



Australian Government

MSL965003 Construct, modify and maintain high vacuum systems

Release: 1

MSL965003 Construct, modify and maintain high vacuum systems

Modification History

Release 1. Supersedes and is equivalent to MSL965003A Construct, modify and maintain high vacuum systems

Application

This unit of competency covers the ability to construct, monitor, modify and maintain high vacuum systems. Personnel are required to use advanced bench/hand glasswork techniques and equipment to fabricate glass apparatus.

This unit of competency is applicable to skilled and experienced scientific glassblowers. They will apply specialised technical knowledge and precise technical skills and considerable planning and judgement in their work.

While no specific licensing or certification requirements apply to this unit at the time of publication, laboratory operations are governed by relevant legislation, regulations and/or external accreditation requirements. Local requirements should be checked.

Pre-requisite Unit

MSL963001 Operate basic handblowing equipment

MSL963002 Repair glass apparatus using simple glassblowing equipment

Competency Field

Scientific glassblowing

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes.

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

1	Construct high vacuum systems	1.1	Consult with clients regarding design specifications and cost
		1.2	Identify or prepare appropriate blueprints, drawings, sketches and designs

- 1.3 Identify hazards and workplace safety requirements
 - 1.4 Prepare equipment in accordance with job requirements
 - 1.5 Construct and install vacuum apparatus
 - 1.6 Trial and commission vacuum apparatus
 - 1.7 Use leak detection equipment to vacuum check system
 - 1.8 Complete records and file in the reporting system
- 2 **Modify high vacuum systems**
 - 2.1 Identify opportunities to improve efficiency of vacuum system
 - 2.2 Use leak detection equipment to vacuum check system
 - 2.3 Identify gaps and deficiencies which limit system's usefulness
 - 2.4 Confirm modification requirements with appropriate personnel
 - 2.5 Modify system to meet requirements
- 3 **Maintain high vacuum systems**
 - 3.1 Identify maintenance procedures and appropriate records
 - 3.2 Plan and evaluate maintenance according to appropriate quality standards
 - 3.3 Identify, document and report need for maintenance for faulty or damaged equipment
 - 3.4 Maintain vacuum and associated systems according to standard procedures
 - 3.5 Use leak detection equipment to vacuum check system
- 4 **Monitor and finetune vacuum operation**
 - 4.1 Monitor system to determine whether equipment is operating to specification
 - 4.2 Evaluate equipment outputs to determine nature of problem

		4.3	Define nature of sub-standard performance clearly
		4.4	Fine tune system to restore system to specification
5	Maintain a safe work environment	5.1	Use established safe work practices and personal protective equipment (PPE) to ensure safety of self and other workers
		5.2	Minimise the generation of wastes
		5.3	Ensure the safe disposal of wastes
		5.4	Clean, care for and maintain work area, equipment and tools
		5.5	Report any hazards or incidents according to workplace procedures
6	Maintain records	6.1	Record data in accordance with workplace requirements
		6.2	Maintain glass apparatus and system equipment logs in accordance with workplace requirements
		6.3	Maintain security and confidentiality of workplace information

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.

Standards, codes, procedures and/or workplace

- Standards, codes, procedures and/or workplace requirements include the latest version of one or more of:
- Australian and international standards covering the requirements

requirements

for the laboratory safety; quality and environmental management; and labelling, storage, handling and transport of hazardous materials

- national work health and (WHS) standards and codes of practice
- specific codes, guidelines and procedures, such as principles of good laboratory practice (GLP)
- workplace documents, such as standard operating procedures (SOPs); quality and equipment manuals; maintenance schedules; material safety data sheets (MSDS); safety procedures; material, production and product specifications; production and laboratory schedules; workplace recording and reporting procedures; and waste minimisation and safe disposal procedures

Hazards

Hazards include, but are not limited to, one or more of:

- glass dust
- sharps and broken glassware
- residues on used glassware, such as mercury
- heat sources, such as burners and ovens
- fluids under pressure (acetylene and oxygen)
- cuts associated with glass grinders and cutters
- manual handling of heavy bags, containers and equipment

Safety procedures

Safety procedures include, but are not limited to, one or more of:

- ensuring access to service shut-off points
- recognising and observing hazard warnings and safety signs
- correct labelling of samples and hazardous materials
- extracting dust
- following established manual handling procedures
- handling and storing hazardous materials and equipment in accordance with labels, MSDS, manufacturer instructions, and workplace procedures and regulations
- regular cleaning and/or decontamination of equipment and work areas
- using PPE, such as heat resistant gloves, safety glasses, goggles, face guards, coveralls, respirators and safety boots

WHS and environmental management requirements

WHS and environmental management requirements include:

- complying with WHS and environmental management requirements at all times, which may be imposed through state/territory or federal legislation. These requirements must not be

compromised at any time

- applying standard precautions relating to the potentially hazardous nature of samples
- accessing and applying current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health, where relevant

Unit Mapping Information

Release 1. Supersedes and is equivalent to MSL965003A Construct, modify and maintain high vacuum systems

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=5c63a03b-4a6b-4ae5-9560-1e3c5f462baa>

Assessment Requirements for MSL965003 Construct, modify and maintain high vacuum systems

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Performance Evidence

Evidence of competence in this unit must satisfy all of the requirements of the elements and performance criteria, and include demonstration of:

- safely constructing, trialling and commissioning at least one (1) glass high vacuum system
- consulting with clients about design specifications and cost
- preparing and interpreting blueprints, drawings, sketches, designs and customer requirements
- applying theoretical concepts and practical principles to make relevant design conclusions, modifications and fine tune vacuum operation
- using advanced bench/hand glasswork techniques and equipment to fabricate glass apparatus
- safely modifying at least one (1) high vacuum system by evaluating its efficiency and usefulness, recommending improvements and making the approved modifications
- safely maintaining at least one (1) high vacuum system, including:
 - checking and maintaining gas manifolds, cylinders and pumps
 - ensuring the safety of vacuum and related equipment
 - monitoring performance of the apparatus, troubleshooting problems and restoring it to specification
- completing workplace documentation accurately and communicating work results.

Knowledge Evidence

Must provide evidence that demonstrates knowledge of:

- design principles for high vacuum glass systems
- operating principles and procedures for high vacuum pumps and leak detectors
- glass working methods and procedures relevant to high vacuum systems, including:
 - control of stress and strain in glass systems
 - characteristics, capabilities and limitations of specific glassblowing techniques
 - properties of glass and specific ways to join glass for high vacuum applications
 - ideal joint placement for high vacuum systems
 - ultra cleaning procedures for glass in high vacuum systems
 - preparation and use of glass-to-metal seals

- hazards and safety procedures relevant to constructing and working with high vacuum systems
- other relevant work health and safety (WHS) and environment requirements.

Assessment Conditions

- Judgement of competence must be based on holistic assessment of the evidence. Assessment methods must confirm consistency of performance over time, rather than a single assessment event. The timeframe must allow for adequate assessment of operation under all normal and a range of abnormal conditions.
- This unit of competency is to be assessed in the workplace or a simulated workplace environment. A simulated workplace environment must reflect realistic operational workplace conditions that cover all aspects of workplace performance, including the environment, task skills, task management skills, contingency management skills and job role environment skills.
- Foundation skills are integral to competent performance of the unit and should not be assessed separately.
- 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.
- Knowledge evidence may be collected concurrently with performance evidence or through an independent process, such as workbooks, written assessments or interviews (provided a record is kept in each case).
- This unit of competency may be assessed with:
 - MSL965001 Design and manufacture glass apparatus and glass systems
 - MSL965002 Perform glass coating, grinding and finishing operations
- Holistic assessment methods are suggested:
 - inspection of glass high vacuum systems that the candidate has constructed, modified and maintained
 - analysis of the candidate's work outputs over a period of time to ensure accurate and consistent work is obtained within required timelines
 - feedback from peers and supervisors
 - oral/written questioning about design principles for glass high vacuum system, glass working methods and procedures used in high vacuum systems, quality problems and safe work procedures.
- Access is required to instruments, equipment, materials, workplace documentation, procedures and specifications associated with this unit, including, but not limited to:
 - a scientific glassblowing facility, appropriate safety equipment, materials and safe work procedures, and repair methods
 - bench burner, hand torch, micro torch and ribbon burner, gas supplies and gas economiser
 - hand tools, such as carbon paddles and mandrels, range of forceps, glass tubing gauges, angle setting jigs, calipers, glass support rollers, brass shapers, carbon rods, glass knife, stainless steel gauze, vernier calipers and other measuring tools, and strain viewer

- glassworking lathe, mechanical glass cutters and saws, and mechanical glass grinding equipment
- annealing oven
- high vacuum apparatus, including leak detection equipment, pumps and lubricants, pressure gauges/manometers, vacuum traps, vacuum manifolds, vacuum distillation apparatus and gas handling systems
- measuring and recording equipment.
- Assessors must satisfy the assessor competency requirements that are in place at the time of the assessment as set by the VET regulator.
- The assessor must demonstrate both technical competence and currency.
- Technical competence can be demonstrated through:
 - relevant VET or other qualification/Statement of Attainment AND/OR
 - relevant workplace experience.
- Currency can be demonstrated through:
 - performing the competency being assessed as part of current employment OR
 - having consulted with a laboratory about performing the competency being assessed within the last twelve months.

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