



Australian Government

Department of Education, Employment and Workplace Relations

FDFTEC4004A Apply basic process engineering principles to food processing

Revision Number: 2

FDFTEC4004A Apply basic process engineering principles to food processing

Modification History

September 2012: clarified pre-requisite information.

Unit Descriptor

Unit descriptor	This unit of competency provides an introduction to process engineering concepts. It covers the skills and knowledge required to map production processes, measure outputs (yields, material variances) and apply an understanding of the basic principles of systems and equipment commonly used in the food processing industry.
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Application of the Unit

Application of the unit	Application of this unit includes systems and equipment used for heat transfer, refrigeration, pumping and evaporation/drying.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
	FDFOP2030A	Operate a process control interface
	FDFTEC4007A	Describe and analyse data using mathematical principles* <i>FDFOP2015A Apply principles of statistical process control*</i> <i>FDFOP2061A Use numerical</i>

Prerequisite units		
		<i>applications in the workplace</i>

Employability Skills Information

Employability skills	This unit contains employability skills.
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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.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Map a production process	1.1. The scope of a production process to be mapped is identified 1.2. Appropriate process mapping symbols are selected and used 1.3. A map is developed that identifies the relationship of each step in the process
2. Calculate yields and efficiencies of a production process	2.1. Inputs to and outputs of a production processing system are identified 2.2. Information required to monitor performance of a production process is collected 2.3. Calculate yields, efficiencies and material variances
3. Apply principles of fluid flow to a production process	3.1. Fluid properties that affect flow are identified 3.2. Components and related equipment used in the pumping system are identified 3.3. Features of the system design that affect performance of the pumping system are identified 3.4. The effect of pumping on the fluid properties is identified 3.5. The operating capacity of pumping systems used in the production process is established 3.6. Procedures for the safe use of pumping equipment are reviewed and/or established
4. Apply principles of heat transfer to a production process	4.1. Types of heat transfer are identified 4.2. Methods and related equipment used to transfer heat are identified 4.3. Types of heat transfer media are identified 4.4. Operating principles of cooling, chilling and freezing processes are identified 4.5. The effect of heat transfer on product/material properties is identified 4.6. The operating capacity of heat transfer equipment used in the production process is established 4.7. Procedures for the safe use of heat transfer equipment are reviewed and/or established
5. Apply principles of evaporation to a production process	5.1. Methods and related equipment used for evaporation are identified 5.2. The effect of evaporation on product/material properties is identified 5.3. Tests used to determine the concentration of a liquid are identified 5.4. The operating capacity of evaporation equipment used in the production process is established

ELEMENT	PERFORMANCE CRITERIA
	5.5.Procedures for the safe use of evaporation equipment are reviewed and/or established
6. Apply principles of drying to a production process	6.1.Methods and related equipment used for drying are identified 6.2.The effect of drying on product/material properties is identified 6.3.Tests used to determine moisture content of materials and/or product are identified 6.4.The operating capacity of drying equipment used in the production process is established 6.5.Procedures for the safe use of drying equipment are reviewed and/or established
7. Apply principles of process control to management of production processes	7.1.Sensors and instrumentation providing input information to the control system are located 7.2.Consequences of a system malfunction are identified

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Ability to:

- establish and apply process mapping protocols and symbols used in the workplace to describe a production process
- identify the inputs to a production process and the outputs of a production process
- identify the data required to calculate yields, efficiencies and material variances
- locate sources of information in the workplace, such as printing reports from information management systems
- calculate yields, efficiencies and material variances using software or application of a formula
- identify properties of fluids that affect fluid flow, including viscosity, temperature and size, and distribution of particulates
- identify types of pumping equipment appropriate for different types of liquids
- identify tests or measures taken to monitor operation of pumps and related performance information
- apply information to describe pump system capacity in a production process
- identify features in the pumping system design that affects pumping efficiencies, including length of pipework, number and placement of valves and fittings, height of inlet and discharge points, internal surface and diameter of the pipe
- identify possible effects of pumping on liquid properties
- identify operational and safety features of pumps used in a production process, including inspections required to identify signs of faulty performance and/or wear
- review and/or establish procedures to define safe pump operation and maintenance
- identify heat transfer methods and types of equipment commonly used in the food industry, such as:
 - retorts
 - jacketed vessels/kettles
 - heat exchangers, including plate, tubular and scraped surface
 - cooling tunnels
 - refrigeration circuits
 - chillers
 - freezers
- identify typical applications in the food industry and the heat transfer medium used for each heat transfer method
- identify the effects of heat transfer on properties of materials/products, including possible consequences where the heat transfer process is not operated within specified parameters

