



Australian Government

Department of Education, Employment and Workplace Relations

MEM04020A Supervise individual ferrous melting and casting operation

Release: 1

MEM04020A Supervise individual ferrous melting and casting operation

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit of competency covers the skills and knowledge required to technically supervise an individual ferrous melting and casting operation in a foundry to ensure specifications are met and safety procedures maintained.
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Application of the Unit

Application of the unit	<p>In a typical scenario, a foundry tradesperson will be required to monitor a ferrous melting and casting operation including tasks undertaken by other employees to ensure that correct quantities and temperatures are used, correct procedures are followed and product specifications achieved.</p> <p>The unit covers advanced trade skills and knowledge in ferrous melting and casting to enable the foundry tradesperson to act as a first line resource to other employees engaged in ferrous melting and casting. Work is performed under the overall direction of a metallurgist.</p> <p>Band: B</p> <p>Unit Weight: 4</p>
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Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		
Path 1	MEM04001B	Operate melting furnaces
	MEM04004B	Prepare and mix sand for metal moulding
	MEM04005C	Produce moulds and cores by hand (jobbing)
	MEM04007B	Pour molten metal
	MEM09002B	Interpret technical drawing
	MEM13004B	Work safely with molten metals/glass
	MEM18001C	Use hand tools

Employability Skills Information

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

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify specifications for required casting	1.1. Identify required material specification 1.2. Identify mould requirements 1.3. Identify any special melting and casting requirements for the job 1.4. Identify safety procedures for the required melting and casting operation 1.5. Identify and follow regulations and codes of practice relevant to foundry and individual melting, pouring and casting operation
2. Verify metal charges to melting	2.1. Select required components to give the required metal specification 2.2. Calculate required charge of each component 2.3. Recommend changes/additions to the charge 2.4. Monitor the preparation of the charge including checking for contaminants
3. Monitor furnace operation	3.1. Check that the furnace is in good operational condition and that appropriate lining is present 3.2. Organise for maintenance/repairs as required 3.3. Identify metal or alloy specification for required casting 3.4. Monitor a melt to ensure the product meets specification
4. Monitor pouring of molten metal	4.1. Check pouring area is secure and that all non-essential personnel are excluded 4.2. Check all members of pouring crew are wearing appropriate and in good condition personal protective equipment 4.3. Ensure escape routes are known in advance by all members of the pouring crew 4.4. Check emergency pour out pit is operational and other safety measures are in place 4.5. Ensure moulds are ready to receive liquid metal, ensure access ways and pouring ways are clear, and that there are appropriate spaces between each mould 4.6. Check pouring is undertaken at correct temperature and in efficient order 4.7. Ensure pouring basin and moulds are ready to receive liquid metal 4.8. Take required samples for analysis

ELEMENT	PERFORMANCE CRITERIA
5. Control hazards	<ul style="list-style-type: none">5.1. Identify hazards in the metal melting/pouring process5.2. Assess the risks arising from those hazards5.3. Implement procedures to control those hazards in line with procedures and duty of care

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- taking calculations needed for determining charges
- performing visual checks of furnaces for operational condition and safety risks
- taking samples
- following safety and quality procedures

Required knowledge

Required knowledge includes:

- charge calculations:
 - importance of composition control
 - methods used to calculate for additions
 - types of alloy additions and their effects on casting behaviour and finished product
- steel:
 - induction furnace melting, principles, refractories suitable for steelmaking and their characteristics
 - arc furnace melting; acid, basic, single slag, double slag, deoxidisation and hydrogen control
 - ladle refining
- cast iron:
 - types of cast iron
 - influence of carbon and silicon contents
 - carbon equivalent
 - effect of cooling rate

