICASS) practical component is undertaken in a real workplace, a workshop or a "Structured Environment". This component is moderated internally, and externally quality assured 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 number of) written paper(s) set to the requirements of the Subject Learning Outcomes. The Department of Higher Education and Training (DHET) administers the theoretical component according to relevant assessment policies.

A compulsory component of external summative assessment (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 workplace or workshop environment, 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 for students who experience barriers to learning be customised and supported to enable these students to achieve to their maximum potential.

4 PERIOD OF VALIDITY OF INTERNAL CONTINUOUS ASSESSMENT (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 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 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.

LECTURER ASSESSMENT	The lecturer assesses students' performance against given criteria in different contexts, such as individual work, group work, etc.
SELF-ASSESSMENT	Students assess their own performance against given criteria in different contexts, such as individual work, group work, etc.
PEER ASSESSMENT	Students assess another student's or group of students' performance against given criteria in different contexts, such as individual work, group work, etc.
GROUP ASSESSMENT	Students assess the individual performance of other students within a group or the overall performance of a group of students against given criteria.

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.

	METHODS FOR COLLECTING EVIDENCE		
	Observation-based (Less structured)	**Task-based** (Structured)	**Test-based** (More structured)
Assessment instruments	• Observation • Class questions • Lecturer, student, parent discussions	• Assignments or tasks • Projects • Investigations or research • Case studies • Practical exercises • Demonstrations • Role-play • Interviews	• Examinations • Class tests • Practical examinations • Oral tests • Open-book tests
Assessment tools	• Observation sheets • Lecturer's notes • Comments	• Checklists • Rating scales • Rubrics	• Marks (e.g. %) • Rating scales (1-7)
Evidence	• Focus on individual students • Subjective evidence based on lecturer observations and impressions	**Open middle**: Students produce the same evidence but in different ways. **Open end**: Students use same process to achieve different results.	Students answer the same questions in the same way, within the same time.

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. It is a different way of assessment that cannot be compared to tests. Each criterion described in the rubric must be assessed separately. Mainly two types of rubrics are used, namely holistic and analytical.

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 the task or question 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 4

SECTION C: ASSESSMENT IN WELDING – LEVEL 4

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 achieve 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 DHET on the due date towards the end of the year.

The following internal assessment units currently **GUIDE** the internal assessment of *Welding Level 4*:

TASKS	**Time-frame**	**Type of assessment activity**	**Minimum time and proposed mark allocation** (*can be increased but not reduced)	**Scope of assessment**	**% contribution to the year mark**
				Do not confuse the weightings of topics in the Subject Guidelines with the % contribution to the year mark	
1	Term 1	Test	1 hour (50 marks)	Topics completed in Term 1	10
2	Term 1	Practical Assessment/ Assignment	Determined by the scope and nature of the task	One or more of the topics completed as an assignment	25
3	Term 2	Practical Assessment/ Assignment	Determined by the scope and nature of the task	One or more of the topics completed as an assignment	25
4	Term 2	Test*	1 hour (50 marks)	Topics completed in Term 1 and 2	10

5	Term 3	Internal Examination*	As per external examinations (P1 & P2 where applicable)	Topics completed to date (P1 =15 & P2=15, where applicable)	30
				TOTAL	**100**

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 updated and 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.

Scale of Achievement for the Vocational component

RATING CODE	RATING	MARKS %
5	Outstanding	80-100
4	Highly competent	70-79
3	Competent	50-69
2	Not yet competent	40-49
1	Not achieved	0-39

The planned and 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 (memoranda, rubrics, checklists) 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)
- A contents page/list of content (for accessibility)
- A subject assessment schedule
- The evidence of marked assessment tasks and feedback according to the assessment schedule
- A summary record of results showing all the marks achieved per assessment for the subject
- Evidence of moderation (only where applicable for student's whose tasks were moderated)

Where tasks cannot be contained as evidence in the Portfolio of Evidence (PoE), their exact location must be recorded and they must be readily available for moderation purposes.

