



Australian Government

MEM48010 Determine and supervise heat treatment of metal

Release: 1

MEM48010 Determine and supervise heat treatment of metal

Modification History

Release 1. Supersedes and is equivalent to MSATCM405A Determine and supervise heat treatment of metal.

Application

This unit of competency defines the knowledge and skills required to apply metallurgical principles and techniques to determine and supervise the heat treatment of metal.

It requires application of metallurgical scientific principles and techniques as a member of a design and development team or similar in support of enhancing properties of metals through heat treatment.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

MEM06003 Carry out heat treatment

MEM11011 Undertake manual handling

MEM13015 Work safely and effectively in manufacturing and engineering

MEM16006 Organise and communicate information

MEM48004 Interpret basic binary phase diagrams

Competency Field

Metallurgy

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Determine job requirements	1.1 Follow standard operating procedures (SOPs) 1.2 Comply with work health and safety (WHS) requirements at all times 1.3 Use appropriate personal protective equipment (PPE) in accordance with SOPs 1.4 Determine heat treatment application requirements through review

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	of information sources and consultations and briefings with relevant personnel
2. Determine heat treatment of metals to suit application requirements	2.1 Select the relevant scientific techniques and principles of heat treatment and associated software and hardware technologies 2.2 Use calculations and coherent units in the solution of engineering calculations 2.3 Use significant figures appropriate to the process, data and results in engineering calculations 2.4 Determine heat treatment requirements
3. Supervise heat treatment of metal	3.1 Communicate heat treatment parameters to appropriate personnel 3.2 Determine and implement safety procedures appropriate to heat treatment process and item to be treated 3.3 Supervise heat treatment techniques and use of associated software and hardware technologies to ensure required heat treatment solutions is achieved 3.4 Evaluate heat treatment process and advise on defects

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Sources of information include one or more of the following:	• reference texts • manufacturers' catalogues and industrial magazines • websites • phone information gathering
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	• email information gathering.
Scientific techniques and principles of heat treatment relate to one or more of the following:	• ferrous heat treatment • iron-carbon equilibrium and plain carbon steels • iron-carbon phase equilibrium • austenite-ferrite transformation • austenite-pearlite steels • influence of grain size and carbide distribution on mechanical properties • microstructure and properties of slowly cooled steels • effect of temperature and composition on structure and properties • effects of alloying elements in iron-carbon alloys • gamma and sigma phase fields • distribution of alloying elements in steel • effects of alloying elements in the kinetics of gamma and sigma transformations • structural changes resulting from alloying additions • transformation diagrams for alloy steels • isothermal transformation of austenite • austenite grain size • formation of pearlite and bainite • role of alloying elements • mechanical properties of pearlite and bainite • temperature time transformation (TTT) diagrams • quenching treatments • formation of martensite • morphology and crystallography of ferrous martensites • mechanical properties of martensites • retained austenite • quenching media including stages of quenching and effect of variables • thermal and transformation stresses and quenching defects • transformation of austenite continuous cooling • cooling curves • continuous cooling transformation (CCT) diagrams • hardening and heat treatment • factors affecting how well a metal responds to hardening processes • hardenability testing • tempering and tempering of irons, steels, nonferrous metals and alloys • mechanical properties of tempered irons, steels, nonferrous metals and alloys.

Special heat treatments include one or more of the following:	• austempering • martempering (marquenching) • maraging steels • high-strength low-alloy (HSLA) steels • surface treatments • carburising • carbonitriding • nitriding • induction and flame hardening • other methods • heat treatment defects • nature and prevention of defects • surface • structural and property • stress-related • dimensional • embrittlement.
Nonferrous heat treatments include one or more of the following:	• aluminium alloys: • solution treatments • quenching • precipitation hardening • coldworking • temper designations • copper alloys: • solution annealing • age hardening • precipitation hardening • coldworking • quenching and tempering • miscellaneous nonferrous.
Risks and safety procedures include one or more of the following:	• biological factors in quench tank fluids • carcinogenic oil fumes • flash point of oils and risk of fire in oil quenching • inert atmospheres and their potential to cause asphyxiation • specification and use of personal protective equipment (PPE) • location of emergency switches • tagging and isolation procedures • atmosphere control • identification of high-risk alloys and metals • appropriate transfer times to quench and from quench to temper furnace.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MSATCM405A Determine and supervise heat treatment of metal.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM48010 Determine and supervise heat treatment of metal

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include:

- following work instructions, standard operating procedures (SOPs) and safe work practices
- selecting appropriate scientific principles to suit specific heat treatment applications
- selecting appropriate techniques and associated software and hardware technologies to suit specific applications in heat treatment on at least two occasions
- applying and manipulating appropriate formulas for heat treatment applications involving engineering calculations
- applying appropriate calculations to engineering situations
- referring solutions to the original aim of the application
- quoting solutions for the application in appropriate units using appropriate significant figures
- quoting limitations of solutions for the application due to assumptions, scientific principles and techniques used
- presenting solutions for the application on at least two occasions, referring to the original aim of the application including elimination or containment of risks and establishing of safety procedures.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- safe work practices and procedures and use of personal protective equipment (PPE)
- scientific techniques and principles of heat treatment
- limitations of scientific principles of heat treatment
- special heat treatments
- nonferrous heat treatments
- significant figures appropriate to the process, data and results
- risks and safety procedures appropriate to heat treatment of metals and alloys.
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Assessment Conditions

- Assessors must:
 - have vocational competency in determining and supervising heat treatment of metal at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015* or its replacement and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.
- Where possible, assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
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