



Australian Government

PMAOPS302 Operate reactors and reaction equipment

Release: 1

PMAOPS302 Operate reactors and reaction equipment

Modification History

Release 1. Supersedes and is equivalent to PMAOPS302B Operate reactors and reaction equipment

Application

This unit of competency covers the skills and knowledge required to operate a production unit which, as its prime function, causes and controls a chemical reaction. The production unit operation will integrate several plant items (single unit operations). Operation of the production unit includes the operation of ancillary equipment that is integral to the operation of the production unit, such as:

- heating/cooling
- mixing
- separating
- catalyst regeneration
- weigh/charge/dispense
- pumps/valves.

The unit of competency applies to reactor or reaction equipment, such as:

- batch
- continuous
- catalytic
- fluidised bed
- pressurised/under vacuum
- gas/liquid/slurry/emulsion.

This unit of competency applies to operations technicians who are required to demonstrate a significant understanding of the process and the equipment operation in order to identify and rectify operational problems, run all aspects of the reactor operation, monitor and manage the supply of raw materials and output of product, and adjust product properties to meet specifications.

This unit of competency applies to an individual operating independently in a plant with local control or in liaison with the control room operator in a plant with a centralised control panel, such as distributed control system (DCS) type controls.

This unit of competency applies to an individual working alone or as part of a team or group and working in liaison with other shift team members and the control room operator, as appropriate.

This competency does not require the operation of a central control panel.

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

Pre-requisite Unit

Nil

Competency Field

Operations

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes.

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

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| 1 | Prepare for work | 1.1 | Receive and give shift handover |
| | | 1.2 | Identify work requirements |
| | | 1.3 | Identify and control hazards |
| | | 1.4 | Coordinate with appropriate personnel |
| | | 1.5 | Check for recent work undertaken on reactor unit |
| | | 1.6 | Note any outstanding/incomplete work |
| | | 1.7 | Check operational status of reactor unit |
| | | | |
| 2 | Operate reactor unit in accordance with procedures | 2.1 | Describe the type of reactor unit, the component plant items and their duties |
| | | 2.2 | Complete routine checks, logs and paperwork taking action on unexpected readings |
| | | 2.3 | Change rate, grade or specification smoothly |
| | | 2.4 | Manage transitions smoothly and in a timely manner to minimise scrap/off grade as a result of a transition |
| | | 2.5 | Adjust reactor unit and its component plant items as appropriate to their type and duty to maximise performance |

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| | | 2.6 | Charge/discharge reactor, if appropriate |
| | | 2.7 | Monitor condition of catalyst, if appropriate, and take action to maintain production schedule and quality |
| | | 2.8 | Monitor materials and stock levels of fees and take action to maintain production schedule and quality. |
| 3 | Diagnose and take action on abnormal situations | 3.1 | Monitor reactor unit and its component plant items frequently and critically throughout shift using measured/indicated data and senses |
| | | 3.2 | Describe impacts of any changes upstream and downstream |
| | | 3.3 | Recognise actual and developing situations which may require action |
| | | 3.4 | Apply operational knowledge to resolve problems |
| | | 3.5 | Take actions on abnormal situations which cannot be resolved during the shift to ensure safety and the resolution of the situation |
| | | 3.6 | Follow through items initiated until final resolution has occurred |
| 4 | Isolate and de-isolate reactor unit and its component plant items | 4.1 | Complete any required pre-start checks |
| | | 4.2 | Start up/shut down reactor unit according to the reactor type and duty in liaison with other personnel |
| | | 4.3 | Start up/shut down/changeover component plant items within unit according to their type and duty in liaison with other personnel |
| | | 4.4 | Build reaction rate steadily and stabilise reaction system to produce in specification product at specified rates within minimum time |
| | | 4.5 | Isolate entire reactor unit and/or any component plant item |
| | | 4.6 | Make safe for required work |
| | | 4.7 | Check reactor unit/plant item is ready to be returned to |

			service
		4.8	De-isolate and prepare reactor unit/plant item for return to service
5	Clean reactors/vessels in accordance with procedures	5.1	Identify cleaning requirements
		5.2	Clean to requirements

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.

Regulatory framework The latest version of all legislation, regulations, industry codes of practice and Australian/international standards, or the version specified by the local regulatory authority, must be used, and include one or more of the following:

- legislative requirements, including work health and safety (WHS)
- industry codes of practice and guidelines
- environmental regulations and guidelines
- Australian and other standards
- licence and certification requirements

All operations to which this unit applies are subject to stringent health, safety and environment (HSE) requirements, which may be imposed through state/territory 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.

Hazards Hazards include one or more of the following:

- electricity

- gas
- gases and liquids under pressure
- structural hazards
- structural collapse
- equipment failures
- industrial (machinery, equipment and product)
- equipment or product mass
- noise, rotational equipment or vibration
- plant services (steam, condensate and cooling water)
- working at heights, in restricted or confined spaces, or in environments subjected to heat, noise, dusts or vapours
- flammability and explosivity
- hazardous products and materials
- unauthorised personnel
- sharp edges, protrusions or obstructions
- slippery surfaces, spills or leaks
- extreme weather
- other hazards that might arise
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Situations requiring action

Situations requiring action include one or more of the following:

- variations in catalyst activity
- control of exotherm/endotherm
- adjustments to meet product specifications
- variations in feed rates/quality
- raw materials variations
- instrument failure/wrong reading
- equipment failure (electrical/mechanical)
- mechanical failure
- operational problems

Actions on abnormal situations includes the following:

- determine problems needing action
- determine possible fault causes
- develop solutions to problems which do not have a known solution
- follow through items initiated until final resolution has occurred
- report problems outside area of responsibility to designated person

Operational knowledge includes one or more of the following:

- procedures
- training

- technical information such as journals, engineering specifications
- remembered experience
- relevant knowledge obtained from appropriate people

Start up/shut down Start up/shut down includes the following:

- start up and shut down to/from normal operating conditions
- start up and shut down to/from isolated, cold or empty
- start up and shut down to/from other conditions/situations experienced on the plant

Procedures All operations must be performed in accordance with relevant procedures.