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN WELDING – LEVEL 4

Topic 1: Principles and techniques of welding (pipe)

SUBJECT OUTCOME	
1.1 Identify and describe welded joints in pipes	
Range: Butt welds in pipes; in line and at an angle; the importance of gas backing.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The types of pipe weld connections are identified and discussed.	• Identify and discuss types of pipe weld connections.
• Joint preparations are identified	• Identify joint preparations.
• Methods of joint preparation of pipes is described	• Describe the methods of joint preparation of pipes.
• The adaptation of joint preparation methods of pipes is explained	• Explain the adaptation of joint preparation methods of pipes.
• Tube to plate welds and branch connections are identified and drawn	• Identify and draw tube to plate welds and branch connections
• The method of performing tube to plate welding is described	• Describe the method of performing tube to plate welding
• Branch connections (set-on, set-in and set through) are described.	• Describe branch connections (set-on, set-in and set through).
ASSESSMENT TASKS OR ACTIVITIES	
• Theory test or questionnaire • Project assignment • Research portfolio Or combination of the above	

SUBJECT OUTCOME	
1.2 Explain welding problems associated with alloyed steels	
Range: • *Stainless steels* • *Aluminium alloys* • *Copper alloys* • *Nickel alloys* • *Titanium and other special materials*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The influence of welding on steel is explained.	• Explain the influence of welding on steel.
• The differences between non-alloy, stainless steels and other alloy steels are described.	• Describe the differences between non-alloy, stainless steels and other alloy steels.
• The effects of alloying elements on the properties of steel are explained.	• Briefly explain the effects of alloying elements on the properties of steel.
• The basic properties of stainless steel, aluminium and other alloys, their welding processes and health aspects are described and explained.	• Describe and explain the basic properties of stainless steel, aluminium and other alloys, their welding processes and health aspects.
• The addition of elements to create alloys is explained	• Explain the addition of elements to create alloys.
• Weld-ability, welded joints and distortion related to the alloys are explained.	• Explain the weld-ability, welded joints and distortion related to the alloys.
• The effects of welding on steel are explained	• Explain the effects of welding on steel.
• The basis of ISO (TR) 15608 is explained.	• Explain the basis of ISO (TR) 15608.
• Materials are identified according to ISO (TR) 15608.	• Identify materials according to ISO (TR) 15608.
• Types of joints (butt; “T”; lap and corner – EN 12345, ISO [(DIS) 17659]) are identified and discussed.	• Identify and discuss types of joints (butt; “T”; lap and corner – EN 12345, ISO [(DIS) 17659]).
• Types of welding (butt and fillet) are identified and explained.	• Identify and explain types of welding (butt and fillet).
• Various welding consumables and their backing gases are listed and identified.	• List and identify various welding consumables and their backing gases
• Corrosion and post weld treatment of alloys are explained.	• Explain corrosion and post weld treatment of alloys
• Typical welding problems associated with stainless steels and other alloys are described	• Describe typical welding problems associated with stainless steels and other alloys.
ASSESSMENT TASKS OR ACTIVITIES	
• Theory test or questionnaire • Project assignment • Research portfolio Or combination of the above	

SUBJECT OUTCOME	
1.3 Explain the causes and consequences of weld failures	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The safety requirements relating to welded products are explained.	• Explain the safety requirements relating to welded products.
• Examples of failures are provided and their causes and consequences explained	• Provide examples of failures and explain their causes and consequences.
• Product failures due to bad welding are described and explained	• Describe and explain product failures due to bad welding.
• The role of the welder in avoiding failures is explained.	• Explain the role of the welder in avoiding failures.
• The implications of failure and product liability are explained	• Explain the implications of failure and product liability.
ASSESSMENT TASKS OR ACTIVITIES	
• Theory test or questionnaire • Project assignment • Research portfolio Or combination of the above	

SUBJECT OUTCOME	
1.4 Explain the harmonised system of international standards	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The role and operation of CEN and ISO and their relationship with National Standards Organisations are described and explained.	• Describe and explain the role and operation of CEN and ISO and their relationship with National Standards Organisations.
• International and national standards for welding equipment and welding consumables are described and explained.	• Describe and explain important international and national standards for welding equipment and welding consumables.
• International and national standards for welding practice and product standards that contain welding requirements are described and explained.	• Describe and explain important international and national standards for welding practice and product standards that contain welding requirements.
• Standards for quality and co-ordination in welding are described and explained.	• Describe and explain standards for quality and co-ordination in welding.
ASSESSMENT TASKS OR ACTIVITIES	
• Theory test or questionnaire • Project assignment • Research portfolio Or combination of the above	

