Australian Government

Department of Education, Employment and Workplace Relations

PMAOPS303B Operate furnaces to induce reaction

Revision Number: 1

PMAOPS303B Operate furnaces to induce reaction

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit covers the operation of furnaces for the primary purpose of causing, inducing or facilitating a chemical reaction such as cracking, smelting or other very high temperature processes. The furnace will typically be directly fired, or may use the feed as the fuel. It does not apply to steam heated reactors.

Application of the Unit

Application of the unit	In a typical scenario, an operating technician in a plant looks after the operation of a furnace, which may be used to cause and control the cracking of oil or gas, the smelting of ore or other process function. The furnace is not used primarily to generate heat or raise steam, but rather to cause a chemical change which requires high temperatures (and which may or may not be assisted by other means). The generation of heat as a by-product which may be used elsewhere is not precluded. It includes the operation of equipment ancillary to the main furnace. This competency unit covers furnaces and furnace processes such as: • thermal cracking • catalytic cracking • reduction • cabin type • cylindrical or vertical. It does not include: • packaged furnaces which are covered by MSAPMOPS100A Use equipment • furnaces used for the production of steam, which are covered by *MEM07033B Operate and monitor basic boiler* or *MEM07034A Operate and monitor intermediate class boiler* • furnaces used for heating eat transfer fluids (eg 'Dowtherm') which are covered by PMAOPS323BOperate and monitor heating furnace. The plant technician would: • identify and rectify operational problems • predict the potential impact of furnace output on the operation of the whole plant • facilitate output changes. Generally the plant technician would be part of a team during start-up and shutdown procedures and may be expected to be capable of performing all parts of this unit. At all times they would be liaising and cooperating with other members of the team. This unit does not require the operation of a control panel.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.

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.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for work.	1.1. Identify work requirements 1.2. Identify and control hazards 1.3. Coordinate with appropriate personnel
2. Start up furnace.	2.1. Perform pre-start-up checks 2.2. Start up individual items of equipment and the entire furnace system 2.3. Start up from standby and after maintenance 2.4. Build production rate steadily with no surges or lulls 2.5. Stabilise system to produce in specification product at specified rates within minimum time.
3. Monitor and control the reaction process.	3.1. Complete routine checks, logs and paperwork 3.2. Recognise the signs of potential and actual problems 3.3. Take action to minimise the impact on safety, health, the environment and the business of potential and actual problems 3.4. Monitor condition of catalyst (if any) and take action to maintain production schedule and quality 3.5. Monitor availability of feeds and take action to maintain production schedule and quality 3.6. Remove product as appropriate 3.7. Trim plant to achieve required rates and quality while maximising plant efficiency.
4. Change production rates and/or product specification.	4.1. Predict from rates and schedule when a transition will be required 4.2. Give advanced notice of transition to work team 4.3. Trim plant in a manner which prepares it for the change 4.4. Manage changes smoothly and in a timely manner 4.5. Minimise off grade as a result of a transition.
5. Maintain plant effectiveness.	5.1. Frequently and critically monitor all plant throughout shift 5.2. Use measured/indicated data and smell, sight, sound and feel as appropriate to monitor plant 5.3. Identify critical equipment/processes and tune their performance 5.4. Identify issues likely to impact on plant performance and take appropriate action 5.5. Predict impact of a change in one unit/area on other plant units/areas and communicate this to relevant

ELEMENT	PERFORMANCE CRITERIA
	people 5.6. Test trips and alarms 5.7. Complete minor maintenance according to procedures.
6. Shut down furnace.	6.1. Determine type of shut down required 6.2. Give advance warning of shut down where possible 6.3. Change over individual items of equipment 6.4. Shut down individual items of equipment and the entire furnace system 6.5. Shut down to a stand-by condition if required 6.6. Shut down in an emergency when required 6.7. Prepare plant for maintenance/vessel entry as required 6.8. Receive plant back from maintenance 6.9. Reset trips and alarms after a shut down 6.10. Prepare plant for the introduction of hydrocarbons and operation 6.11. Leave plant in a condition ready to restart.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

This competency requires skills in:

- monitoring
- observation
- analysis

following procedures

Competence also includes the ability to isolate the causes of problems to an item of equipment within the furnace system and to be able to distinguish between causes of problems/alarm/fault indications such as:

- process materials variations
- chemical processes (including combustion)
- instrument failure/wrong reading
- equipment (mechanical/electrical problems)
- operational problem
- as is relevant to the practical operation of equipment at that job level.

