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1 Introduction

The Metal and Engineering Curriculum Framework has been developed to provide students with the opportunity to gain credit towards the NSW Higher School Certificate and credit towards national vocational qualifications in manufacturing, engineering and related services under the Australian Qualifications Framework. The framework is based on the national Metal and Engineering Training Package (MEM98).

This industry curriculum framework incorporates all Higher School Certificate Metal and Engineering VET courses whether:
- delivered by schools
- delivered by TAFE colleges
- delivered by other Registered Training Organisations on behalf of schools or TAFE colleges.

This document, the Metal and Engineering Curriculum Framework Stage 6 Support Document, contains materials and advice which are intended to assist teachers and trainers in the implementation of courses within the framework and in the assessment of student competency. It must be read in conjunction with Parts A and B of the syllabus.

Part A of the syllabus contains general advice about the Metal and Engineering Curriculum Framework and describes course structures and requirements, including work placement. For HSC accreditation the delivery of all courses in Metal and Engineering must comply with the structures and requirements described in Part A.

Part B of the syllabus contains units of competency from the Metal and Engineering Training Package. Part B must be used in the delivery of all HSC courses in Metal and Engineering.

The documentation for the Metal and Engineering Curriculum Framework also includes a Competency Record for recording assessment activities and student achievement of competency. The use of the Competency Record is recommended but is not mandatory. RTOs may choose to design an alternative form of competency record or use versions produced by industry bodies.

Industry Curriculum Framework Documentation

Support materials for this curriculum framework include this support document and a resource list. The Board has also developed the Stage 6 Industry Curriculum Frameworks Support Document for Students with Special Education Needs.

Parts A and B of the syllabus are available in hard copy from the Board of Studies and may also be accessed on the Board’s website (http://www.boardofstudies.nsw.edu.au). The Competency Record and this support document may be accessed through the website.
2 Teaching Programs

2.1 General Information

Teaching programs for courses in the Metals and Engineering Curriculum Framework can be developed using a number of different approaches.

These include:
- programming individual units of competency sequentially
- identifying a theme which is common to several units of competency and programming teaching and learning activities which address this theme
- devising a project, experience or event which requires students to learn and use a number of competencies
- a combination of any of the above.

Each approach has merit depending on the nature of particular competencies, access to facilities, equipment, resources and work places, and the needs and experience of the student group and individual students.

When considering these approaches, teachers and trainers should keep in mind the following general principles:

- VET courses focus on the achievement of workplace competence. They are intended to equip students with the skills and knowledge required to perform workplace roles to the standard expected in industry. Competence incorporates all aspects of work performance including communication, problem solving and the capacity to apply skills and knowledge in both familiar and new situations as well as industry-specific skills.
- Students must be given the opportunity to develop skills over time and have multiple opportunities to demonstrate that they possess the necessary combination of skills and knowledge.
- Students must have the opportunity to develop and practise skills in a workplace setting.
- Assessment of competence involves the assessment of skills and knowledge combined. An integrated or holistic approach to assessment is encouraged in line with the concept of competence as the integration of a wide range of skills, knowledge and attitudes. An integrated approach to course delivery will facilitate integrated competency assessment.

On the basis of these principles, it is recommended that teachers and trainers develop teaching and learning programs that allow for the integrated development of several elements and/or units of competency simultaneously. Where this is not possible, learning activities developed for individual units of competency should seek to integrate elements within the unit and to address the linkages to other units identified in the training package and in the syllabus.

Where possible, assessment tasks and events should be included as an integral part of training.
2.2 Course Design

When designing courses within the Metal and Engineering Curriculum Framework, teachers and trainers need to ensure that the design of courses satisfies the requirements of both the HSC and the Metal and Engineering Training Package.

Course design must reflect the following HSC requirements

- Units of competency from the HSC Foundation. This foundation provides:
  - MEM1.1FA 2 points and counts as 20 nominal hours
  - MEM1.2FA
  - MEM1.3FA
  - MEM1.4FA
  - MEM2.1C12A

- Elective units of competency totalling (at least) the additional nominal hours or points value for each course
  - 120 hour : 10 points and 100 nominal hours
  - 180 hour : 16 points and 160 nominal hours
  - 240 hour : 22 points and 220 nominal hours

- An appropriate work placement is scheduled that has a duration that meets course requirements
  - 120 hour : 38 hours
  - 180 hour : 53.2 hours (seven 7.6 hour work days)
  - 240 hour : 76 hours

To gain qualifications in Metal and Engineering, persons must be assessed as competent in the appropriate units of competency according to the following requirements.

Certificate 1
- All foundation units of competency MEM1.1FA
  - MEM1.2FA
  - MEM1.3FA
  - MEM1.4FA
- MEM2.1C12A (2 points)
- Additional units of competency to total 16 points

Certificate II
- All foundation units of competency MEM1.1FA
  - MEM1.2FA
  - MEM1.3FA
  - MEM1.4FA
- MEM2.1C12A (2 points)
- Additional units of competency to total 32 points

Teachers and trainers should structure HSC courses to meet HSC requirements and maximise qualification outcomes from the training package. Refer to the Metal and Engineering Training Package for further information.

The Metal and Engineering Curriculum Framework has units of competency organised into functional streams:
- Production
- Fabrication
- Mechanical
- Electrical/Electronic
- Drawing, drafting & design
Courses should be designed with a focus on a single stream to provide students with a vocational outcome and to also maximise articulation into further training. Alternatively, a generic course may be structured, drawing on a range of units of competency from across streams, to provide students with a broad range of entry level skills.

2.3 Sequence of Delivery

The sequencing of a teaching program is a matter of professional judgement based on the existing skills and experience of students, student interest, access to facilities including workplaces and the timing of work placement.

However,
- some units are clearly introductory whereas others clearly depend on existing skills
- some units (eg those concerned with OHS) must be delivered before students undertake work placement
- other units can only be fully developed once a student has experienced a workplace environment.