Topic 2: Shielded metal arc welding (pipe)

SUBJECT OUTCOME	
2.1 Explain the shielded metal arc welding (SMAW) process for welding pipe in all positions	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Terminology associated with shielded metal arc welding procedures is explained.	• Explain the terminologies associated with shielded metal arc welding procedures.
• Terms and definitions used are consistent with generally accepted welding terminology as recorded in national and international welding standards	• Use terms and definitions that are consistent with generally accepted welding terminology as recorded in national and international welding standards
• Basic and major components of shielded metal arc welding (SMAW) equipment and their functions are identified and their function and purpose explained	• Identify basic and major components of shielded metal arc welding equipment and explain their function and purpose
• The importance of correct assembly of the shielded metal arc welding equipment and the consequences of incorrect assembly are explained	• Explain the importance of correct assembly of the shielded metal arc welding equipment, and the consequences of incorrect assembly.
• The importance of the correct setting of the power source and choice of electrode and the consequences of incorrect selection are explained	• Explain the importance of the correct setting of the power source and choice of electrode and the consequences of incorrect selection.
• The thickness of materials in relation to size and type of welding electrode used, and the influence of electrode manipulation during the welding process are explained.	• Explain the thickness of materials in relation to size and type of welding electrode used, and the influence of electrode manipulation during the welding process.
• The chemical and mechanical processes that take place during welding are explained.	• Explain the chemical and mechanical processes that take place during welding.
• The shielded metal arc welding (SMAW) process is described.	• Describe the shielded metal arc welding (SMAW) process.
• Setting up procedures are demonstrated	• Demonstrate setting up procedures
• Welding consumables and their misuse, mishandling and baking procedures are identified and described.	• Identify and describe welding consumables, their misuse, mishandling and baking procedures
• Welding characteristics of low carbon steel are described, and unsafe welding conditions and their implications are identified.	• Describe the welding characteristics of low carbon steel, and identify unsafe welding conditions and their implications.
ASSESSMENT TASKS OR ACTIVITIES	
Questionnaire-based activities related to: • The shielded metal arc welding process and related equipment. • The shielded metal arc welding equipment used • The shielded metal arc welding method and the application of specifications (parent material, current setting, electrode angle, electrode-type, and other consumables used). • Implementation of safety precautions during shielded metal arc welding.	

- Explaining the heat characteristics of common metals during the shielded metal arc welding process
- Correct use of terminology is assessed.

For the practical assessment:

- Students must request all the necessary equipment they require to set up the welding equipment correctly, losing marks for any omissions.
- Using knowledge and skills acquired, the equipment must be set up correctly and checked by the lecturer before any welding operations begin.

Range: Parts include: Suitable welding power source, earth clamp, electrode holder, cables, safety clothing and equipment.

SUBJECT OUTCOME	
2.2 Plan and prepare for the welding process	
Range: Observations applicable prior to the tack-welding process include heat input, electrode size, filler material selection, joint preparation, welding technique, consumable usage and handling. *Range: Material to be used:* *Size of pipes to be welded should be: Nominal bore (NB) 10mm minimum.* *Minimum wall thickness of pipe 1mm.* *Select from range of Carbon Steels (Material Group 1, 2, 3 or 11, according to CR/ISO TR 15608).*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Safety aspects of Shielded Metal Arc Welding (SMAW) in the welding workshop are explained.	• Explain the safety aspects of Shielded Metal Arc Welding (SMAW) in the welding workshop.
• Shielded metal arc welding equipment is identified and selected as per requirements.	• Identify, select and prepare the shielded metal arc welding (SMAW) equipment.
• Pipes are inspected and prepared prior to welding as specified on drawing and the welding process	• Inspect and prepare the pipe in accordance with drawing prior to the welding process.
• Dimensions and alignment are checked as specified on drawing.	• Check dimensions and alignment as specified on drawing and the welding process.
• The welding environment is prepared.	• Prepare the welding environment.
• Possible welding hazards are identified and rectified in accordance with standard work site practices.	• Identify and rectify possible welding hazards in accordance with standard work site practices.
• Pre-operational checks are carried out in accordance with specifications.	• Carry out pre-operational checks in accordance with specifications.
• Pipes are tack-welded into position as specified on drawing.	• Tack-weld pipes into position as specified on drawing.
• Safety precautions are adhered to.	• Adhere to safety precautions.
ASSESSMENT TASKS OR ACTIVITIES	
Students are given a welding task according to the range. • Planning and preparation is to be assessed by a theory test questionnaire accompanied by an observation checklist contained within a practical project or task	

- Before any welding can take place all students must be found competent in this activity
- The shielded metal arc equipment is to be well insulated to avoid electric shock.
- Work-piece tack welded in position as per drawing specifications.
- Safety precautions adhered to.
- Inspection of work-piece prior to welding.