REQUIRED SKILLS AND KNOWLEDGE

- microstructure and classification of graphite
- carbide stabilisers and graphite
- inoculation and types of inoculant
- spheroidal graphite formation and treatment methods
- casting characteristics of grey, S.G (ductile) and malleable cast irons
- ferrous alloys:
 - definitions of ferrous metals
 - the grades of iron and their applications, including S.G. iron, ductile iron, grey and white irons, alloy cast irons, chilled and malleable iron
 - the grades of steel and their applications including carbon steel and alloys steels
 - methods of controlling physical properties
 - advantages/disadvantages of density of each type of ferrous metal
 - methods of controlling tensile strength of ferrous metals
 - methods of controlling the hardness of ferrous metals
 - the influence of melting points on production processes
 - the shrinkage percentage of the types of ferrous metals
 - how to control metal fluidity
 - the use of degassing to control gas defects
 - be able to take action to control grain size
 - casting temperature
 - make a selection of ferrous metal based on required properties
 - conduct metal analysis on ferrous metal
 - use Australian standards (or other appropriate standard) for ferrous metals
- types of furnaces and their relative advantages and disadvantages:
 - blast furnace
 - cupola
 - induction
 - direct arc
 - indirect arc
 - open hearth
 - reverberatory
 - rotary
 - maintenance
- refractory types and purposes including:
 - dolomite
 - silica brick
 - chrome brick
 - ganister

REQUIRED SKILLS AND KNOWLEDGE

- fireclay
- firebrick
- magnesite
- kyanite
- fused alumina
- linings types and purposes including:
 - monolithic
 - castable
 - rammable
 - bricks
 - basic
 - acid
 - neutral
- types of ladles:
 - lip
 - tea pot
 - bottom pour
- safe working with ladles:
 - pre-heat ladles
 - ladle maintenance
 - check mechanical condition of ladles including gearboxes and safety locks
- use of lifting and handling equipment including:
 - tongs
 - shanks
 - cranes
 - hoists
 - bogey ladles
 - maintenance
- supervision of other staff in melting and casting safety including:
 - housekeeping
 - personal protective clothing
 - dry area and tools
 - pre-heating of ladles
 - safe working load of overhead cranes
- furnace operation procedures including:
 - ensuring a dry and safe charge
 - warm and dry equipment
 - pre-heating

REQUIRED SKILLS AND KNOWLEDGE

- scrap selection
- housekeeping
- melting schedule
- pouring schedule
- calculations including volume and mass calculations
- charge calculations
- maintaining supply
- maintenance of melting and pouring equipment
- types of control equipment:
 - thermal analysis
 - pyrometers
 - gas analysis
 - chemical analysis
 - wet chemical analysis
 - spectrograph
 - fluidity test
- quality control and procedures for:
 - accurate weighing
 - correct chemical analysis
 - covers and fluxes
 - mould/metal reactions
 - conduct and interpretation of thermal analysis
 - alloying procedure
 - thermal analysis
 - degassing
 - deoxidising
 - ladle refining
 - chill/wedge test
 - customer requirements
- types of defects and prevention including but not limited to:
 - contamination
 - gas absorption
 - metal analysis
 - temperature control
 - oxidation
 - other defects common to iron and steel
- tapping and pouring operations including:
 - when to pour according to job and furnace specification

REQUIRED SKILLS AND KNOWLEDGE

- availability of emergency pour out pits and other safety equipment
- availability of cranes or other transport
- pour out rate
- ensure mechanical test bar is available and taken if required
- ensure pig pouring and tagging is performed correctly

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, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

Evidence should be provided from a number of castings using different alloys and/or different moulds.

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

Assessors should ensure that candidates can competently and consistently:

- monitor the melting and casting of ferrous metal
- safely operate a melting furnace and monitor and supervise the operation of a furnace by other employees
- safely handle pouring equipment and monitor and supervise the operation of pouring equipment by other employees.

Context of and specific resources for assessment

Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.

Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

Method of assessment

Assessment must satisfy the endorsed assessment guidelines of the MEM05 Metal and Engineering Training Package.

Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.

Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.

EVIDENCE GUIDE	
	<p>Assessment may be applied under project related conditions (real or simulated) and require evidence of process.</p> <p>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p> <p>Assessment may be in conjunction with assessment of other units of competency where required.</p>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

RANGE STATEMENT	
<p>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.</p>	
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
Contaminants	Contaminants include: non-specified metal, rubber, grease, water, paint and non-metallics, closed containers or pipes and pressure containers such as aerosols
Material specification	Material specification includes: ferrous metals and ferrous alloys as well as contaminants

Unit Sector(s)

Unit sector	
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Co-requisite units

Co-requisite units		

Competency field

Competency field	Casting and moulding
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