

2018–19 Case for Change

Manufacturing and Engineering Industry Reference Committee (IRC)

MEM Manufacturing and Engineering Training Package

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Welding, Technician and Trainer/Supervisor/Coordinator Skills

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- Description: This project covers three key skill areas important to the manufacturing and engineering industries:
- **Welding skills:** The updating of units of competency, restructuring of qualifications and development of new training components to meet changes in welding standards, techniques, processes and procedures. This includes:
 - Development of new qualifications to meet the emerging needs of Welding Supervisor and Welding Inspection occupations in relation to international welding standards and weld procedure development
 - Restructuring the hierarchy of welding units of competency and qualifications leading to the higher-level welding processes and standards associated with advanced and coded welding standards
 - Updating units of competency and qualifications to ensure adequacy in meeting the needs of new welding applications such as continuous ship building, submarine manufacture and related heavy engineering applications, including infrastructure and renewable energy.
 - **Technician skills:** The updating of training components to meet emerging skills needs.
 - **Stage 1** Consult industry stakeholders to identify potential gaps in training product content associated with emerging and converging technologies and advanced manufacturing processes and systems in technician and para-professional roles.
 - **Stage 2** Review and where necessary update units of competency and/or development of new training products that reflect skills requirements identified in Stage 1. Particular consideration to be given to the potential inclusion of an advanced manufacturing stream in an existing qualification or development of new training products that reflect emerging technologies and associated requirements (such as those associated with Industry 4.0).
 - **Trainer/Supervisor/Coordinator skills:** The development of post-trade training components to meet the needs of higher level job roles with training, supervisory or coordination responsibilities.
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Welding, Technician and Trainer/Supervisor/Coordinator Skills

Rationale: Two key drivers of industry growth and change underpin this work:

- key **Government initiatives**, such as the new Australian Defence Force projects, which will have particular impact on Australia's shipbuilding and military vehicle manufacturing sectors, but also many implications for the broader manufacturing and engineering industries.
- **technology trends** around automation and digitisation (including those incorporated under Industry 4.0), use of advanced materials, and augmented and virtual reality, which are creating new ways of working and new business opportunities and models, as well as providing industry with opportunities to increase efficiency and productivity.

Changing work and career values are also posing a challenge for the industry, in terms of attracting new, highly capable entrants to the industry and ensuring an ongoing supply of skills in an ageing workforce. Highlighting the new opportunities arising from changing technology and industry practices, and ensuring training products keep pace with these changes, will assist in attracting new entrants to the manufacturing and engineering sector and in upskilling existing workers in the sector.

At the same time, the accelerating adoption of new technologies and convergence of technologies and practices from different sectors are driving a need for a new cross-disciplinary combination of skills.

In addition to these sector-wide drivers, there are a number of more specific drivers of the individual components of this work, each of which has been discussed in the Industry Skills Forecast.

Key drivers for welding skills:

- Defence Industry projects
- Welding skills shortages
- New welding processes and international standards, which are not yet addressed in current training products.

Key drivers for technician skills:

- Technology changes, which are requiring more advanced skills for operation and maintenance
- Emerging job roles requiring more advanced or new combinations of skills.

Key drivers for trainer/supervisor/coordinator skills.

- Gaps in training products associated with supervisory or training classifications and roles within the manufacturing and engineering sector
- No defined skill pathways for specific job roles with training, supervisory or coordination responsibilities.

The risks of not proceeding with this work include:

- Ongoing and increasing skill shortages in welding occupations
- A lack of supply of skills to meet the needs of Defence Industry projects
- Inability of businesses employing workers in manufacturing and engineering occupations to keep pace with changing technology and practices and remain competitive within national and global markets
- Increasing levels of training being conducted by equipment manufacturers without the underpinning broad skills and knowledge that is developed by the VET system. This will result in a narrowing of the sector's skills base and a lack of portability and transferability of skills for individuals.

All of these risks are highly significant in terms of both likelihood and impact, and when combined with evidence of skill shortages that are already occurring, highlight the time-critical nature of this work.