SUBJECT OUTCOME	
2.3 Weld materials in all positions	
Range: *Welding positions include groove-welding positions only: Flat rotational; Flat/Horizontal; Vertical (fixed position); Inclined at 45°.* *Material to be used:* *Size of pipes to be welded should be: Nominal bore (NB) - 10mm (minimum).* *Minimum wall thickness of pipe -1mm.* *Select from range of Carbon Steels (Material Group 1, 2, 3 or 11, according to CR/ISO TR 15608).* *Specification requirements include heat input, electrode manipulation, electrode size, joint preparation, welding technique, consumable handling.* *Defects include excessive slag, spatter and irregular weld finish (bead).* *Hazards include fire, electrocution; incorrect set-up procedures and unsafe use of power tools.* *Welded joints acceptance criteria to be in accordance with a national and/or international welding standard.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Safety precautions applicable to the shielded metal arc welding (SMAW) process are adhered to in accordance with OHS Act.	• Adhere to safety precautions applicable to the shielded metal arc welding (SMAW) process in accordance with OHS Act.
• Welding parameters are established and requirements complied with.	• Establish welding parameters and conform to requirements.
• Welding consumables are selected and used as per requirements	• Select and use welding consumables as per requirements.
• The shielded metal arc welding (SMAW) process is used to weld carbon steel pipe in all positions	• Use the shielded metal arc welding (SMAW) process in all positions to weld carbon steel pipe
• Pipes are welded in position in accordance with instruction sheet and drawing requirements.	• Weld pipes in position in accordance with instruction sheet and drawing requirements.
• Welded work-pieces are inspected for defects using visual and non-destructive inspections, and quality checks are applied on welded materials.	• Inspect welded work-piece for defects using visual and non-destructive inspections, and apply quality checks on process.
• The end product is inspected for conformance to specifications as reflected on drawing or job requirement.	• Inspect the end product for conformance to specifications as reflected on drawing or job requirement.
• Welding defects are identified and corrective action is taken.	• Identify welding defects and take corrective action.

ASSESSMENT TASKS OR ACTIVITIES
Practical project or task • Lecturer to ensure correct posture, weld-direction, angle of electrode to work-piece, pressures • Students to use skills, knowledge and safety during cutting • Lecturers to ensure that all personal protective equipment (PPE) is correctly and appropriately worn • All welding must take place in a controlled environment and lecturers to ensure quality of cuts • Welded joints acceptance criteria to be in accordance with a national and/or international welding standard.

SUBJECT OUTCOME	
2.4 Care for and store welding equipment and consumables	
Range: *Care and storage practices should conform to manufacturers' requirements and be conducive to preventative maintenance schedules.* *Defective equipment to be dealt with in accordance to worksite practices. Consumables and equipment are to be stored in a usable condition for the next user.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Pipes are cleaned after welding as per required practices.	• Clean pipes after welding.
• The proper care and storage of tools, equipment and consumables is explained in accordance with worksite practices.	• Explain the care and storage procedures for tools, equipment and consumables in accordance with worksite practices and specifications.
• Shielded metal arc welding equipment is dismantled according to workshop procedures.	• Dismantle shielded metal arc welding equipment according to workshop procedures.
• The welding equipment, hand tools and consumables are packed away neatly and safely in accordance with laid down procedures.	• Pack and store the welding equipment, hand tools and consumables neatly and safely in accordance with laid down procedures.
ASSESSMENT TASKS OR ACTIVITIES	
Students are given a welding task according to the range • Care and storage of welding equipment is to be assessed by a theory test questionnaire accompanied by an observation checklist contained within the practical project (welding task). • Tools and equipment are stored in accordance with worksite practices • Defective equipment is reported.	