In developing a program of work for the presentation of the Metals and Engineering Curriculum Framework, teachers need to consider factors such as the availability of specific workshop facilities, the indicative time in which the course is to be conducted and the possible range of units identified.

Following is a suggested selection of units to inform the development of a program.

### FOUNDATION

<table>
<thead>
<tr>
<th>Code</th>
<th>Unit of Competency</th>
<th>Industry Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEM 1.1FA</td>
<td>Undertake interactive workplace communication</td>
<td></td>
</tr>
<tr>
<td>MEM 1.2FA</td>
<td>Apply principles of OHS in work environment</td>
<td></td>
</tr>
<tr>
<td>MEM 1.3FA</td>
<td>Apply quality procedures</td>
<td></td>
</tr>
<tr>
<td>MEM 1.4FA</td>
<td>Plan to undertake a routine task</td>
<td></td>
</tr>
<tr>
<td>MEM2.1C12A</td>
<td>Apply quality systems</td>
<td>2</td>
</tr>
</tbody>
</table>

For 120 hours course add

### SPECIALISATION UNITS

<table>
<thead>
<tr>
<th>Code</th>
<th>Unit of Competency</th>
<th>Industry Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEM2.5C11A</td>
<td>Measure with graduated devices</td>
<td>2</td>
</tr>
<tr>
<td>MEM2.8C10A</td>
<td>Perform computations</td>
<td>2</td>
</tr>
<tr>
<td>MEM9.2AA</td>
<td>Interpret technical drawing</td>
<td>2</td>
</tr>
<tr>
<td>MEM18.1AA</td>
<td>Use hand tools</td>
<td>2</td>
</tr>
<tr>
<td>MEM18.2AA</td>
<td>Use power tools/hand held operations</td>
<td>2</td>
</tr>
</tbody>
</table>

Total 12 units

For 180 hour course add

<table>
<thead>
<tr>
<th>Code</th>
<th>Unit of Competency</th>
<th>Industry Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEM5.12AA</td>
<td>Perform routine manual arc and / or</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>gas metal arc welding</td>
<td></td>
</tr>
<tr>
<td>MEM9.1AA</td>
<td>Draw and interpret sketch</td>
<td>2</td>
</tr>
</tbody>
</table>

Total 18 units
For 240 hour course add
MEM 3.3AA  Sheet and plate assembly 4
   plus 2 units of choice (eg. MEM 5.5AA) 2
       Total 24 units

or
MEM 7.5AA  Perform general machining
   (either subtract 2 non-compulsory units
   from above or study 26 points) 8

or
MEM 18.55AA  Dismantle, replace and assemble
   engineering components 3
   plus a minimum of 3 units of choice 3

2.4 Programming Student Work Placement

When developing programs of work, teachers need to be aware that students are required to complete the Manufacturing and Engineering Industry Induction Training Program satisfactorily before being permitted to participate in work placement.

Further, in cases where students are intending to undertake work placement on a construction site, they must satisfactorily complete a WorkCover NSW – approved Construction Industry OH&S General Induction Training Program prior to work placement. The Board of Studies has developed a program for this purpose which has been approved by Workcover.
2.5 Sample Program of Work

Suggested Time Allowed: 120 hours
It should be noted that teachers may elect to alter the 120 hours suggested and may also find it appropriate to delete or expand suggested learning experiences.

Rationale:
This program introduces the students to a range of workshop practices and experiences typical to the metals and engineering industry. It is based around skills development and provides the opportunity for students to be assessed as being competent through the manufacture of the integrated project, a fabricated vice. This project draws on various elements of competency from a number of units. The program of work is suited to students in the first year of the metals and engineering course.

Students studying only the 120 hour course may substitute one of the following units:
MEM5.12AA Perform routine manual arc and / or gas metal arc welding (4 points) or
MEM2.5C11A Measure with graduated devices (2 points) and
MEM2.8C10A Perform computations (2 points).

Successful completion of this program of work, in conjunction with associated exercises will provide students with the opportunity to demonstrate competency in the units listed.
This program of work also integrates elements of competency from the following units of competency:
MEM9.2AA Interpret technical drawing
MEM7.5AA Perform general machining
MEM3.3AA Sheet and plate assembly

The inclusion of content from these units provides opportunities to record assessment evidence for these elements of competency. Teachers must ensure that all performance criteria and elements of competency, with consideration to the range statement, are addressed in this or subsequent programs of work.

Note: Foundation units (*) are embedded throughout the program and assessed throughout the course.

Unit codes/titles covered in this program of work:
MEM1.2FA Apply principles of OH&S in work environment*
MEM1.3FA Apply quality procedures*
MEM1.4FA Plan to undertake a routine task*
MEM2.1C12A Apply quality systems*
MEM1.1FA Undertake interactive workplace communication*
MEM18.1AA Use hand tools
MEM9.1AA Draw and interpret sketch
MEM18.2AA Use power tools / hand held operations
MEM5.12AA Perform routine manual arc and /or gas metal arc welding

Resources:
This program of work lists a variety of resources, however, this does not preclude teachers from accessing a range of other relevant resources. The resources listed may assist teachers in the delivery of the program.
National / TAFE Modules:

New South Wales TAFE Code 8264K.

New South Wales TAFE Code 88267D.

New South Wales TAFE Code 8264V.

New South Wales TAFE Code 8265H.

New South Wales TAFE Code 7786AL.

New South Wales TAFE Code 7786AM.

National Metal and Engineering Curriculum Module, MEC 076, Engineering Drawing Interpretation 1, Australian Training Products Ltd., Melbourne.
New South Wales TAFE Code 7786AN.

New South Wales TAFE Code 8264J.

New South Wales TAFE Code 8264C.

Texts and Student workbooks:

Moriarty, T, Metal and Engineering: A Practical Introduction, Tasmor Enterprises, Port Macquarie, 1999
ISBN 0 644 25881 0

ISBN: 0 582 42431 3
Videos:


Video Education Australia Pty Ltd, *Hiberna, Building an Oil Rig*, (video, 45 min), Canada, 1995.