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Ministers' Priorities Addressed:	<p>This case for change addresses the following Ministers' Priorities:</p> <p>Obsolete qualifications removed from the system</p> <p>The proposed work will review existing qualifications and units of competency, which is expected to result in streamlining and rationalising of MEM Manufacturing and Engineering Training Package products.</p> <p>More information about industry's expectations of training delivery is available to training providers to improve their delivery and to consumers to enable more informed choices</p> <p>Updates to the Companion Volume after this work will provide training providers with clarity on vocational outcomes and pathways, and discussions with industry will provide the opportunity to promote vocational pathways.</p> <p>The training system better supports individuals to move more easily between related occupations</p> <p>Each of the skill areas covered by this work – welding skills, technician skills and trainer/supervisor/coordinator skills – are in demand across a range of industry sectors (not just in the manufacturing industry). Therefore, enhancement of skills in these areas will have a flow-on effect to the mobility, portability and transferability of skills within and across sectors.</p> <p>Improved efficiency of the training system through units that can be owned and used by multiple industry sectors</p> <p>Units of competency from the MEM Manufacturing and Engineering Training Package are frequently imported into other training packages due to their focus on key work roles that are undertaken across a range of industry sectors. For example, a search on a sample of 49 units of competency across the 7 nominated qualifications identified that these units are included in numerous qualifications and skills sets across 36 training packages, including the Agriculture, Horticulture and Conservation and Land Management, Creative Arts and Culture, Health, and Transport and Logistics Training Packages. Updating of these units to reflect changed technology and work practices is also likely to increase their relevance and value to other industry sectors. Any new units developed as part of this work are also highly likely to meet this priority.</p> <p>Foster greater recognition of skill sets</p> <p>Skill sets will be considered as part of this work, particularly in the areas of trainer/supervisor/coordinator skills, as they may provide a means of upskilling existing qualified workers.</p>
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Welding, Technician and Trainer/Supervisor/Coordinator Skills

Consultation Plan: IBSA Manufacturing Training Development Projects follow the Training Package Development and Endorsement Process Policy and use a five-phase methodology. An IBSA Industry Manager will coordinate the project and work with the IRC.

Phase 1 – Initial research and analysis

Establishment of three Technical Advisory Committees (TACs) to validate the project scope and plan, to contribute to further industry assessment and to assist in determining industry needs and job role functional analysis.

The IRC will appoint the Technical Advisory Committees to inform this work and ensure that membership covers the technical skills and knowledge of the broad range of job roles covered by each component of this project. Industry and member associations, licensing and regulatory authorities will be included.

Proposed membership of the Welding Skills TAC will include representatives from:

- Welding Technology Institute of Australia
- Australian Industry Group
- Australian Manufacturing Workers Union
- Australian Institute for Non-Destructive Testing (AINDT)
- One or more welding practitioners
- One or more technical experts from organisations involved with the Defence Industry Projects (e.g. Naval Group, BAE Systems).

Proposed membership of the Technician Skills TAC will include representatives from:

- Australian Industry Group
- Australian Manufacturing Workers Union
- Advanced Manufacturing Growth Centre
- Specialist expertise will be sought/brought in where required.

Proposed membership of the Trainer/Supervisor/Coordinator Skills TAC will include representatives from:

- Australian Industry Group
- Australian Manufacturing Workers Union
- Specialist expertise will be sought/brought in where required.

Phase 2 – Draft 1 and public consultation

Develop first draft of training package components for feedback from the TAC and then the broader manufacturing and engineering industry and RTOs.

Phase 3 – Draft 2 and public consultation

Respond to feedback and develop second draft of training package components. Feedback to be sought from the broader manufacturing and engineering industry and RTOs.

Phase 4 – Approval process

Adjust training package components in response to further feedback and seek approval from respective committees, namely the TAC and IRC and consultation with state training authorities.

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Phase 5 – Submission to Department

Submit to the Department of Education and Training for AISC approval.

Consultation Plan

IBSA will create a project web page to provide project updates, gather feedback from stakeholders and validate training package components.