Topic 3: Gas tungsten arc welding (TIG) (ferrous and non-ferrous materials)

SUBJECT OUTCOME	
3.1 Describe the gas tungsten arc welding (GTAW) process for welding ferrous and non-ferrous material in all positions	
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.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Terms and definitions used are consistent with generally accepted welding terminology as recorded in national and international welding standards.	• Use and explain the terminology associated with the gas tungsten arc welding process.
• Basic and major components of GTAW equipment are identified and their functions and purpose are explained.	• Identify components of GTAW equipment used for welding ferrous and non-ferrous material and explain their function and purpose.
• The importance of the correct equipment assembly, setting of the power source and choice of electrode and the consequences of incorrect selection are explained.	• Explain the importance of the correct equipment assembly, setting of the power source and choice of electrode and the consequences of incorrect selection.
• The chemical and mechanical processes that take place during welding are explained.	• Explain the chemical and mechanical processes that take place during welding.
• The gas tungsten arc welding (GTAW) method in all positions explained.	• Explain the gas tungsten arc welding (GTAW) method in all positions.
• The thickness of materials in relation to size and type of welding electrode used, and the influence of electrode manipulation during the welding process are explained.	• Explain the thickness of materials in relation to size and type of welding electrode used, and the influence of electrode manipulation during the welding process.
• The misuse, mishandling, and baking procedures of welding consumables is described and explained.	• Describe and explain the misuse, mishandling, and baking procedures of welding consumables.
• Welding characteristics of different materials are identified and unsafe welding conditions and their implications are described.	• Describe the welding characteristics of different materials and identify unsafe welding conditions and their implications.
• Setting up procedures are demonstrated.	• Demonstrate setting up procedures.
ASSESSMENT TASKS OR ACTIVITIES	
Questionnaire-based activities related to: • The gas tungsten arc welding process and related equipment. • The gas tungsten arc welding method and the application of specifications (parent material, current setting, electrode angle, electrode-type, and other consumables used). • Application of safety precautions during gas tungsten arc welding. • Explaining the heat characteristics of common metals during the gas tungsten arc welding process • Correct use of terminology is assessed.	

For the practical assessment:

- Students must request all the necessary equipment they require to set up the welding equipment correctly, losing marks for any omissions.
- 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 tungsten arc welding (GTAW) process	
Range: *Material to be used:* ***Carbon Steel Pipe*** *Size of pipes to be welded should be: Nominal bore (NB) - 10mm (minimum).* *Minimum wall thickness of pipe: 1mm.* *Select from range of Carbon Steels (Material Group 1, 2, 3 or 11, according to CR/ISO TR 15608).* ***Aluminium:*** *Range of materials: aluminium and aluminium alloys.* *Materials group: To be selected from groups 21, 22, 24 or sub-group 23.1 [ISO (TR) 15608; Table 2] for the purpose of assessment.* *Minimum plate thickness: 1,6mm.* ***Stainless Steel:*** *Range of materials: stainless steel and stainless steel alloys.* *Materials group: To be selected from groups 8 or 10 according to ISO (TR) 15608, for the purpose of assessment.* *Minimum plate thickness: 1,6mm.* *Observations applicable prior to the tack-welding process: Heat input, electrode size, filler material selection, joint preparation, welding technique, consumable usage, handling and gas shielding.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The safety aspects of gas tungsten arc welding (GTAW) in the welding workshop are explained and implemented.	• Explain and implement the safety aspects of gas tungsten arc welding (GTAW) in the welding workshop.
• Gas tungsten arc welding equipment is identified and selected as specified in the welding procedure.	• Identify, select and prepare the gas tungsten arc welding (GTAW) equipment for the welding process.
• Potential causes for welding defects or imperfections are identified prior to welding, and action taken to meet requirements.	• Identify potential causes of welding defects or imperfections prior to welding, and take action to meet requirements.
• Welding hazards are identified and eliminated in accordance with standard working practices.	• Identify welding hazards and eliminate in accordance with standard working practices.
• Dimensions and alignment are checked for conformance to the drawing specifications.	• Check dimensions and alignment as specified on the drawing.