Required knowledge

Competence includes an understanding of the furnace system and its integral equipment to the level needed to control the system and recognise and resolve problems; in particular:

- all items on a schematic of the furnace system and the function of each, including furnace components such as:
  - burner
  - convection section
  - radiation section
  - floor/walls including insulation (refractory)
  - stack/damper (flue type)
- the nature/condition of materials entering and leaving each stage of the process, the changes which have occurred in that stage and why they have occurred
- the principles of operation of the furnace, including combustion principles, draft, burner design, excess air/flue CO/CO2
- the importance of flame patterns/flame impingement
- the causes and remedies of common problems
- methods of changing rate and the advantages and disadvantages of each
- the chemistry of the reaction(s) occurring in the furnace to the level of writing equations and identifying and manipulating variables which control rate and yield.

REQUIRED SKILLS AND KNOWLEDGE
This knowledge is required of all major items of equipment which comprise the furnace system.

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	Assessment of this unit should include demonstrated competence on actual plant and equipment in a work environment. The unit will be assessed in as holistic a manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations which will include disruptions to normal, smooth operation. Simulation may be required to allow for assessment of parts of this unit. Simulation should be based on the actual plant and will include walk-throughs of the relevant competency components. Simulations may also include the use of case studies/scenarios and role plays. This unit of competency requires a significant body of knowledge which will be assessed through questioning and the use of what-if scenarios both on the plant (during demonstration of normal operations and walk-throughs of abnormal operations) and off the plant.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action. The emphasis should be on the ability to stay out of trouble rather than on recovery from a disaster. Consistent performance should be demonstrated. In particular look to see that: • early warning signs of equipment/processes needing attention or with potential problems are recognised • the range of possible causes can be identified and analysed and the most likely cause determined • appropriate action is taken to ensure a timely return to full performance • obvious problems in related plant areas are recognised and an appropriate contribution made to their solution. These aspects may be best assessed using a range of

EVIDENCE GUIDE	
	scenarios/case studies/what-ifs as the stimulus with a walk-through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations which may have been generated from the past incident history of the plant, incidents on similar plants around the world, hazard analysis activities and similar sources.
Context of and specific resources for assessment	Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios/case studies/what-ifs will be required as will a bank of questions which will be used to probe the reasoning behind the observable actions.
Method of assessment	In all plants it may be appropriate to assess this unit concurrently with relevant teamwork and communication units. In a major hazard facility, it may be appropriate to assess this unit concurrently with: • *MSAPMOHS200A Work safely*.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.	
Codes of practice/ standards	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.
Context	This competency unit includes all such items of equipment and unit operations which form part of the furnace system. Typically this may include: • pumps • valves • utilities and services • heat exchangers and/or scrubbers • fuel systems • tapping systems and may also include other equipment as well as the furnace itself.
Typical problems	Typical problems include: • soot blowing • control of draft, fuel and air • variations in catalyst activity (where appropriate) • control of temperature and cracking/product rate/quality • variations in feed rates/quality.
Appropriate action	Appropriate action includes: • determining problems needing action • determining possible fault causes • rectifying problem using appropriate solution within area of responsibility • following through items initiated until final resolution has occurred • reporting problems outside area of responsibility to designated person.
Health, safety and environment (HSE)	All operations to which this unit applies are subject to stringent health, safety and environment requirements, which may be imposed through State or Federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence.

Unit Sector(s)

Unit sector	Operational/technical

Competency field

Competency field	

Co-requisite units

Co-requisite units	