Western Sydney Institute of TAFE, Metal Fabrication and Welding Trade, (video, 25 min), Western Sydney Institute of TAFE, 1990.

Software:


Websites:

Blackwoods
http://www.blackwoods.com.au

Manufacturing, Engineering & Related Services - Manufacturing ITAB
http://www.mersitab.com.au

Worksafe Library
http://www.worksafe.gov.au

Australian Training Products Limited
http://www.atpl.net.au
<table>
<thead>
<tr>
<th>Teaching Strategies and Related Resources</th>
<th>Unit/Element of Competency</th>
<th>Possible Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occupational Health and Safety.</strong></td>
<td><strong>MEM1.2FA Apply principles of OH&amp;S in work environment.</strong></td>
<td>Observation of OH&amp;S practices.</td>
</tr>
<tr>
<td><strong>Note:</strong> Principles of OH&amp;S must be applied and assessed in all areas of the course.</td>
<td>1.2F.1 Work is carried out safely and in accordance with company policy and company procedures and legislative requirements. 1.2F.1.2 Housekeeping is undertaken in accordance with company procedures. 1.2F.1.3 Responsibilities and duties of employees are understood and demonstrated in day to day actions. 1.2F.1.4 Personal protective equipment is worn and stored according to company procedures. 1.2F.1.5 All equipment and safety devices are used according to legislative requirements and company/manufacturer's procedures.</td>
<td>Completion of worksheet.</td>
</tr>
<tr>
<td>Students to have an induction to the workshop including: Safety tests Standard operating procedure Risk assessment of equipment and processes used</td>
<td><strong>Resources:</strong> Text: Worksafe News, National Occupational Health and Safety Commission Website: <a href="http://www.worksafe.gov.au">www.worksafe.gov.au</a></td>
<td>OH&amp;S must be a component of all worksheets, practical tests and assignments used in the course.</td>
</tr>
<tr>
<td>Teaching Strategies and Related Resources</td>
<td>Unit/Element of Competency</td>
<td>Possible Student Activities</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Hand Tools:</strong> Demonstrate the correct use, maintenance and storage of: • Marking out tools • Cutting tools • Measuring tools • Dismantling/assembly tools (eg spanners etc) • Gauges • Tool sharpening • Tool selection • Tool restoration • Tool operation • Quality system applied to hand tool use</td>
<td><strong>MEM18.1AA Use Hand Tools.</strong> 18.1A.1.1 Appropriate hand tools selected according to the task requirements. 18.1A.1.2 Hand tools used to produce desired outcomes to job specifications, which may include finish, tension, size or shape. 18.1A.1.3 All safety requirements are adhered to before, during and after use. 18.1A.1.4 Unsafe or faulty tools identified and marked for repair according to designated procedures before, during and after use. 18.1A.1.5 Routine maintenance of tools, including hand sharpening undertaken according to standard operational procedures, principles and techniques. 18.1A.1.6 Hand tools are stored safely in appropriate location according to standard operational procedures and manufacturer’s recommendations.</td>
<td>Manufacture vice components using marking out and hand cutting tools. • Base plate • Side plate • Jaw assembly Knowledge test: Hand tools. Observation of: • Workshop practices • Tool use • Tool storage • Workplace communication • Quality procedures.</td>
</tr>
<tr>
<td>Video: Tools for Metalwork</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students may practise competency in the use of hand tools on vice parts and other suitable tasks other than those set as assessment tasks.
<table>
<thead>
<tr>
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<th>Possible Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text:</strong> Hand and Power Tools</td>
<td>MEM1.3FA Apply Quality Procedures</td>
<td>Measurement exercise. Gauging exercise on radii, squareness</td>
</tr>
<tr>
<td>Hand Tools</td>
<td>1.3F.1.1 Take responsibility for own quality</td>
<td>Tool Sharpening: Centre punch, Screw driver, Twist drill</td>
</tr>
<tr>
<td>Tool Sharpening Using Off-hand Grinding</td>
<td>1.3F.1.2 Interprets taking responsibility for own quality as a practical concept e.g. “right first time”.</td>
<td></td>
</tr>
<tr>
<td>Australian Training Products</td>
<td>1.3F.2 Apply standard procedures of workplace quality to own job.</td>
<td>Tool Restoration: Fit hammer handle, Fit file handle.</td>
</tr>
<tr>
<td>Quality Concepts, TAFE NSW Module</td>
<td>1.3F.2.1 Quality system procedures followed.</td>
<td>Disassemble and/or assemble appropriate mechanical components eg ball valve — Blackwoods p/n 09837119</td>
</tr>
<tr>
<td>Resource Manual</td>
<td>1.3F.2.2 Conformance to specifications ensured.</td>
<td></td>
</tr>
<tr>
<td>Website: <a href="http://www.blackwoods.com.au">www.blackwoods.com.au</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Measurement exercise.**

