



Australian Government

Department of Education, Employment and Workplace Relations

MSATCM405A Determine and supervise heat treatment of metal

Revision Number: 1

MSATCM405A Determine and supervise heat treatment of metal

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor	This unit covers applying metallurgical principles and techniques to determine and supervise the heat treatment of metal.
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Application of the Unit

Application of the unit	This unit 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.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Pre-requisite Units	<i>MSATCM304A</i>	<i>Interpret basic binary phase diagrams</i>
	<i>MEM06003C</i>	<i>Carry out heat treatment</i>

Employability Skills Information

Employability Skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Not applicable.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine heat treatment of metals to suit application requirements	1.1.Consultations and briefings are undertaken with managers, employers and customers and other sources of information researched as appropriate to determine heat treatment application requirements 1.2.The relevant scientific techniques and principles of heat treatment and associated software and hardware technologies are selected for particular application 1.3.Appropriate calculations and coherent units are used in the solution of engineering calculations 1.4.Significant figures are used in engineering calculations. 1.5.Heat treatment requirements
2. Supervise heat treatment of metal	2.1.Heat treatment parameters are communicated to appropriate personnel 2.2.Safety procedures appropriate to heat treatment process and item to be treated are determined and implemented 2.3.Supervise heat treatment techniques and use of associated software and hardware technologies to ensure required heat treatment solutions is achieved 2.4.Evaluate heat treatment process and advise on defects

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- select appropriate scientific principles to suit specific heat treatment applications
- select appropriate techniques and associated software and hardware technologies, to suit specific applications in heat treatment
- apply and manipulate appropriate formulas for heat treatment applications involving engineering calculations
- apply appropriate calculations to engineering situations
- refer solutions to the original aim of the application.
- quote solutions for the application in appropriate units, using appropriate significant figures.
- quote limitations of solutions for the application, due to assumptions, scientific principles and techniques used
- present solutions for the application referring to the original aim of the application including elimination or containment of risks and establishing of safety procedures

Required knowledge:

Competency includes sufficient knowledge of:

- heat treatment principles as given in the range statement
- limitations of selected scientific principles
- risks and safety procedures appropriate to heat treatment of metals and alloys

Evidence Guide

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

A person who demonstrates competency in this unit must be able to determine and supervise heat treatment of metal. Critical aspects for assessment and evidence are required to demonstrate competency in this unit.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the ability to:

- Select the appropriate heat treatment cycle(s) for nominated materials, so that they meet the required physical properties.

Relationship to other units

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic scientific principles and techniques in mechanical engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.

Assessment method and context

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation

EVIDENCE GUIDE**Resource implications**

required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

This section should be read in conjunction with the range of variables for this unit of competency. Resources required include suitable access to a situation where heat treatment of metal is undertaken. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Range Statement

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Codes of practice/standards	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used.
Sources of information	• reference texts • manufacturers' catalogues and industrial magazines • websites • use of phone, email and fax information gathering
Scientific techniques and principles of heat treatment relate to:	Ferrous heat treatment • the 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. • the 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 for alloying additions. • transformation diagrams for alloy steels. • isothermal transformation of austenite. • austenite grain size • formation of pearlite • formation of bainite • role of alloying elements • mechanical properties of pearlite and bainite • Temperature Time Transformation (TTT) diagrams. • quenching treatments. • formation of martensite

RANGE STATEMENT	
	• morphology and crystallography of ferrous martensites • mechanical properties of martensites • retained austenite • quenching media - stages of quenching, effect of variables • thermal and transformation stresses, 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 • use of TTT and CCT diagrams • hardenability testing e.g. Jominy • hardenability and heat treatment • tempering • tempering of irons and steels. • tempering of non ferrous metals and alloys • mechanical properties of tempered irons and steels • mechanical properties of non ferrous metals and alloys
Special heat treatments	• 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

RANGE STATEMENT	
Non-ferrous heat treatments	• aluminium alloys • solutions treatments • quenching • precipitation hardening • coldworking • temper designations • copper alloys • solution annealing • age hardening • precipitation hardening • coldworking • quenching and tempering • miscellaneous non-ferrous
Significant figures	Are those relevant to accuracy and are appropriate to the process, data and desired range of results
Risks and safety procedures	• 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 Sector(s)

Unit Sector	Metallurgy
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Competency field

Competency Field

Co-requisite units

Co-requisite Units	