



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **PMBPROD334A Produce products using twin screw extruders**

**Revision Number: 1**

## **PMBPROD334A Produce products using twin screw extruders**

### **Modification History**

Not applicable.

### **Unit Descriptor**

#### **Unit descriptor**

This competency covers the operation and adjustment of twin screw extrusion equipment and extrusion processes and the solving of non-routine problems. It applies to extrusion processes for pipe, sheet, profile, film, cable and rod. It usually applies to products extruded from dry blend PVC powder/resin and other materials.

### **Application of the Unit**

#### **Application of this unit**

This competency is typically performed by technicians applying knowledge of materials, product purpose and processes to the operation of twin screw extrusion equipment to produce product conforming to requirements. It also requires using a range of well-developed skills requiring some discretion and judgement to recognise and solve a range of problems.

The technician will:

- start up and shutdown the extruder
- check settings and adjustments of equipment
- monitor extruder operation
- make appropriate adjustments to correct materials, equipment or process variations
- solve extruder, material and process problems, seeking guidance where necessary or appropriate.

This unit does not include:

- operation, start up and shutdown of single screw extruders, see *PMBPROD313C Produce extruded products*
- extrusion die changes - see *PMBPREP305B Change extrusion die and calibration set-up*.
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### **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

### Prerequisites

This unit of competency has no prerequisites.

## Employability Skills Information

### Employability Skills

The required outcomes described in this unit contain applicable Employability Skills. The Employability Skills Summary of the qualification(s) in which this unit is packaged will assist in identifying Employability Skill requirements.

## Elements and Performance Criteria Pre-Content

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
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

<b>ELEMENT</b> ELEMENT	<b>PERFORMANCE CRITERIA</b> 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 process, upstream and downstream operations from production plan or request. 1.2 Identify and check materials required, including additives and regrind and their amounts or percentages. 1.3 Implement measures to control identified hazards in line with procedures and duty of care. 1.4 Identify requirements for materials, quality, production and equipment checks.
2. Start up twin screw extrusion process to procedures.	2.1 Identify process settings required for product. 2.2 Set process to required settings. 2.3 Check materials are correct. 2.4 Take appropriate action for non-conforming materials. 2.5 Set up date, batch and materials markings as required. 2.6 Complete pre-start checks. 2.7 Start up ancillary equipment as required. 2.8 Start up extrusion process. 2.9 Synchronise/balance system components as required.
3. Operate and make adjustments to the twin screw extrusion process to procedures.	3.1 Operate extrusion process, noting key variables. 3.2 Monitor controls/displays/terminals for production and process data. 3.3 Take samples as required and identify product out of specification. 3.4 Monitor product/process quality. 3.5 Make adjustments to remedy faults and nonconformity as required. 3.6 Establish a stable compounding and extrusion process. 3.7 Adjust process to minimise scrap and trim. 3.8 Clean, adjust and lubricate equipment as required.
4. Shut down twin screw extruder to procedures.	4.1 Determine type of shut down. 4.2 Select appropriate purging method. 4.3 Purge efficiently and adequately as required. 4.4 Leave machine in appropriate condition and with appropriate locks, tags or notices.

<b>ELEMENT</b> ELEMENT	<b>PERFORMANCE CRITERIA</b> Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
	4.5 Complete relevant documentation. 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. 5.2 Determine problems needing priority action. 5.3 Refer problems outside area of responsibility to appropriate person, with possible causes. 5.4 Seek information and assistance as required to solve problems. 5.5 Solve problems within area of responsibility. 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 foreign material in the polymer feed leading to black spots in the product.

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 the knowledge of managing risks using the hierarchy of controls applied to the extrusion process. Application of approved hazard control, safety procedures, the use of PPE in relation to handling materials, equipment operation and cleanup.