• Work-piece/s is inspected and prepared (including groove preparation) for gas tungsten arc welding as specified in the drawings and working practices.	• Inspect and prepare the work-piece/s (including groove preparation) for gas tungsten arc welding according to drawings and working practices.
• Task dimensions and work-piece alignment are checked as specified on drawing.	• Check task dimensions and work-piece alignment as specified on drawing.
• Pre-operational checks are carried out in accordance with manufacturer's specifications.	• Carry out pre-operational checks in accordance with manufacturers' specifications.
• The welding environment is prepared**.**	• Prepare the welding environment**.**
• Work-piece is tack-welded into position as specified as per drawing.	• Tack-weld work-piece into position as specified as per drawing.

ASSESSMENT TASKS OR ACTIVITIES

Students are given a welding task according to the range.

- Planning and preparation is to be assessed by a theory test questionnaire accompanied by an observation checklist contained within a practical project or task
- Before any welding can take place all students must be found competent in this activity
- The gas tungsten arc welding equipment is to be well insulated to avoid electric shock.
- Work-piece tack welded in position as per drawing specifications.
- Safety precautions adhered to.
- Inspection work-piece prior to welding.

SUBJECT OUTCOME

3.3 Weld materials using the gas tungsten arc process in all positions

Range:

Welding positions: Fillet Weld: Flat rotated; Horizontal, Vertical; Overhead.

Groove weld: Flat rotated, Horizontal, Vertical, Inclined at 45º.

Defects include excessive slag, spatter and irregular weld finish (bead).

Hazards include fire, electrocution; incorrect set-up procedures and unsafe use of power tools is explained.

Material to be used:

Carbon Steel Pipe:

Size of pipes to be welded should be: Nominal bore (NB) - 10mm (minimum).

Minimum wall thickness of pipe -1mm.

Select from range of Carbon Steels (Material Group 1, 2, 3 or 11, according to CR/ISO TR 15608).

Aluminium:

Range of materials: aluminium and aluminium alloys.

Materials group: To be selected from groups 21, 22, 24 or sub-group 23.1 [ISO (TR) 15608; Table 2] for the purpose of assessment.

Minimum plate thickness: 1,6mm.

Stainless Steel:

Range of materials: stainless steel and stainless steel alloys.

Materials group: To be selected from groups 21, 22, 24 or sub-group 23.1 [ISO (TR) 15608; for the purpose of assessment.

Minimum plate thickness: 1,6mm.

Observations applicable to the welding process: Heat input, electrode size, joint preparation, welding technique, consumable usage, handling and gas shielding.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
• Safety precautions are complied with in accordance with OHS Act (applicable to the GTAW process) and workshop requirements.	• Comply with all safety precautions according to workshop requirements and OHS Act.
• Welding consumables are selected and used as per requirements for welding carbon steel, aluminium and stainless steel plate	• Select and use welding consumables as per requirements for welding carbon steel, aluminium and stainless steel plate.
• The gas tungsten arc welding (GTAW) process is used in all positions.	• Use the gas tungsten arc welding (GTAW) process in all positions.
• The work-piece material is welded in accordance with work instruction sheet and drawing requirements.	• Weld the work-piece material in accordance with work instruction sheet and drawing requirements.
• Quality checks are applied on process and welded materials.	• Apply quality checks on process.
• The end product is inspected for defects and for conformance to specifications as reflected on drawing or job requirement.	• Inspect welded work-piece for defects (use visual and non-destructive testing), and for conformance to specifications as reflected on drawing or job requirement
• Welding defects are identified and corrective action is taken	• Identify welding defects and take corrective action.

ASSESSMENT TASKS OR ACTIVITIES

Practical project or task

- Lecturer to ensure correct posture, weld-direction, angle of electrode to work-piece, pressures
- Lecturers to ensure that all personal protective equipment (PPE) is correctly and appropriately worn
- Students to use skills, knowledge and safety during cutting
- All welding must take place in a controlled environment and lecturers to ensure quality of cuts.

SUBJECT OUTCOME

3.4 Care for and store welding equipment and consumables

ASSESSMENT STANDARDS	LEARNING OUTCOMES
• Work-pieces/pipes are cleaned after welding as per worksite practices	• Clean work-pieces/pipes after welding.
• Post-cleaning of welded joint is performed.	• Perform post-cleaning of welded joint.
• The proper care and storage of tools, equipment and consumables is explained in accordance with worksite practices.	• Explain the care and storage procedures for tools, equipment and consumables in accordance with worksite practices and specifications.

