



Australian Government

MEM04020 Supervise individual ferrous melting and casting operation

Release: 2

MEM04020 Supervise individual ferrous melting and casting operation

Modification History

Release 2. Quantum of hours of workplace practice removed. Supersedes and is equivalent to MEM04020 Supervise individual ferrous melting and casting operation (Release 1).

Release 1. Supersedes and is equivalent to MEM04020A Supervise individual ferrous melting and casting operation.

Application

The unit of competency defines the skills and knowledge required by a foundry tradesperson to supervise ferrous melting and casting operations in a foundry to ensure specifications are met and safety procedures maintained. This work is performed under the overall direction of a metallurgist.

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

Band: B

Unit Weight: 4

Pre-requisite Unit

MEM04001	Operate melting furnaces
MEM04004	Prepare and mix sand for metal moulding
MEM04007	Pour molten metal
MEM04024	Produce moulds and cores by hand
MEM04025	Produce moulds and cores by hand (advanced)
MEM09002	Interpret technical drawing
MEM11011	Undertake manual handling
MEM12023	Perform engineering measurements
MEM12024	Perform computations
MEM13004	Work safely with molten metals/glass
MEM13015	Work safely and effectively in manufacturing and engineering

MEM14006	Plan work activities
MEM16006	Organise and communicate information
MEM18001	Use hand tools

Competency Field

Casting and moulding

Elements and Performance Criteria

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

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	Identify job requirements from specifications, drawings, job sheets or work instructions
2	Identify specifications for required casting	2.1	Identify required material specification and mould requirements
		2.2	Identify any special melting and casting requirements for the job
		2.3	Identify safety procedures for the required melting and casting operation
		2.4	Identify and follow regulations and codes of practice relevant to foundry and individual melting, pouring and casting operation
3	Verify metal charges to	3.1	Select required components to give the required metal specification

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

	melting	3.2	Calculate required charge of each component
		3.3	Recommend changes and/or additions to the charge
		3.4	Monitor the preparation of the charge, including checking for contaminants
4	Monitor furnace operation	4.1	Check that the furnace is in good operational condition and that appropriate lining is present
		4.2	Organise for maintenance and repairs as required
		4.3	Identify metal or alloy specification for required casting
		4.4	Monitor a melt to ensure the product meets specification
5	Monitor pouring of molten metal	5.1	Check pouring area is secure and that all non-essential personnel are excluded
		5.2	Check all members of the pouring crew are wearing appropriate PPE
		5.3	Ensure escape routes are known in advance by all members of the pouring crew
		5.4	Check emergency pour out pit is operational and other safety measures are in place
		5.5	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
		5.6	Check pouring is undertaken at correct temperature and in efficient order
		5.7	Ensure pouring basin and moulds are ready to receive liquid metal
		5.8	Take required samples for analysis
6	Control hazards	6.1	Identify hazards in the metal melting/pouring process

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

- 6.2 Assess the risks arising from those hazards
- 6.3 Implement procedures to control those hazards in line with procedures and duty of care

Foundation Skills

This section describes those required skills (reading, writing, oral communication and numeracy) that are essential to workplace performance in this unit of competency.

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.

Moulds include one (1) or more of the following:

- sand
- die
- investment

Contaminants include one (1) or more of the following:

- non-specified metal
- rubber
- grease
- water
- paint and non-metallics
- closed containers or pipes
- pressure containers, including aerosols

Material specification includes one (1) or more of the following:

- ferrous metals
- ferrous alloys
- contaminants

Unit Mapping Information

Release 2. Supersedes and is equivalent to MEM04020 Supervise individual ferrous melting and casting operation (Release 1).

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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 MEM04020 Supervise individual ferrous melting and casting operation

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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 on at least two (2) occasions and include:

- following work instructions, standard operating procedures (SOPs) and safe work practices
- identifying and interpreting specifications, safety procedures and codes of practice/standards for the required melting and casting operation
- checking for contaminants when verifying metal changes to melting and recommending changes and/or additions to the charge as required
- providing evidence from castings that were made using different alloys and moulds
- monitoring melting and casting operations of ferrous metal
- operating a melting furnace safely and monitoring and supervising the operation of a furnace by other employees
- handling pouring equipment and monitoring safely and supervising the operation of pouring equipment by other employees.

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)
- charge calculations – importance of composition control, methods used to calculate for additions and 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 and ladle refining
- cast iron – types of cast iron, influence of carbon and silicon contents, carbon equivalent, effect of cooling rate, microstructure and classification of graphite, carbide stabilisers and graphite, inoculation and types of inoculant, spheroidal graphite formation and treatment methods and casting characteristics of grey, S.G (ductile) and malleable cast irons

- ferrous alloys – definitions of ferrous metals, grades of iron and their applications, including S.G. iron, ductile iron, grey and white irons, alloy cast irons, chilled and malleable iron, 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, shrinkage percentage of the types of ferrous metals, how to control metal fluidity, 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 and 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 and maintenance
- refractory types and purposes, including dolomite, silica brick, chrome brick, ganister, fireclay, firebrick, magnesite, kyanite and fused alumina
- linings types and purposes, including monolithic, castable, rammable, bricks, basic, acid and neutral
- types of ladles – lip, tea pot and bottom pour
- safe working with ladles – pre-heat ladles, ladle maintenance and checking mechanical condition of ladles including gearboxes and safety locks
- use of lifting and handling equipment including – tongs, shanks, cranes, hoists, bogey ladles and maintenance
- supervision of other staff in melting and casting safety, including housekeeping, PPE, dry area and tools, pre-heating of ladles and safe working load of overhead cranes
- furnace operation procedures, including ensuring a dry and safe charge, warm and dry equipment, pre-heating, scrap selection, housekeeping, melting schedule, pouring schedule, calculations, including volume and mass calculations, charge calculations, maintaining supply and maintenance of melting and pouring equipment
- types of control equipment – thermal analysis, pyrometers, gas analysis, chemical analysis, wet chemical analysis, spectrograph and 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 and customer requirements
- types of defects and prevention, including but not limited to contamination, gas absorption, metal analysis, temperature control, oxidation and other defects common to iron and steel
- tapping and pouring operations, including when to pour according to job and furnace specification, 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 and ensure pig pouring and tagging is performed correctly.

Assessment Conditions

- Assessors must:

- have vocational competency in the supervision of individual ferrous melting and casting operation 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.
- Assessment must occur in a functioning workplace. Where assessment in the workplace would be unsafe, impractical or threatens the environment, assessment must occur in a sufficiently rigorous simulated environment that reflects the circumstances that would be experienced in a functioning workplace. Assessment must cover all aspects of workplace performance, including 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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