Knowledge as a basis for solving processing and material problems, including:

- characteristics of materials and behaviour in relation to heat, pressure, flow rate and time
- function and operating principles of twin screw extruder equipment, machine components and ancillary equipment (eg stackers, haul off, saw/cutter, printing, embossing, coil winder, packaging)
- requirements for compounding within the extruder
- critical process variables such as temperature, torque, power
- impact of extruder machine speed, torque, temperature, pressure, time, haul-off speed, on product quality and production output
- operation and adjustment of vacuum system and the venting of volatiles
- the relationship between the type of extruder and the materials being extruded
- nature of mechanical, hydraulic, pneumatic, electrical and electronic principles which affect machine operation and product development
- processing behaviours of the materials extruded in the workplace
- impact of variations in raw materials and equipment operation in relation to final product
- changes to materials at various stages of production
- waste management and importance of non-conforming materials.

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 extrusion process
- identify factors which may affect product quality or production output and appropriate remedies
- identify when assistance is required to solve problems.

Distinguish between causes of faults such as:

- routine product extrusion faults - burn marks, flow marks, poor surface finish, poor colour dispersion, blistering, colour contamination, black spots
- incorrect quantity of materials
- contaminated materials/additives
- equipment faults.

### **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.

Basic numeracy is required, eg to determine how many 2 kg, 3 kg and 5 kg bags are needed to make up a requirement for 50 kg.

## **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 *PMBPROD213B Operate extruders*, 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 extrusion process characteristics in relation to the process requirements and the end product
- make adjustments to the process as required
- identify and take appropriate action on problems and potential problems.

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

- extrusion production quality and output standards are met consistently the process runs consistently and smoothly, with the minimum need for human intervention
- all safety procedures are adhered to.

### **Assessment method and context**

It is preferred that assessment takes place on an industrial extruder in a work-like environment.

Competence in this unit may be assessed:

- by using an appropriate, industrial twin screw extrusion system requiring demonstration of start-up, operation and shutdown procedures
- 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.

## Resource implications

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.

## 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 all work environments and sectors within the plastics, rubber and cablemaking industry. It includes the operation of all relevant ancillary equipment where that equipment is integral to the extrusion 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:

- twin screw extruder equipment and components (such as main drive, gear box, thrust assembly, adapter, gate, breaker plate, screen pack, doser, screw/s, barrel, heaters, thermocouples)
- vacuum pump, vacuum system
- extrusion dies (eg rod, sheet, pipe, profile and cable)
- twin screw extruders, including those with parallel, tapered or other screw configurations
- auxiliary equipment (eg water pump, feeders, hopper loader, pelletiser, dehumidifiers)
- tools for taking samples
- relevant personal protective equipment

### Materials

This unit applies primarily to dry blended PVC powder, where the materials are 'compounded' within the extruder. For other materials, refer to *PMBPROD313C Produce products using single screw extruders*.

### Hazards

Typical hazards include:

- spills
- dusts/vapours
- slip and fall (eg due to spilt granules)
- temperature (eg due to heated barrel, head and die)



- volatiles vented from the extruder
- hazardous materials, including decomposing polymer during start up and shut down
- moving equipment (eg moving moulds, robots and ancillary equipment)
- manual handling hazards
- equipment operations.

### **Problems**

'Anticipate and solve problems' means resolve a wide range 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 include:

- burn marks
- flow marks
- poor surface finish
- poor colour dispersion
- blistering
- colour contamination
- black spots
- dimensional changes
- high reversion
- ovality
- bowing.

Non-routine faults, which may have multiple causes include:

- product distortion
- plateout
- residual stresses
- intermittent faults.

Typical process and product problems may include:

- die/tooling problems such as damage or build-up
- equipment malfunction
- variations in temperatures, pressures, torque, speeds and times
- vacuum performance and volatile venting rates
- variations in material properties and/or contamination of materials
- variation in material flow rates
- processing problems.

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:

- differences between actual and set temperatures
- speeds, including screw speed and haul-off
- colour and uniformity
- surface finish and appearance
- product finished thickness

- output rate
- product integrity and general conformance to specification/sample.
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## **Unit Sector(s)**

Not applicable.