REQUIRED SKILLS AND KNOWLEDGE

- distinguish between conduction, convection and radiation in the application of heat
- identify the properties of heat and steam, including an understanding of the terms latent heat, saturated and supersaturated steam
- identify the heat transfer requirements and equipment used in a production process, including mapping the stages and equipment used in a heat transfer process and holding stages
- identify tests or measures taken to monitor performance of heat transfer equipment and related expression of performance information
- apply information to describe heat transfer process capacity in a production process
- identify operational and safety features of heat transfer equipment used in a production process, including inspections required to identify signs of faulty performance and/or wear
- review and/or establish procedures to define safe operation and maintenance of heat transfer processes and equipment used in a production process
- identify the effects of evaporation on product, such as:
 - physical property changes such as crystallisation, increased solids/viscosity
 - intensification of flavour and concentration of acids
 - changes in microbiological characteristics due to application of heat and reduction of moisture/water activity
- identify the equipment components of an evaporation process, such as:
 - heat transfer surface (rising film, falling film, forced circulation and plate)
 - vapour separator
 - vapour condenser
 - vacuum unit
- map the stages and equipment used in an evaporation process
- identify tests or measures taken to monitor performance of an evaporation process and related expression of performance information
- apply information to describe evaporation process capacity in a production process
- identify tests carried out to determine material/product solids and related terms (common test methods include baume, refractive index and brix)
- identify the processing parameters, time required to achieve the target result and steam required
- identify operational and safety features of evaporation equipment used in a production process, including inspections required to identify signs of faulty performance and/or wear
- review and/or establish procedures to define safe operation and maintenance of evaporation processes and equipment used in a production process
- identify the effects of drying on product, such as:
 - changes that occur at each stage of the drying process
 - reduction in weight and bulk
 - changes in microbiological characteristics due to application of heat and

REQUIRED SKILLS AND KNOWLEDGE

reduction of moisture/water activity

- identify the equipment components of a drying process, such as:
 - hot air drying (fluidised bed driers, spray driers, belt trough driers, and air lift driers)
 - freeze drying (vacuum)
- map the stages and equipment used in a drying process
- identify tests or measures taken to monitor performance of a drying process and related expression of performance information
- describe drying process
- identify tests carried out to determine process outcomes on material/product
- identify the processing parameters, time and energy required to achieve the target result
- identify operational and safety features of drying equipment used in a production process, including inspections required to identify signs of faulty performance and/or wear
- review and/or establish procedures to define safe operation and maintenance of drying processes and equipment used in a production process
- identify the main types of sensors used in food processing to provide input data to control systems and how these sensors operate
- identify the location and operation of sensors and related data input devices to a control system on equipment used in a production process
- for a given production process, identify the criticality of system control and consequences of a system malfunction or power outage
- develop and/or review procedures to be followed in the event of a system malfunction or power outage
- use communication skills to interpret and complete work information to support operations of work team or area
- demonstrate and support cooperative work practices within a culturally diverse workforce

Required knowledge

Knowledge of:

- the basic operating features and components of pumps commonly used and typical applications, such as:
 - rotodynamic (centrifugal) pumps
 - positive displacement pumps, including reciprocating piston pumps, rotary pumps (including gear and lobe pumps), screw pumps, eccentric rotor pumps (including progressive cavity or mono pumps) and flexible vane pumps
- related components of the pumping system, including valves, taps and pipework, and where required, Australian standards and workplace protocols for indicating materials carried by pipework
- features in the pumping system design that affects pumping efficiencies, including

REQUIRED SKILLS AND KNOWLEDGE

- length of pipework, number and placement of valves and fittings, height of inlet and discharge points, internal surface and diameter of the pipe
- the following terms:
 - pressure and pressure drop
 - velocity
 - head
- typical applications in the food industry and the heat transfer medium used
- equipment components of a drying process
- heat transfer requirements and equipment used in a production process
- tests carried out to determine process outcomes on material/product
- operational and safety features of drying equipment
- inspections required to identify signs of faulty performance and/or wear
- main types of sensors used in food processing to provide input data to control systems and how these sensors operate

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, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

Assessment must be carried out in a manner that recognises the cultural and literacy requirements of the assessee and is appropriate to the work performed. Competence in this unit must be achieved in accordance with food safety standards and regulations.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Evidence of ability to:

- map a production process
- apply engineering principles to a food production context
- perform required calculations.

Context of and specific resources for assessment

Assessment must occur in a real or simulated workplace where the assessee has access to:

- production process and related equipment, manufacturers' advice and operating procedures
- methods and related software systems as required for collecting data and calculating yields, efficiencies and material variances appropriate to production environment
- tests used to report relevant product/process information and recorded results.

Method of assessment

This unit should be assessed together with core units and other units of competency relevant to the function or work role.

Guidance information for assessment

To ensure consistency in one's performance, competency should be demonstrated on more than one occasion over a period of time in order to cover a variety of circumstances, cases and responsibilities, and where possible, over a number of assessment activities.

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. 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) may also be included.

Policies and procedures

Uses of processing equipment and related work processes are consistent with company policies and procedures, regulatory and licensing requirements, legislative requirements, and industrial awards and agreements and takes account of occupational health and safety (OHS) and environmental impact

Calculation

Calculation of yields, efficiencies and material variances may involve:

- use of software programs and systems, such as SAP
- application of a relevant formula

Unit Sector(s)

Unit sector

Technical

Competency field

Competency field

Co-requisite units

Co-requisite units		

