Australian Government

Department of Education, Employment and Workplace Relations

# PMBPROD391B Produce composites using resin infusion

**Revision Number: 1**

# PMBPROD391B Produce composites using resin infusion

## Modification History

Not applicable.

## Unit Descriptor

**Unit descriptor**
This competency covers the operation of resin infusion equipment to make composite products and the solving of problems.

## Application of the Unit

**Application of this unit**
This competency is typically performed by advanced operators applying knowledge of materials, product purpose and processes to the operation of resin infusion equipment to produce products conforming to requirements. It also requires using a range of well developed skills requiring some discretion and judgement to recognise and resolve a range of problems. The operator should:

- set up and start resin infusion equipment
- check settings and adjustments of equipment
- identify and plan own work requirements from production requests
- monitor equipment operation
- make appropriate adjustments to correct materials, equipment or process variations
- solve resin infusion equipment, material and process problems, seeking guidance where necessary or appropriate.
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## Licensing/Regulatory Information

Not applicable.

# Pre-Requisites

**Prerequisites**
This unit has the prerequisite of *PMBPROD291B Operate resin infusion moulding equipment*.

# Employability Skills Information

**Employability Skills**
This unit contains employability skills.

# Elements and Performance Criteria Pre-Content

| ELEMENT | PERFORMANCE CRITERIA |
|---|---|
| Elements describe the essential outcomes of a unit of competency | Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide. |

# Elements and Performance Criteria

| ELEMENT | PERFORMANCE CRITERIA |
|---|---|
| ELEMENT | Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide. |
| 1. Plan own work requirements. | 1.1 Identify the most appropriate equipment to be used for production and upstream and downstream operations from production plan or request.<br>1.2 Identify and check materials required including additives.<br>1.3 Implement measures to control hazards in line with procedures and duty of care.<br>1.4 Identify requirements for materials, quality, production, and equipment checks. |
| 2. Start resin infusion moulding process to procedures. | 2.1 Identify process settings for required product.<br>2.2 Set process to required settings.<br>2.3 Check materials are correct.<br>2.4 Take appropriate action for non-conforming materials.<br>2.5 Set up date, batch and materials markings to specifications, as required.<br>2.6 Complete pre-start checks.<br>2.7 Start up resin infusion moulding process |
| 3. Operate and make adjustments to the resin infusion process to procedures. | 3.1 Operate resin infusion equipment, noting key variables.<br>3.2 Monitor controls/displays/terminals for production and process data.<br>3.3 Take samples as required and identify product out of specification.<br>3.4 Monitor product/process quality.<br>3.5 Make adjustments to remedy faults and non-conformity to standard as required.<br>3.6 Establish a stable resin infusion process.<br>3.7 Adjust process to minimise scrap and trim.<br>3.8 Clean, adjust and check equipment damage as required. |
| 4. Shut down machine to procedures. | 4.1 Determine type of shut down.<br>4.2 Select appropriate cleaning method.<br>4.3 Clean efficiently and adequately as required. |

| **ELEMENT**<br>ELEMENT | **PERFORMANCE CRITERIA**<br>Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide. |
|---|---|
| | 4.4 Leave machine in appropriate condition and with appropriate locks, tags or notices.<br>4.5 Complete relevant documentation.<br>4.6 Ensure area is clean and clear after the shutdown, in readiness for the next start-up. |
| 5. Anticipate and solve problems. | 5.1 Recognise a problem or a potential problem.<br>5.2 Determine problems needing priority action.<br>5.3 Refer problems outside area of responsibility to appropriate person, with possible causes.<br>5.4 Seek information and assistance as required to solve problems.<br>5.5 Solve problems within area of responsibility.<br>5.6 Follow through items initiated until final resolution has occurred. |

# Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.
Application of knowledge of the materials, equipment and process sufficient to recognise material and equipment conditions which may lead to out of specification production.For example, once resin infusion begins there is very little that can be done to rectify a problem at this point. If a leak were to occur, eventhe smallest amount of air introduced could potentially destroy a composite part. There aresome cases where problems can be corrected, but the best solution is to check and monitor equipment and set up before infusion.
Knowledge of organization procedures, quality requirements at each production stage, and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards.
Application of knowledge of managing risks using the hierarchy of controlsapplied to the resin infusion process. Application of approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.
Skills to identify the range of possible causes of product faults.
Knowledge as a basis for solving processing and material problems including:

- characteristics of materials and behaviour in relation to heat, pressure and time
- function and operating principles of composites forming equipment, machine components and ancillary equipment including the mechanical, hydraulic, pneumatic, electrical and electronic principles which effect machine operation
- impact of temperature, pressure, time during cycles on product quality and production output
- phases of the resin infusion composite forming cycle and the effect of the key variables on product quality, in order to make appropriate adjustments to equipment settings. For example, the vacuum is applied while reinforcements are still dry, which allows for any possible leaks to be sought out before resin is infused. If something is not sitting properly, the vacuum need only be released and readjusted. This decreases the possibility of damaged composite products.
- changes to materials at various stages of production
- waste management and importance of non-conforming materials
- impact of variations in raw materials and equipment operation in relation to final product.
- polymer properties and their interactions with process conditions
- relationships between polymer properties and process conditions
- changes to polymer properties to better suit process requirements.
- product problems related to polymer properties
- product problems related to process conditions
- adjustments to process conditions to meet polymer and product requirements

Competence also includes the ability to:

- plan own work, including predicting consequences and identifying improvements
- maintain output and product quality using appropriate instruments, controls, test information and readings
- identify and describe own role and role of others involved directly in the process
- identify factors which may affect product quality or production output and appropriate remedies
- identify when assistance is required to solve problems.

**Language, literacy and numeracy requirements**
This unit requires the ability to read and interpret typical product specifications, job sheets and material labels as provided to operators.
Writing is required to the level of completing workplace forms and production reports.
Numeracy is required to the level of determining required weights/volumes of materials in a resin mix for different circumstances (say using a data sheet), number of layers of impregnated matrix required to yield the required product laminate thickness, and similar activities.

# 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 this training package.

**Overview of assessment**
A holistic approach should be taken to the assessment.
Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.
Where the assessee does not currently possess evidence of competency in *PMBPROD291BOperate resin infusion moulding equipment*, it may be co-assessed with this unit.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**
It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- identify critical materials properties and resin infusion process variables in relation to the process requirements and the end product
- make adjustments to the process as required
- identify and take action on problems and potential problems.

Consistent performance should be demonstrated. For example, look to see that:

- the process runs consistently and smoothly, with the minimum need for human intervention
- all safety procedures are always followed.

**Assessment method and context**
Assessment will occur on an industrial infusion moulding equipment and will be undertaken in a work-like environment.
Competence in this unit may be assessed:

- using appropriate, industrial resin infusion equipment requiring demonstration of starting, operating and completing the composite moulding process
- in a situation allowing for the generation of evidence of the ability to recognise, anticipate and respond to problems
    - by using a suitable simulation and/or a range of case studies/scenarios
    - through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.
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.

**Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.
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.

# 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. Add any 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. Where reference is made to industry codes of practice and/or Australian/international standards, the latest version must be used.

**Context**

This competency applies to manufacture of composite products using resin infusion equipment within the plastics and rubber industries.
It includes all moulds, pumps and programmable logic controllers (PLCs) if fitted and all relevant ancillary equipment integral to the composites forming process.

**Procedures**

All operations are performed in accordance with procedures.
Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

**Tools and equipment**

This competency includes use of equipment and tools such as:

- moulds, closures and fittings
- vacuum pumps and fittings (such as couplings, hoses, breathers, bleeders)
- additional equipment (such as resin bucket, resin line holder, zip-strips)
- controller (such as PLC if fitted)
- relevant personal protective equipment ( PPE)
- hand tools used in the production process (such as clamps to stop resin moving up vacuum hose)
- ancillary materials (such as release films and fabrics, sealant tapes, preforms, cores, and pre-pregs)
- material loading equipment used for loading of raw materials.

**Hazards**
Typical hazards include:

- hazardous vapours and materials
- fibres, airborne and handled
- humidity, air temperatures, radiant heat, hot moulds
- stationary and moving machinery, parts and components
- manual handling hazards.

**Problems**
'Anticipate and solve problems' means resolve a wide variety of routine and non-routine problems, using product and process knowledge to develop solutions to problems which do not have a known solution/ a solution recorded in the procedures.
Typical routine faults may include:

- resin pooling
- under-saturation of resin
- dry reinforcements not sitting flat
- leaks in vacuum bag
- poor colour dispersion
- poor surface finish
- dry spots
- vacuum switch-off timing incorrect.

Non-routine faults which may have multiple causes include:

- mould release problems
- stoppage of resin flow
- excess resin
- warping or cracking after moulding
- variations in vacuum
- variations affecting cure rate.

Typical process and product problems may include:

- resin, over or under supplied to mould
- release agents performance
- contamination
- temperature variations, affecting resin cure-rate
- blemishes
- missing detail
- warped moulds or dies
- worn or damaged mould parts or fittings
- variations in materials and/or contamination of materials.

Appropriate action for problems outside of area of responsibility may be reporting to an appropriate person.
Appropriate action for solving problems within area of responsibility includes asking questions and seeking assistance from appropriate persons/sources.

**Variables**
Key variables to be monitored include:

- operating temperatures

- cycle time (such as the resin filling time)
- output rate
- vacuum pressure
- surface finish and condition
- equipment - adjustments/setup
- product weight
- product integrity and general conformance to specification/sample.
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# Unit Sector(s)

Not applicable.