Proposed consultations include:

- Industry representatives and employers to identify the industry and job requirements and trends and work opportunities, including:
 - Members of Australian Industry Group, Australian Manufacturing Workers Union, and Advanced Manufacturing Growth Centre
 - Welding Technology Institute of Australia and welding inspectors/supervisors
 - Department of Defence
 - Australian Institute for Non-Destructive Testing (AINDT)
 - Employers and contractors such as BAE Systems, Naval Group, Austral, and Thales.
- RTOs with these qualifications on scope and recent or current students, if accessible, to gain feedback on the qualifications and employment outcomes, including:
 - The Victorian VET Engineering Senate, which comprises both public and private providers
 - Public providers such as NSW TAFE, QLD TAFE, TasTAFE, TAFE SA and the TAFE division of Charles Darwin University in the Northern Territory, which also has regional reach
 - A number of private providers such as Hunter Valley Training and Hunter Trade College, ATEC in Adelaide
 - State industry advisory bodies that have contact with relevant industry stakeholders and both public and private providers
 - State training authorities to ensure all jurisdictions are engaged.

Scope of Project

Timing	<p>Estimated Project Duration: 12–18 months</p> <p>Anticipated Start Date: September 2018</p> <p>Anticipated Completion Date: Case for Endorsement to be submitted to the Department between September 2019 and March 2020</p>
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Training Package	<p>Training Package to be developed/revised:</p> <p>MEM Manufacturing and Engineering Training Package</p>
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Welding, Technician and Trainer/Supervisor/Coordinator Skills

Qualifications	<p>7 existing qualifications to be redeveloped and updated:</p> <p>Welding / Technicians</p> <ul style="list-style-type: none"> • MEM30305 Certificate III in Engineering – Fabrication Trade • MEM30505 Certificate III in Engineering – Technical • MEM40105 Certificate IV in Engineering • MEM50212 Diploma of Engineering – Technical • MEM50105 Diploma of Engineering – Advanced Trade • MEM60112 Advanced Diploma of Engineering • MEM80112 Graduate Diploma of Engineering. <p>Subject to the analysis of contemporary and emerging work practices undertaken in Phase 1 of the project, this work may result in the development of:</p> <ul style="list-style-type: none"> • a new qualification in welding supervision and inspection • new qualifications or new streams within existing technician qualification • a new qualification for trainer/supervisor/coordinator skills.
Skill Sets	<p>Subject to the analysis of contemporary and emerging work practices undertaken in Phase 1 of the project, this work may result in the development of:</p> <ul style="list-style-type: none"> • a new skill set for trainer/supervisor/coordinator skills • one or more new skill sets for technician skills.
Units of Competency	<p>233 existing units of competency (as listed below) have been identified as relevant to welding and technician job roles and will be reviewed as part of this project.</p> <p>Subject to the analysis of contemporary and emerging work practices undertaken in Phase 1 of the project, this work may result in the redevelopment of a portion of these units and the development of a number of new units of competency to meet any skills gaps. Obsolete units will be deleted.</p> <ul style="list-style-type: none"> • MEM04020 Supervise individual ferrous melting and casting operation • MEM04021 Supervise individual non-ferrous melting and casting operation • MEM05001 Perform manual soldering/desoldering – electrical/electronic components • MEM05002 Perform high reliability soldering and desoldering • MEM05004 Perform routine oxy fuel gas welding • MEM05005 Carry out mechanical cutting • MEM05007 Perform manual heating and thermal cutting • MEM05011 Assemble fabricated components • MEM05012 Perform routine manual metal arc welding • MEM05013 Perform manual production welding