**Tool Sharpening:**
- Centre punch
- Screw driver
- Twist drill

**Tool Restoration:**
- Fit hammer handle
- Fit file handle.

Disassemble and/or assemble appropriate mechanical components eg ball valve — Blackwoods p/n 09837119
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</thead>
</table>
| Drawing and interpreting sketches:       | MEM9.1AA Draw and interpret sketch | **Drawing** Sketch, dimension and interpretation exercises relating to vice components using basic drawing equipment:  
• Base plate  
• Side plate  
• Jaw assembly  
Drawing exercises to be presented and assessed throughout this program of work. |
| • Freehand sketching                     | 9.1A.1 Prepare freehand sketch.   |
| • Dimensioning technique                 | 9.1A.1.1 Sketches correctly and appropriately drawn. |
| • Drawing interpretation                 | 9.1A.1.2 Sketch depicts object or part. |
| Use vice components as basis for skills  | 9.1A.1.3 Dimensions obtained correctly. |
| development in this unit. Other drawing  | 9.1A.1.4 Dimensions shown clearly.  |
| exercises employed as necessary to meet  | 9.1A.1.5 Instructions shown clearly. |
| competency.                               | 9.1A.1.6 Base line or datum point indicated. |
| **Video**: *Introduction to the Metal Fabrication and Welding Trade*, TAFE NSW, Blacktown | 9.1A.2 Interpret details from freehand sketch.  
9.1A.2.1 Components assemblies or objects recognised as required.  
9.1A.2.2 Dimensions identified as appropriate to field of employment.  
9.1A.2.3 Instructions identified and followed as required.  
9.1A.2.4 Material requirements identified as required.  
9.1A.2.5 Symbols recognised as appropriate in sketch. |
| **Text**: TAFE NSW, *Module Resource Manual, Engineering Drawing Interpretation MEC 076, Metal and Engineering, A Practical Introduction* | | |
| **CD**: *Engineering Drawing Interpretation* – Skilpak | | |
### Power Tools

**Outline**
- Types of power tools:
  - portable (pneumatic), electric/battery electric
  - fixed, drill press, bench grinder
  - selection of power tool for task requirement
  - safety and safe operating procedure, clamping adjustment, OH&S principles, personal protective equipment, hazard management (noise, dust, sparks etc)
  - maintenance, identification of faults, storage

**Resources:**

**Video:** [Personal Protective Equipment](#)
[Safe and Effective Grinding](#)

**Text:** [Hand and Power Tools](#)
[Power Tools MEC073](#)
[Power Tool Manufacturers' Catalogues](#)

### MEM18.2A Use power tools/hand-held operations.

18.2A.1 Use power tools.

18.2A.1.1 Appropriate power tools selected according to the task requirements.

18.2A.1.2 Power tools used following a determined sequence of operations which may include clamping, alignment and adjustment to produce desired outcomes to job specification which may include finish, size and shape.

18.2A.1.3 All safety requirements are adhered to before, during and after use.

18.2A.1.4 Unsafe or faulty tools identified and marked for repair according to designated procedures before, during and after use.

18.2A.1.5 Operational maintenance of tools, including hand sharpening undertaken according to standard operational procedures, principles and techniques.

18.2A.1.6 Power tools are stored safety in appropriate location according to standard operational procedures and manufacturer’s recommendations.

### Possible Student Activities

- Knowledge test: Power tools
- Practical use of:
  - Drill, portable and fixed:
    - Jaw assembly
    - Net
    - Spindle
    - Base plate
  - Grinder, portable and fixed:
    - Base plate
    - Tool sharpening

*Note: To achieve competence in this unit, it may be necessary to incorporate additional exercises to involve the use of other hand-held power tools.*

Observation of practical activities.
<table>
<thead>
<tr>
<th>Teaching Strategies and Related Resources</th>
<th>Unit/Element of Competency</th>
<th>Possible Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning</strong></td>
<td>MEM1.4FA Plan to undertake a routine task.</td>
<td>Produce a flow chart relating to the manufacture of vice components:</td>
</tr>
<tr>
<td>• Operations sheet</td>
<td>1.4F.1 Identify task requirements.</td>
<td>• Base plate</td>
</tr>
<tr>
<td>• Sequence of operations</td>
<td>1.4F.1.1 Instructions as to procedures are obtained, understood and where necessary, clarified.</td>
<td>• Side plate</td>
</tr>
<tr>
<td>• Time limits</td>
<td>1.4F.1.2 Relevant specifications for task outcomes are obtained, understood and where necessary, clarified.</td>
<td>• Jaw assembly</td>
</tr>
<tr>
<td>• Specifications</td>
<td>1.4F1.3 Task outcomes are identified.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.4F1.4 Task requirements such as completion time and quality measures are identified.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>1.4F.2 Plan steps required to complete task.</strong></td>
<td>Produce a tool use list relating to manufacture of vice components:</td>
</tr>
<tr>
<td></td>
<td>1.4F.2.1 Based on instructions and specifications provided, the individual steps or activities required to undertake the task are understood and where necessary, clarified.</td>
<td>• Base plate</td>
</tr>
<tr>
<td></td>
<td>1.4F.2.2 Sequence of activities required to be completed is identified in plan.</td>
<td>• Side plate</td>
</tr>
<tr>
<td></td>
<td>1.4F.2.3 Planned steps and outcomes are checked to ensure conformity with instructions and relevant specifications.</td>
<td>• Jaw assembly</td>
</tr>
</tbody>
</table>

Students assigned to work teams to review and develop workshop procedures in relation to stock control, conversion of material, machine use, storage and SOP etc.

Case study of local engineering/manufacturing enterprise.