• Gas tungsten arc welding equipment and consumables are dismantled and stored according to manufacturer's specifications and workshop procedures.	• Dismantle and store the gas tungsten arc welding equipment and consumables in accordance with manufacturer's specifications and requirements.
• The welding equipment, hand tools and consumables, are packed away neatly and safely in accordance with laid down procedures	• Pack away the welding equipment, hand tools and consumables neatly and safely in accordance with laid down procedures.
ASSESSMENT TASKS OR ACTIVITIES	
Students are given a welding task according to the range. • Care and storage of welding equipment is to be assessed by a theory test questionnaire accompanied by an observation checklist contained within the practical welding task project. For the purpose of assessment: • Tools and equipment are stored in conformance with worksite practices • Defective equipment is reported**.**	

Topic 4: Metal inert gas welding (MIG) (carbon steel)

SUBJECT OUTCOME	
4.1 Describe the metal inert gas welding (MIG) process for welding carbon steel in all positions	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Terms and definitions used are consistent with generally accepted welding terminology as recorded in national and international welding standards.	• Use terms and definitions for MIG welding consistently with generally accepted terminology as recorded in national and international welding standards.
• Basic and major components of metal inert gas welding (MIG) equipment are identified and their functions and purpose explained.	• Identify components of MIG equipment used for welding carbon steel and explain their function and purpose.
• Welding characteristics of carbon steel are identified and the implications for unsafe conditions described.	• Identify welding characteristics of carbon steel and describe the implications for unsafe conditions.
• The chemical and mechanical processes that take place during welding are explained.	• Briefly explain the chemical and mechanical processes that take place during welding.
• The gas metal arc welding (MIG) process for carbon steel is explained.	• Explain the gas metal arc welding (MIG) process for carbon steel.
• The various welding parameters are identified in relation to the thickness of materials (steel) being welded.	• Identify the various welding parameters in relation to the thickness of materials (steel) being welded.
• The consequences of misuse and/or mishandling of welding consumables are explained.	• Explain the consequences of misuse and/or mishandling of welding consumables.
• Setting up procedures are demonstrated	• Demonstrate setting up procedures.

ASSESSMENT TASKS OR ACTIVITIES
Questionnaire-based activities related to: • The metal inert gas welding (MIG) process and related equipment. • The metal inert gas welding (MIG) equipment used • The metal inert gas welding (MIG) method and the application of specifications (parent material, gas, and other consumables used). • Application of safety precautions during metal inert gas welding (MIG). • Explaining the heat characteristics of common metals during the metal inert gas welding (MIG) process • Correct use of terminology is assessed. For the practical assessment: • Students must request all the necessary equipment they require to set up the welding equipment correctly, losing marks for any omissions. • Using knowledge and skills acquired, the equipment is set up correctly and checked by the lecturer before any welding operations begin.

SUBJECT OUTCOME	
4.2 Plan and prepare for the welding process	
Range: *Safety legislation as per job requirements.* *Inspection methods: Visual and non-destructive.* *Observations applicable prior to the welding process include heat input range, electrode diameter, filler material, gas composition, gas flow, joint preparation from welding procedure.* *Range of materials: stainless steel and stainless steel alloys.* *Materials group: To be selected from groups 8 or 10 [ISO (TR) 15608] for the purpose of assessment.* *Minimum plate thickness: 1,6mm.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The safety aspects of metal inert gas welding (MIG) in the welding workshop are explained.	• Explain the safety aspects of metal inert gas welding (MIG) in the welding workshop.
• Metal inert gas welding (MIG) equipment is identified and selected as specified in the welding procedure.	• Identify, select and prepare the metal inert gas welding (MIG) equipment for the welding process.
• Work-piece/s is prepared prior to welding as specified on drawing and by standard working practices.	• Inspect and prepare work-piece/s prior to welding as specified on drawing and as required by standard working practices.
• Task dimensions and work-piece alignment are checked as specified on drawing.	• Check task dimensions and work-piece alignment as specified on the drawing.
• The welding environment is prepared.	• Prepare the welding environment.
• Pre-operational checks are carried out in accordance with welding equipment manufacturer's specifications	• Carry out pre-operational checks in accordance with welding equipment manufacturer's specifications.
• Welding hazards are identified and rectified in accordance with standard working practices.	• Identify and rectify welding hazards in accordance with standard working practices.