Welding, Technician and Trainer/Supervisor/Coordinator Skills

- MEM05014 Monitor quality of production welding/fabrications
- MEM05015 Weld using manual metal arc welding process
- MEM05016 Perform advanced welding using manual metal arc welding process
- MEM05017 Weld using gas metal arc welding process
- MEM05018 Perform advanced welding using gas metal arc welding process
- MEM05019 Weld using gas tungsten arc welding process
- MEM05020 Perform advanced welding using gas tungsten arc welding process
- MEM05022 Perform advanced welding using oxy acetylene welding process
- MEM05023 Weld using submerged arc welding process
- MEM05024 Perform welding supervision
- MEM05025 Perform welding/fabrication inspection
- MEM05026 Apply welding principles
- MEM05041 Weld using flame powder spraying
- MEM05042 Perform welds to code standards using flux core arc welding process
- MEM05043 Perform welds to code standards using gas metal arc welding process
- MEM05044 Perform welds to code standards using gas tungsten arc welding process
- MEM05045 Perform pipe welds to code standards using manual metal arc welding process
- MEM05046 Perform welds to code standards using manual metal arc welding process
- MEM05047 Weld using flux core arc welding process
- MEM05048 Perform advanced welding using flux core arc welding process
- MEM05049 Perform routine gas tungsten arc welding
- MEM05050 Perform routine gas metal arc welding
- MEM05051 Select welding processes
- MEM05052 Apply safe welding practices
- MEM05053 Set and edit computer controlled thermal cutting machines
- MEM05054 Write basic NC/CNC programs for thermal cutting machines
- MEM05055 Weld using oxy fuel gas welding process
- MEM05056 Perform routine flux core arc welding
- MEM05057 Perform routine submerged arc welding
- MEM05058 Perform welds to code standards using oxy fuel gas welding process
- MEM09155 Prepare mechanical models for computer-aided engineering (CAE)
- MEM09156 Prepare mechatronic models for computer-aided engineering (CAE)
- MEM09157 Perform mechanical engineering design drafting

Welding, Technician and Trainer/Supervisor/Coordinator Skills

- MEM09158 Perform mechatronics engineering design drafting
- MEM09202 Produce freehand sketches
- MEM09203 Measure and sketch site information
- MEM09204 Produce basic engineering detail drawings
- MEM09205 Produce electrical schematic drawings
- MEM09206 Produce drawings for mechanical services
- MEM09207 Produce drawings for reticulated services
- MEM09208 Detail fasteners and locking devices in mechanical drawings
- MEM09209 Detail bearings, seals and other componentry in mechanical drawings
- MEM09210 Create 3-D solid models using computer-aided design (CAD) system
- MEM09211 Produce drawings or models for industrial piping
- MEM09212 Produce detailed drawings of steel to non-steel connections
- MEM09213 Produce schematic drawings for hydraulic and pneumatic fluid power systems
- MEM09214 Perform advanced engineering detail drafting
- MEM09215 Supervise detail drafting projects
- MEM09216 Interpret and produce curved 3-D shapes and patterns
- MEM09217 Prepare plans for pipe and duct fabrication
- MEM09218 Participate in drafting projects for building services
- MEM09219 Prepare drawings for fabricated sheet metal products
- MEM09220 Apply surface modelling techniques to 3-D drawings
- MEM09221 Create 3-D model assemblies using computer-aided design (CAD) system
- MEM09222 Interpret and maintain or restore original drawings
- MEM09223 Interpret architectural and engineering design specifications for structural steel detailing
- MEM09224 Detail bolts and welds for structural steelwork connections
- MEM09225 Detail standardised structural connections
- MEM09226 Detail structural steel members
- MEM09227 Incorporate structural steel detailing into fabrication and construction project management
- MEM09228 Detail ancillary steelwork
- MEM13010 Supervise occupational health and safety in an industrial work environment
- MEM14001 Schedule material deliveries
- MEM14002 Undertake basic process planning
- MEM14003 Undertake basic production scheduling
- MEM14085 Apply mechanical engineering analysis techniques

Welding, Technician and Trainer/Supervisor/Coordinator Skills

- MEM14086 Apply mechatronic engineering analysis techniques
 - MEM14087 Apply manufactured product design techniques
 - MEM14088 Apply maintenance engineering techniques to equipment and component repairs and modifications
 - MEM14089 Integrate mechanical fundamentals into an engineering task
 - MEM14090 Integrate mechatronic fundamentals into an engineering task
 - MEM14091 Integrate manufacturing fundamentals into an engineering task
 - MEM14092 Integrate maintenance fundamentals into an engineering task
 - MEM15007 Conduct product and/or process capability studies
 - MEM15008 Perform advanced statistical quality control
 - MEM15010 Perform laboratory procedures
 - MEM15011 Exercise external quality assurance
 - MEM15012 Maintain/supervise the application of quality procedures
 - MEM22001 Perform engineering activities
 - MEM22002 Manage self in an engineering environment
 - MEM22007 Manage environmental effects of engineering activities
 - MEM22012 Coordinate resources for an engineering project or operation
 - MEM22013 Coordinate engineering projects
 - MEM22014 Coordinate engineering-related manufacturing operations
 - MEM22015 Source and estimate engineering materials requirements
 - MEM22017 Coordinate continuous improvement and technical development
 - MEM22018 Coordinate sales and promotion of engineering-related products or services
 - MEM23003 Operate and program computers and/or controllers in engineering situations
 - MEM23004 Apply technical mathematics
 - MEM23005 Apply statistics and probability techniques to engineering tasks
 - MEM23006 Apply fluid and thermodynamics principles in engineering
 - MEM23007 Apply calculus to engineering tasks
 - MEM23008 Apply advanced algebra and numerical methods to engineering tasks
 - MEM23063 Select and test mechanical engineering materials
 - MEM23064 Select and test mechatronic engineering materials
 - MEM23109 Apply engineering mechanic principles
 - MEM23111 Select electrical equipment and components for engineering applications
 - MEM23112 Investigate electric and electronic controllers in engineering applications
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Welding, Technician and Trainer/Supervisor/Coordinator Skills