Procedures are written, verbal, visual, computer-based or in some other form, include one or more of the following:

- emergency procedures
- work instructions
- standard operating procedures (SOPs)
- safe work method statements (SWMS)
- formulas/recipes
- batch sheets
- temporary instructions
- any similar instructions provided for the smooth running of the plant

Operate Operate is to monitor, adjust/make change to the production unit and/or its component items to meet specifications, by one or more of the following:

- manually in the plant
- using local controller in the plant

Product Product includes anything produced by a process step and so includes:

- intermediate products, such as the product from one process step, which then becomes the feed for another

Unit Mapping Information

Release 1. Supersedes and is equivalent to PMAOPS302B Operate reactors and reaction equipment

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=9fc2cf53-e570-4e9f-ad6a-b228ffdb6875>

Assessment Requirements for PMAOPS302 Operate reactors and reaction equipment

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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 the ability to:

- use data and own senses to monitor plant and maximise performance
- perform pre-start checks, start-up/shutdown and cleaning procedures, and isolations and de-isolations
- predict impact of a change in one unit/area on other plant units/areas and take appropriate action
- identify hazards and risks and apply risk control procedures
- identify early warning signs of equipment/processes needing attention or with potential problems
- resolve routine and non-routine problems
- use schematics and data to monitor plant and optimise performance
- identify hazards and risks and apply risk control procedures.

Knowledge Evidence

Evidence must be provided that demonstrates knowledge of:

- all items on a schematic of the production unit and functions, and troubleshooting of major components and their problems
- principles of operation of plant/equipment:
 - basis of the process used in the production unit to cause chemical reaction
 - methods of controlling the reaction rate and yield and the advantages and disadvantages of each
 - impact of external factors (e.g. variations in weather and feed)
- interactions between plant items/processes
- process-specific science (physics, chemistry and biochemistry) to the level of being able to interpret the science and extract factors controlling the process and product and by-product production rate and quality (e.g. for chemistry interpret the equation for factors controlling rate and yield and also interfering reactions, such as salts and hydrates)
- the nature/condition of materials at each stage of the reaction, the changes which have occurred in that stage and why they have occurred
- the reaction in chemical terms and equations, including the effect of changing reaction variables (e.g. temperature, pressure, catalyst, concentration and pH)

- systems' operating parameters and integrity limits, including temperature, pressure, flow and pH
- product specifications and tolerances
- routine and non-routine problems that may arise, the range of possible causes and processes to develop solutions
- hierarchy of control
- hazards that may arise in the job/work environment, and:
 - their possible causes
 - potential consequences
 - appropriate risk controls.

Assessment Conditions

- The unit should be assessed holistically and the judgement of competence based on a holistic assessment of the evidence.
- The collection of performance evidence:
 - should occur over a range of situations which include typical disruptions to normal, smooth operations
 - will typically include a supervisor/third-party report focusing on consistent performance and problem recognition and solving. A supervisor/third-party report must be prepared by someone who has a direct, relevant, current relationship with the person being assessed and who is in a position to form a judgement on workplace performance relevant to the unit of competency
 - must include the use of an industrial style reactor
 - may use industry-based simulation for part only of the unit particularly where safety, lack of opportunity or significant cost is an issue.
- Assessment should 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 reflecting realistic operational workplace conditions. This must cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Assessment in a simulated environment should use evidence collected from one or more of:
 - walk-throughs
 - pilot plant operation
 - demonstration of skills
 - industrybased case studies/scenarios
 - 'what ifs'.
- Knowledge evidence may be collected concurrently with performance evidence (provided a record is kept) or through an independent process, such as workbooks, written assessments or interviews (provided a record is kept).
- 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.

- Conditions for assessment must include access to all tools, equipment, materials and documentation required, including relevant workplace procedures, product and manufacturing specifications associated with this unit.
- The regulatory framework will be reflected in workplace policies and procedures and is not required to be independently assessed.
- Foundation skills are integral to competent performance of the unit and should not be assessed separately.
- Assessors must satisfy the assessor competency requirements that are in place at the time of the assessment as set by the VET regulator.
- In addition, the assessor or anyone acting in subject matter expert role in assessment must demonstrate both technical competency and currency. If the assessor cannot demonstrate technical competency and currency they must assess with a subject matter expert who does meet these requirements.
- Technical competence can be demonstrated through one or more of:
 - relevant VET or other qualification/Statement of Attainment
 - appropriate workplace experience undertaking the type of work being assessed under routine and non-routine conditions
 - appropriate workplace experience supervising/evaluating the type of work being assessed under routine and non-routine conditions
- Currency can be demonstrated through one or more of:
 - being currently employed undertaking the type of work being assessed
 - being employed by the organisation undertaking the type of work being assessed and having maintained currency in accordance with that organisation's policies and procedures
 - having consulted/had contact with an organisation undertaking the type of work being assessed within the last twelve months, the consultation/contact being related to assessment
 - conducting on-the-job training/assessments of the type of work being assessed
 - being an active member of a relevant professional body and participating in activities relevant to the assessment of this type of work.

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