• The work-piece is tack-welded into position as specified per welding procedure.	• Tack-weld the work-piece into position as specified per welding procedure.
• Safety precautions are adhered to.	• Adhere to safety precautions.

ASSESSMENT TASKS OR ACTIVITIES

Students are given a welding task according to the range

- Planning and preparation is to be assessed by a theory test questionnaire accompanied by an observation checklist contained within a practical project or task
- Before any welding can take place all students must be found competent in this activity
- The metal inert gas welding (MIG) equipment is to be well insulated.
- Safety precautions must be adhered to.
- Inspection of work-piece prior to welding.
- Despite the minimum material thickness as specified, students must display sufficient competency to prepare the groove prior to welding.

SUBJECT OUTCOME

4.3 Weld materials in all positions

Range:

Welding positions include: Fillet welding: Flat/Horizontal, Vertical, Overhead.

Groove welding: Flat/Horizontal, Vertical.

Overhead Welding positions.

Includes destructive test methods.

Range: Defects include excessive slag, spatter and irregular weld finish (bead).

Hazards include fire, electrocution; incorrect set-up procedures, and unsafe use of power tools is explained.

Range of materials: carbon steel

Observations applicable to the welding process: (Information on heat input range, electrode diameter, filler material, gas composition, gas flow, joint preparation from welding procedure): Heat input, metal transfer mode, electrode size, joint preparation, welding technique, consumable usage, handling and gas shielding.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
• Safety precautions applicable to the metal inert gas welding (MIG) process are observed in accordance with OHS Act.	• Adhere to all safety precautions in accordance with workshop requirements and OHS Act.
• Welding consumables are selected and used as per procedure requirements for job	• Select and use welding consumables as per procedure requirements for job.
• Potential causes of welding imperfections and defects are identified and removed or controlled prior to welding and precautions taken as per welding practices.	• Identify and remove or control potential causes of welding imperfections and defects prior to welding and take precautions as per welding practices.
• The work-piece is welded in accordance with work instruction sheet and drawing requirements using the metal inert gas welding (MIG) process in all positions.	• Use the metal inert gas welding (MIG) process in all positions to weld the work-piece in accordance with work instruction sheet and drawing requirements.

• The welded work-piece is inspected to conform to specifications as reflected on drawing or job requirement, and quality checks are applied on the process.	• Inspect welded work-piece for defects (use destructive testing) and apply quality checks on process.
• Welding defects are identified and corrective action is taken.	• Identify welding defects and take corrective action.

ASSESSMENT TASKS OR ACTIVITIES

Practical project or task

- Lecturer to ensure correct posture, weld-direction, angle of electrode to work-piece, pressures.
- Students to use skills, knowledge and safety during cutting.
- Lecturers to ensure that all personal protective equipment (PPE) is correctly and appropriately worn.
- All welding must take place in a controlled environment and lecturers to ensure quality of cuts.
- Welded joints acceptance criteria to be in accordance with a national and/or international welding standard.

SUBJECT OUTCOME

4.4 Care for and store welding equipment and consumables

Range:

Care and storage practices should conform to manufacturer's requirements and be conducive to preventative maintenance schedules.

Defective equipment to be dealt with in accordance to accepted worksite practices.

Consumables and equipment are to be stored in a usable condition for the next user.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
• Work-piece is cleaned after welding as per good worksite practices.	• Perform post-cleaning of welded joint.
• The proper care and storage of tools, equipment and consumables is explained in accordance with worksite practices and specifications.	• Explain the care and storage procedures for tools, equipment and consumables in accordance with worksite practices and specifications.
• Metal inert gas welding (MIG) equipment and consumables are dismantled and stored according to manufacturer’s specifications and requirements.	• Dismantle and store the metal inert gas welding (MIG) equipment and consumables in accordance with manufacturer’s specifications and requirements.
• The welding equipment, hand tools and consumables are packed away neatly and safely in accordance with laid down procedures.	• Pack away the welding equipment, hand tools and consumables neatly and safely in accordance with laid down procedures.

ASSESSMENT TASKS OR ACTIVITIES
• Theory test or questionnaire • Project assignment • Research portfolio • Lecturers to assess students' care and storage of equipment and consumables Or combination of the above

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN WELDING – LEVEL 4

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 integrated 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:

LEVEL 4	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	30%	50%	20%