- MEM23113 Evaluate hydrodynamic systems and system components
- MEM23114 Evaluate thermodynamic systems and components
- MEM23115 Evaluate fluid power systems
- MEM23116 Evaluate programmable logic controller and related control system component applications
- MEM23117 Evaluate microcontroller applications
- MEM23118 Apply production and service control techniques
- MEM23119 Evaluate continuous improvement processes
- MEM23120 Select mechanical machine and equipment components
- MEM23121 Analyse loads on frames and mechanisms
- MEM23122 Evaluate computer integrated manufacturing systems
- MEM23123 Evaluate manufacturing processes
- MEM23124 Measure and analyse noise and vibration
- MEM23125 Evaluate maintenance systems
- MEM23126 Evaluate industrial robotic applications
- MEM23129 Evaluate thermal loads in heating, ventilation, air conditioning and refrigeration
- MEM23130 Coordinate servicing and fault finding of HVAC/R control systems
- MEM23131 Evaluate rapid prototyping applications
- MEM23132 Evaluate rapid manufacturing processes
- MEM23133 Evaluate rapid tooling applications
- MEM23134 Evaluate jigs and fixtures
- MEM23135 Evaluate moulding tools and processes
- MEM23136 Evaluate stamping and forging tools
- MEM23137 Evaluate rolling tools and processes
- MEM23138 Evaluate suitability of materials for engineering related applications
- MEM23139 Design a basic single zone duct distribution system
- MEM23140 Determine operational parameters for building HVAC/R hydronic systems
- MEM23141 Complete a building thermal performance survey
- MEM23142 Determine psychrometric processes and system performance
- MEM23143 Apply energy management principles
- MEM23144 Contribute to the design of a commercial refrigeration system
- MEM23145 Apply codes and regulations to air conditioning designs
- MEM23146 Contribute to the design of industrial refrigeration systems
- MEM23147 Contribute to the design of hydronic systems

Welding, Technician and Trainer/Supervisor/Coordinator Skills

- MEM23148 Develop energy management solutions
- MEM23149 Contribute to the design of commercial and industrial exhaust systems
- MEM23150 Contribute to the design of heating systems
- MEM23151 Commission and optimise performance of HVAC/R systems
- MEM23152 Apply principles of refrigeration food storage technology
- MEM23153 Contribute to the design of heat exchanger systems
- MEM23154 Analyse and service HVAC/R control systems
- MEM234001 Plan and manage engineering-related projects or operations
- MEM234002 Integrate engineering technologies
- MEM234003 Design machines and ancillary equipment
- MEM234004 Design for engineering-related noise and vibration mitigation
- MEM234005 Design hydrodynamic pumping systems
- MEM234006 Evaluate and select thermodynamic systems or sub-systems
- MEM234007 Design fluid power systems
- MEM234008 Design plant using computer simulations
- MEM234009 Design computer-integrated manufacturing systems
- MEM234010 Design microcontroller applications
- MEM234011 Design programmable logic controller applications
- MEM234012 Design integrated maintenance management systems
- MEM234013 Plan and design engineering-related manufacturing processes
- MEM234014 Design a robotic system
- MEM234015 Design hydronic heat exchanger systems
- MEM234016 Design refrigeration systems
- MEM234017 Design exhaust, ventilation and dust collection systems
- MEM234018 Design heating, ventilation, air conditioning and refrigeration control systems
- MEM234019 Apply finite element analysis in engineering design
- MEM234020 Coordinate small lot manufacture using rapid manufacture processes
- MEM234021 Apply statistics to technology problems
- MEM234022 Apply advanced calculus to technology problems
- MEM234023 Apply differential equations to technology problems
- MEM234024 Apply advanced mathematics in technology problems
- MEM234025 Apply numerical methods to technology problems
- MEM234026 Develop and coordinate engineering-related contingency plans