**Resources:**

**Video:**
- VEA, Design and Marketing a New Product
- VEA, Hibernia - Building an Oil Rig,
<table>
<thead>
<tr>
<th>Teaching Strategies and Related Resources</th>
<th>Unit/Element of Competency</th>
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</thead>
</table>
| Develop a quality system for the manufacture of the vice, using principles of quality control. Discuss ‘fit for purpose’ as per Australian Standard 1057. Use examples from Australian Industry. Case study of local engineering/manufacturing enterprise in relation to quality system. *Foundation Units should be embedded throughout the program.* | **1.4F.3 Review plan**  
1.4F.3.1 Outcomes are identified and compared with (planned) objectives, task instructions, specifications and task requirements.  
1.4F.3.2 If necessary, plan is revised to better meet objectives and task requirements.  
**MEM2.1C12A Apply quality systems**  
**MEM2.1C12 Understand and follow standard operational or specification requirements.**  
2.1C12.1 Follows instructions/performs duties within a quality improvement system.  
2.1C12.1.3 Defects detected and reported according to standard operating procedures.  
2.1C12.1.4 Performance of operation or quality of product or service to ensure customer satisfaction monitored. | Case study of a local engineering/manufacturing enterprise. |
<table>
<thead>
<tr>
<th>Teaching Strategies and Related Resources</th>
<th>Unit/Element of Competency</th>
<th>Possible Student Activities</th>
</tr>
</thead>
</table>
| **Electric Arc Welding**                | **MEM5.12A A** Perform routine manual arc and or gas metal arc welding. | Theory test:  
  - manual arc and gas metal arc welding safety  
  - welding symbols  
  - welding safety. |
<p>| <strong>Outline</strong>                              | <strong>MEM5.12A.1</strong> Determine weld requirement. | | |
| - Manual metallic arc (mma) and gas metal arc (gma) welding processes | 5.12A.1.1 | | |
| - Principles of operation, basic welding circuit, applications in industry | Weld requirements are determined in accordance with job specifications. | | |
| - Hazard identification and standard operating procedure (SOP) | 5.12A.1.2 | | |
| - Welding symbols (basic) | Location and size of welds are determined in accordance with standard operating procedures and job specifications. | | |
| - Interpret job sheet, identify welding specifications | <strong>MEM9.2A A</strong> Interpret technical drawing. | | |
| - Common electrode types | 9.2A.1.2 | | |
| - Consumable wire and shielding gas | Dimensions identified as appropriate to field of employment. | | |
| - Basic identification of steel (spark test) | 9.2A.1.3 | | |
| <strong>Resources</strong>                            | <strong>MEM5.12A.2</strong> Prepare materials for welding. | | |
| <strong>Video:</strong> <em>Welding Safety</em>, Safetecare, ESAB MIG/MAG Welding | 5.12A.2.1 | | |
| <strong>Text:</strong> <em>Gas Metal Arc Welding of Carbon Steels</em>, Australian Training Products | Material is cleaned and prepared, using appropriate tools and techniques. | | |</p>
<table>
<thead>
<tr>
<th>Teaching Strategies and Related Resources</th>
<th>Unit/Element of Competency</th>
<th>Possible Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Discuss:</strong></td>
<td><strong>MEM5.12A.3 Select welding machine settings, electrodes and/or wire.</strong> 5.12A.3.1 Welding machine settings are correctly set in accordance with established workplace and/or manufacturer's specifications.</td>
<td>Observation and inspection of practical tasks:  - beads on plate (min length 125mm on 6-10mm plate)  - fillet weld (min length 125mm on 6-10mm plate)</td>
</tr>
<tr>
<td>- Selection of available welding setup to suit application.  - Advantages and disadvantages of each.  - Standard operating procedures, safety.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Demonstrate:</strong></td>
<td><strong>MEM5.12A.4 Perform routine welding</strong> 5.12A.4.1 Weld undertaken safely and to prescribed procedures 5.12A.4.2 Welds cleaned in accordance with SOP.</td>
<td></td>
</tr>
<tr>
<td>- Welding machine setup to include amperage/voltage settings, wire speed, gas settings, opening and close down procedure.  - Stress SOP including protection of workmates from welding flash/fumes, etc.  - Material preparation, cleaning, vee preparation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Students to:</strong></td>
<td>Set up welder to prescribed settings.</td>
<td></td>
</tr>
<tr>
<td><strong>Outline</strong></td>
<td><strong>MEM5.12A.3 Select welding machine settings, electrodes and/or wire.</strong> 5.12A.3.1 Welding machine settings are correctly set in accordance with established workplace and/or manufacturer's specifications.</td>
<td></td>
</tr>
<tr>
<td>- Basic weld types: downhand, fillet.  - Basic terms: bead, penetration, arc length, etc.  - Weld inspection (basic): common faults, testing of fillet welds.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Teaching Strategies and Related Resources

<table>
<thead>
<tr>
<th>Possible Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss Use of welding in industry to repair and build up material.</td>
</tr>
<tr>
<td>Skill practice</td>
</tr>
<tr>
<td>- Flat beads on plate (MS)</td>
</tr>
<tr>
<td>- Pad weld material economically</td>
</tr>
<tr>
<td>- Fillet welds</td>
</tr>
<tr>
<td>Students to clean and inspect welds to identify faults.</td>
</tr>
</tbody>
</table>

### Resources:
- Sample welds
- Welding posters

## Unit/Element of Competency

<table>
<thead>
<tr>
<th>MEM9.2AA.2 Select correct technical drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.2A.2.1 Drawing checked and validated against job requirements or equipment</td>
</tr>
<tr>
<td>9.2A.2.2 Drawing version checked and validated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEM2.1C12.2 Engages in quality improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1C12.2.1 Process improvement procedures participated in.</td>
</tr>
<tr>
<td>2.1C12.2.2 Participates in the improvement of internal/external, customer/supplier relationships.</td>
</tr>
</tbody>
</table>

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21
<table>
<thead>
<tr>
<th>Teaching Strategies and Related Resources</th>
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<th>Possible Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sheet and Plate Assembly</strong>&lt;br&gt;Pre-requisite MEM18.1AA, MEM18.2AA&lt;br&gt;&lt;br&gt;<strong>Outline</strong>&lt;br&gt;• Basic skills used to fabricate sheet and plate&lt;br&gt;• Joining methods (seams, fasteners, etc.)&lt;br&gt;&lt;br&gt;<strong>Discuss</strong>&lt;br&gt;• Assembly procedure of vice including the function of individual parts, vice operation, specifications, squareness, clearance and deburring of parts.&lt;br&gt;• Welding distortion – prevention and control.&lt;br&gt;• Tackwelding, welding sequence, pre-setting.&lt;br&gt;• Clamps and jigs.&lt;br&gt;&lt;br&gt;<strong>Demonstrate</strong>&lt;br&gt;• Welding distortion&lt;br&gt;• Welding jigs&lt;br&gt;&lt;br&gt;<strong>Students to:</strong>&lt;br&gt;• Identify advantages of jigs&lt;br&gt;• Work in teams to develop sequence for assembly&lt;br&gt;• Tackweld assemblies&lt;br&gt;</td>
<td>MEM3.3A. A Sheet and Plate Assembly&lt;br&gt;MEM3.3A.1 Read and understand job sheets 3.3A.1.1&lt;br&gt;Job sheets and instructions interpreted and followed&lt;br&gt;MEM3.3A.2 A Select and use sheet and plate assembly equipment 3.3A.2.1&lt;br&gt;Assembly equipment is selected and used in accordance with instructions on job sheet. 3.3A.2.2&lt;br&gt;Equipment is used in a safe manner according to standard operating procedure.&lt;br&gt;MEM3.3A.3 Assembles fabrications 3.3A.3.1&lt;br&gt;Assembly produced following correct sequence of operations</td>
<td>Practical&lt;br&gt;Sheet assembly e.g. Toolbox&lt;br&gt;Knowledge test&lt;br&gt;• Fabrication skills&lt;br&gt;• Joining techniques&lt;br&gt;Sliding Body and Base Assembly to be tack welded</td>
</tr>
<tr>
<td>Teaching Strategies and Related Resources</td>
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</tbody>
</table>
| **Welding**                              | 3.3A.3.3 Assembly tested/checked for compliance with job sheet requirements using standard operating procedures. | Practical Assemblies  
• Sliding body  
• Base assembly |
| • Job assemblies to be fully welded using specified welding process.  
• Job specifications followed re: weld position and type | | |
| **Clean up**                              | 3.3A.4.1 Assemblies/fabrications are handled and stored in a safe manner least likely to cause damage using standard operating procedures. | |
| • Assemblies to be cleaned: all spatter, slag, burrs removed using wire brush, chipping hammer, file or grinder.  
• Welds inspected for compliance | | |
<p>| <strong>Storage</strong>                               | | |
| Vice assembly to be stored prior to final assembly so as to prevent surface rusting. | | |
| <strong>Resources</strong>                             | | |
| Text: <em>Fabrication Techniques</em>, Australian Training Products | | |
| <em>Fabrication Techniques NBB10</em>, TAFE Module Resource Manual | | |</p>
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<tbody>
<tr>
<td><strong>Note:</strong> To complete vice some elementary lathe work operations must be carried out. These may be included in Unit 7.5 A A Perform general machining if selected or attempted as extra.</td>
<td></td>
<td>No formal assessment necessary unless MEM7.5A A Perform general machining attempted.</td>
</tr>
</tbody>
</table>
| **Basic Lathe operations:**  
  - Lathe functions and standard operating procedures  
  - Basic tool geometry (right hand turning)  
  - Basic operations – facing, turning, knurling, drilling  
  - Speed and feed calculations – reading from chart.  |  |  |
| **Students to:**  
  - Demonstrate basic lathe setting up (3 jaw chuck, tool height, speed and feed settings)  
  - Face and machine – spindle end and handle |  |  |
| **Resources:**  
  **Video:** Working with Lathes, Safetycare  
  **Text:** Basic Machining Skills, Australian Training Products |  |  |
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<tbody>
<tr>
<td><strong>Final Assembly</strong></td>
<td>MEM1.1F A Undertake Interactive Workplace Communication.</td>
<td>Drawing interpretation exercise.</td>
</tr>
<tr>
<td>Outline</td>
<td>1.1F.1.1 An appropriate choice of communication techniques, eg telephone, face to face, written report, sketches, etc are used.</td>
<td>Full assembly of vice checked to ensure it is functional as per specification.</td>
</tr>
<tr>
<td></td>
<td>1.1F.1.2 Multiple operations involving topics are communicated.</td>
<td>Observations of quality of workplace communication throughout the program.</td>
</tr>
<tr>
<td></td>
<td>1.1F.1.3 Listening is undertaken without continuous interruptions of the speaker.</td>
<td>Students deliver a report on the production of part of the vice.</td>
</tr>
<tr>
<td></td>
<td>1.1F.1.4 Questions are used to gain extra information.</td>
<td></td>
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<tr>
<td></td>
<td>1.1F.1.5 Correct sources of information are identified.</td>
<td></td>
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<tr>
<td><strong>Workplace communication</strong></td>
<td>All aspects of the program are delivered using elements of workplace communication.</td>
<td></td>
</tr>
<tr>
<td>Outline</td>
<td>• Mission statement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Brain storming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Using a telephone book</td>
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<tr>
<td></td>
<td>• Telephone technique</td>
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<td></td>
<td>• Effective speaking</td>
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<tr>
<td></td>
<td>• Non verbal communication</td>
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</tr>
<tr>
<td></td>
<td>1.1F.1.1 An appropriate choice of communication techniques, eg telephone, face to face, written report, sketches, etc are used.</td>
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<td>1.1F.1.2 Multiple operations involving topics are communicated.</td>
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<td>-------------------------------------------------------------------------------------------</td>
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<td></td>
<td>1.1F.1.6 Information is selected and sequenced appropriately.</td>
<td>Observation of student communication skills in workplace settings continuous throughout the program.</td>
</tr>
<tr>
<td></td>
<td>1.1F.1.7 Verbal and written reporting undertaken where required.</td>
<td></td>
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<tr>
<td></td>
<td>1.1F.1.8 Communication is demonstrated in both familiar and unfamiliar situations and to familiar and unfamiliar individuals and groups.</td>
<td></td>
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<tr>
<td></td>
<td><strong>MEM1.1F.2 Take part in group discussion to achieve appropriate work outcomes</strong></td>
<td></td>
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<tr>
<td></td>
<td>1.1F.2.1 Responses sought and provided to others in the group.</td>
<td></td>
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<tr>
<td></td>
<td>1.1F.2.2 Constructive contributions are made in terms of the production process involved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1F.2.3 Goals and aims are communicated.</td>
<td></td>
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<tr>
<td></td>
<td><strong>1.1F.3. Represents views of group to others</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1F.3.1 Views and opinions of others are understood and reflected accurately</td>
<td></td>
</tr>
</tbody>
</table>
3 Assessment

3.1 Industry Curriculum Frameworks - The Purposes of Assessment

Assessment for Higher School Certificate VET courses within industry curriculum frameworks has two distinct purposes.

a. Assessment for Australian Qualifications Framework (AQF) VET qualifications
   - competency based assessment
   - applies to all courses within frameworks
   - provides industry recognition.

b. Assessment for the Universities Admissions Index (UAI)
   - for 240 hour courses only
   - optional written HSC examination.