Welding, Technician and Trainer/Supervisor/Coordinator Skills

- MEM234027 Plan and manage materials supply for an engineering project or manufacturing operation
- MEM234028 Produce and manage technical documentation
- MEM234029 Produce and manage technical publications
- MEM234030 Provide specialised technical and engineering guidance to other technical employees
- MEM234031 Manage installation, commissioning or modification of machines and equipment
- MEM234032 Manage fluid power related technologies in an enterprise
- MEM234033 Lead engineering-related quality operations in an enterprise
- MEM234034 Manage heating, ventilation, air conditioning and refrigeration systems or projects
- MEM234035 Maintain and apply technical and engineering skills
- MEM24001 Perform basic penetrant testing
- MEM24002 Perform penetrant testing
- MEM24003 Perform basic magnetic particle testing
- MEM24004 Perform magnetic particle testing
- MEM24005 Perform basic eddy current testing
- MEM24006 Perform eddy current testing
- MEM24007 Perform ultrasonic thickness testing
- MEM24008 Perform ultrasonic testing
- MEM24009 Perform basic radiographic testing
- MEM24010 Perform radiographic testing
- MEM24011 Establish non-destructive tests
- MEM24012 Apply metallurgy principles
- MEM30005 Calculate force systems within simple beam structures
- MEM30006 Calculate stresses in simple structures
- MEM30007 Select common engineering materials
- MEM30008 Apply basic economic and ergonomic concepts to evaluate engineering applications
- MEM30009 Contribute to the design of basic mechanical systems
- MEM30010 Set up basic hydraulic circuits
- MEM30011 Set up basic pneumatic circuits
- MEM30012 Apply mathematical techniques in a manufacturing, engineering or related environment
- MEM30013 Assist in the preparation of a basic workplace layout
- MEM30014 Apply basic just in time systems to the reduction of waste
- MEM30015 Develop recommendations for basic set up time improvements
- MEM30016 Assist in the analysis of a supply chain

Welding, Technician and Trainer/Supervisor/Coordinator Skills

- MEM30017 Use basic preventative maintenance techniques and tools
 - MEM30018 Undertake basic process planning
 - MEM30019 Use resource planning software systems in manufacturing
 - MEM30020 Develop and manage a plan for a simple manufacturing related project
 - MEM30021 Prepare a simple production schedule
 - MEM30022 Undertake supervised procurement activities
 - MEM30023 Prepare a simple cost estimate for a manufactured product
 - MEM30024 Participate in quality assurance techniques
 - MEM30025 Analyse a simple electrical system circuit
 - MEM30026 Select and test components for simple electronic switching and timing circuits
 - MEM30027 Prepare basic programs for programmable logic controllers
 - MEM30028 Assist in sales of technical products/systems
 - MEM30029 Use workshop equipment and processes to complete an engineering project
 - MEM30031 Operate computer-aided design (CAD) system to produce basic drawing elements
 - MEM30032 Produce basic engineering drawings
 - MEM30033 Use computer-aided design (CAD) system to create and display 3-D models
 - MEM48001 Test the mechanical properties of materials
 - MEM48002 Monitor ferrous melting and casting processes
 - MEM48003 Monitor basic non-ferrous melting and casting processes
 - MEM48004 Interpret basic binary phase diagrams
 - MEM48005 Demonstrate basic knowledge of casting operations
 - MEM48011 Apply basic chemistry principles to metallurgy
 - MEM48012 Calculate and predict chemical outcomes in metallurgical situations
 - MEM48015 Select metal forming process
 - MEM48016 Select metal joining process
 - MEM48020 Recommend ferrous and non-ferrous metals or alloys for an application
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