3.2 Assessment for AQF Certification

Assessment for AQF Certification
- is competency based
- must be reliable, fair, valid and consistent. Judgements are made on the basis of evidence, which may be in a variety of forms
- must be conducted by qualified assessors and be consistent with Training Package Assessment Guidelines
- assesses students as competent or not yet competent.

An integrated or holistic approach to competency based assessment is encouraged.

The following information (3.2.1 – 3.2.3) is taken from the Metal and Engineering Training Package MEM 98 Policy Document

3.2.1 Guidelines for designing assessment materials

The National Metal and Engineering Competency Standards form a basis for the design of assessment materials. Close attention must be paid to the performance criteria, range of variables and evidence guides. The ’Assessor Guide’ columns provide indications and guidance for assessors on the type of evidence required to be able to make a valid assessment decision. These columns provide the basis for assessors to prepare assessment tools to suit the candidate and the context of the assessment.

Assessors must use methods that enable the gathering of valid, sufficient, accurate, consistent, current and authentic evidence to allow for assessment decisions to be made. The process must also be valid, reliable, flexible, fair and cost effective. These terms will form the basic criteria for quality assurance measures to ensure the design effectiveness of assessment materials used in the industry and are explained below.
valid  The assessment actually assesses what it claims to assess, integrating knowledge and skills with their practical application. Language and literacy requirements during assessment should be no greater than the levels required to demonstrate competency in the unit being assessed.

reliable  The assessment must be able to produce consistent results, no matter who does the assessment or when the assessment is done.

flexible  The assessment should be able to be conducted in a variety of situations. It should allow for diversity in how, where and when competencies have been acquired.

fair  The method chosen must not disadvantage (or advantage) any person, with reasonable adjustments made to assessment procedures and methods for people with special needs. Assessment tasks should be determined with the participation of the person being assessed. See also valid above.

cost effective  The process must be as cost effective as possible in terms of both time and money costs for enterprises and RTOs.

The Manufacturing, Engineering and Related Services (MERS) ITAB will undertake ongoing review and maintenance of these Assessment Guidelines and is committed to ensuring that the assessment process does not place an undue cost burden on the industry and the training system. MERS ITAB will work closely with RTOs to assist in establishing ways of offsetting and minimising the costs of any workplace assessment activity.

The recommended assessment methods encompass a range of techniques, which include, but are not limited to, the use of:

- direct observation of performance
- simulations of workplace activities
- oral questioning
- practical exercises
- projects/assignments
- work portfolios

In the interests of both holistic approaches to assessment and cost-effective practices, assessors are encouraged to develop assessment methods that enable the measurement of a number of related competencies through one assessment process or event. For example, it is likely that all of the Foundation units and most Core units of competency will not require separate assessment or even separate training. It is more likely that both training and assessment for these units will be integrated with one or more Specialisation units.
3.2.2 Guidelines for conducting assessments

Before any assessment takes place at a workplace, employers, employees and any service provider need to establish an assessment process through consultation which meets the needs of the enterprise and is acceptable to all interested parties. Some workplaces use a training committee or a consultative committee for this purpose. When RTOs need to gather assessment evidence from the workplace they should have regard for any enterprise needs, practices and processes.

Assessment procedures must be transparent and address the key assessment principles of being valid, reliable, flexible, fair and cost effective (see above). Assessment should be conducted in a non-threatening atmosphere. The assessor needs to establish rapport with the assessment candidate, and provide timely feedback. The assessment process should foster communication between assessment candidates and assessors, and ensure that:

- the assessment candidate knows and agrees to the assessment procedures before assessment takes place
- assessments take place when the assessment candidate is ready to undertake the assessment. Before undertaking formal assessment tasks, assessment candidates should be encouraged to conduct self-assessment according to the agreed assessment criteria to test their own readiness
- wherever practicable, assessment evidence is gathered on a number of occasions and in a variety of contexts / situations
- during the assessment period, assessors and assessment candidates engage in feedback and discussion, and can seek assistance to have disagreements resolved expeditiously
- records of assessments remain confidential

3.2.3 Sources of information on assessment

MERS ITAB national and state / territory offices as well as the industry parties to MERS ITAB can provide additional information and guidance on assessment issues. Contact details are contained in the National Metal and Engineering Competency Standards Implementation Guide, 1997.

Other sources of information are shown below:

- A Guide to the Competency Standards for Assessment, 1997 ANTA
- Assessment Arrangement in the National Training Framework, 1996 ANTA
- Assessment System Design, 1994 J S McMillan
- Assuring Quality and Choice in National Training, 1997 ANTA
- Competency Standards for Assessment, 1995 ANTA
- Final Report Assessment Research and Development Project, 1996 MERS ITAB
3.3 The HSC Examination

The HSC Examination

• is independent of competency based assessment requirements for AQF qualifications
• is optional for students of Metal and Engineering (240 indicative hours) and intended for Universities Admission Index (UAI) purposes only (240 indicative hour courses in all VET Curriculum Frameworks are currently classified as Category B for the UAI)
• is a two hour written paper.

3.3.1 Internal Examinations

Teachers and trainers should bear in mind that students enrolled in Metal and Engineering (240 indicative hours) may choose to undertake the optional written HSC examination. These students should have the opportunity to practise appropriate written tasks under examination conditions. As far as possible, internal examinations set for this purpose should reflect the specifications and conditions of the HSC examination.
For this reason, it is highly recommended that students sit at least for a trial HSC Examination.

A trial HSC examination is also recommended because of the possible need for teachers to provide the Board of Studies with estimates of student examination performance. This may be required where a student lodges an illness/misadventure appeal relating to the HSC Examination in Metal and Engineering (240 indicative hours).

It should be noted that a trial HSC or other internal examination may also be used as a source of evidence of competency in some units and elements of competency and may therefore contribute to the competency based assessment program.

3.4 Recording Assessment

It is advisable that a competency record be maintained containing information about both units and elements of competency. The Metal and Engineering Competency Record developed by the Board of Studies as part of the syllabus documentation may be used for this purpose. Alternatively, Registered Training Organisations (RTOs) may use records designed by themselves or by industry bodies.

Schools and other RTOs will be required to report to the Office of the Board of Studies on units of competency for which students have been assessed as competent.

A sample record sheet for an individual unit of competency from the Board of Studies Competency Record is shown below.

The Competency Record also contains the following pro formas:
• forms for recording student, school, RTO and work placement employer details
• a summary list of units of competency for each available (or partly available) AQF qualification
• a verification statement
### Competency Record – Sample Unit of Competency Record Sheet

**MEM1.2F A**  
Apply principles of Occupational Health & Safety (OH&S) in work environment

<table>
<thead>
<tr>
<th>Element of Competency</th>
<th>Competent (Assessor Signature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2F.1 Follow safe work practices</td>
<td></td>
</tr>
<tr>
<td>1.2F.2 Report workplace hazards</td>
<td></td>
</tr>
<tr>
<td>1.2F.3 Follow emergency procedures</td>
<td></td>
</tr>
</tbody>
</table>

**VERIFICATION OF ACHIEVEMENT OF UNIT OF COMPETENCY**

I, _________________________, of __________________________  (name of assessor)  (Registered Training Organisation)

 certify that

______________________  (name of student)

 has demonstrated competence in the unit of competency

**MEM1.2F A**  
Apply principles of Occupational Health & Safety (OH&S) in work environment

Signature ______________________ Date ______________________
4 Work Placement

The following principles have been formally endorsed by the Board of Studies for HSC VET courses.

4.1 Principles Underpinning Work Placement in the Higher School Certificate

Preamble

Industry curriculum frameworks have been developed to provide students with the opportunity to gain credit towards the NSW Higher School Certificate and either a national qualification or credit towards a national qualification under the Australian Qualifications Framework.

Industry curriculum frameworks are derived from national training packages. Courses within the framework specify the range of industry-developed units of competency from the relevant training packages that have been identified as being suitable for the purposes of the Higher School Certificate. VET courses in Industry curriculum frameworks are aligned to national vocational qualifications.

Although not all training packages mandate work placement, it is a mandatory HSC requirement of each course within the frameworks. Indicative hours have been assigned to the work placement requirement for each course.

Learning in the workplace serves a number of purposes including enabling students to:

- progress towards the achievement of industry competencies
- develop appropriate attitudes towards work
- learn a range of behaviours appropriate to the industry
- practise skills acquired off the job in a classroom or workshop
- develop additional skills and knowledge, including the Key Competencies.

Under some circumstances, students' part-time work in an appropriate workplace may be used to fulfil work placement requirements. For further details, teachers and principals should consult the Board of Studies' Assessment, Certification and Examination (ACE) Manual or relevant Board of Studies' Official Notices.

The following principles should be read in conjunction with any systems documentation relating to work placement, for example the Industry Curriculum Frameworks Information Package.
Principle 1  
Work placement must have clearly articulated and documented purposes. The structure of the work-based learning experience needs to be planned and developmental.

A range and number of purposes are possible, including, for example:

- learning about a particular industry, workplace culture and career opportunities
- practising skills learnt off the job
- developing new skills
- improving work-related skills
- developing skills including key competencies such as teamwork, using technology, problem-solving
- achieving entry level competencies
- achieving workplace performance of particular competency standards
- assessing in a realistic environment or allowing for holistic assessment
- providing opportunities to build skills in a developmental manner from the simple to the complex
- providing opportunities for the learner to reflect upon the workplace learning experience in the context of an individual's current knowledge and understanding
- encouraging students to undertake further education and training.

Principle 2  
The scheduling of the work placement should reflect student readiness and should complement off-the-job learning programs.

The scheduling of the work placement should take account of:

- whether or not students are workplace ready
- how the timing of the work placement links to overall course planning
- the degree of flexibility available at both the workplace and the school
- how the alignment of both on and off the job competencies can be best achieved.

An individual work placement program focussing on a developmental approach should be negotiated with the workplace supervisor/employer. This approach should focus on students moving from simple to more complex tasks. Dependence on supervision should reduce over time as students move towards greater independence in the workplace. The ultimate goal of a work placement should be competence and autonomy in the range of tasks required for the job being undertaken.
**Principle 3**

**Work placement should be relevant to the VET courses being undertaken.**

The 'real' tasks being undertaken in the workplace should complement the tasks and learning being undertaken by the student in their VET courses at school. Work placement may also provide students with the opportunity of having learning outcomes/units of competency assessed in the workplace by accredited trainers and assessors.

**Principle 4**

**Work placement can provide opportunities for work-based assessment.**

Not all industry curriculum frameworks specify that it is mandatory for competencies to be assessed in the workplace. Assessment events should relate to overall course planning and the purposes of the work placement. In a competency-based course, assessment of competencies is criterion-referenced. This means that a participant's performance is judged against a prescribed standard - not against the performance of other participants.

The purpose of assessment is to judge competence on the basis of performance against the performance criteria set out under each element of competency. A participant is judged to be either **competent** or **not yet competent**.

Competency based assessment is based on the requirements of the workplace. Competence incorporates all aspects of work performance, including problem-solving and the capacity to apply skills and knowledge in both familiar and new situations. Assessment of competence involves the assessment of skills and knowledge combined.

Assessors should adopt an **integrated** or **holistic** approach to assessment. This means that a number of elements of competency or even several units of competency are assessed together. This method of assessment is encouraged, in line with the concept of competence as the integration of a wide range of skills, knowledge and attitudes.