



Australian Government

Department of Education, Employment and Workplace Relations

MEM234013A Plan and design engineering-related manufacturing processes

Release: 1

MEM234013A Plan and design engineering-related manufacturing processes

Modification History

New unit

Unit Descriptor

This unit of competency covers the skills and knowledge required to plan and design engineering-related manufacturing processes, including consideration of client requirements, process control, sustainability, lean systems, product manufacturability, system maintainability, facilities, services, plant and tooling requirements, supply chains, material and product flow, continuous improvement and constraint and contingency management, occupational health and safety (OHS) and regulatory requirements.

Application of the Unit

This unit applies to the design of manufacturing processes across all forms of manufacturing and engineering. Design activities may also include design rectification or modifications of an existing engineering-related manufacturing process. It is suitable for manufacturing system designers or manufacturing operations personnel, and those pursuing engineering or related qualifications and careers.

Prior or concurrent experience in production control techniques, manufacturing plant and processes, product and process improvement techniques, manufacturing plant and processes and evaluation of business performance, computing technology and mathematics is required.

The unit does not apply to technical leadership in project, operational or engineering management. Where these skills are required see unit MEM234001A Plan and manage engineering-related project or operations.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

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.

Elements and Performance Criteria

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| 1 | 1.1 | Clarify product performance objectives and specifications with client |
| | 1.2 | Determine parameters to the brief or contract |
| | 1.3 | Determine OHS, regulatory, sustainability and environmental issues relevant to the proposed manufacturing process |
| | 1.4 | Confirm client's production system capability and provide initial advice on feasibility |
| | 1.5 | Discuss 'time to market' issues with the client and establish timelines |
| | 1.6 | Decide, in conjunction with client, whether the proposed project should fit in with an existing production system or a new or redesigned process be established for the product |
| | 1.7 | Prepare a product development flow chart |
| 2 | Develop manufacturing process design options and prepare concept proposals | |
| | 2.1 | Analyse client's company's production system, if applicable |
| | 2.2 | Generate and validate a range of manufacturing process design solutions using current design methodologies that may include automated design tools |
| | 2.3 | Evaluate and rank options against client's criteria for quality, cost, application of automation, maintainability and regulatory requirements |
| | 2.4 | Determine, social and sustainability implications of solutions |

- 2.5 Document and present concept proposals to client
 - 2.6 Provide feedback on product manufacturability
 - 2.7 Evaluate concept proposals with client and select preferred process
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- 3 Design manufacturing process
 - 3.1 Determine manufacturing process control, maintenance management, human resources and continuous improvement systems implications for final design
 - 3.2 Finalise manufacturing process design, including material and product flow, logistics, transfers, new or modified facilities, services, plant and tooling layout
 - 3.3 Ensure preparation of all required documentation, drawings, specifications and instructions
 - 3.4 Consult with client and stakeholders to obtain sign-off on design
 - 3.5 Monitor installation and commissioning of manufacturing process with stakeholders and make any necessary adjustments to design

Required Skills and Knowledge

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

Required skills

Required skills include:

- interpreting features of product performance objectives and specifications
- planning and designing manufacturing facilities, services, plant, tooling and process, and process control systems
- advising clients based on discipline knowledge and OHS and regulatory standards
- preparing a product development flow chart
- establishing budget and control measures and designing schedule within project control plan
- determining sustainability, OHS, regulatory and risk management requirements
- reviewing software options, facilities and logistics, services, labour, plant and tooling requirements
- modelling and calculating using automated design tools and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- incorporating maintenance management, human resources, information management and continuous improvement systems requirements
- implementing systems thinking, continuous improvement and constraint and contingency management options
- calculating estimated and actual time to market
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions
- investigating faults in existing manufacturing process designs and proposing solutions

Required knowledge

Required knowledge includes:

- advanced and current manufacturing process design methodologies
- standardisation techniques
- economic, social and sustainability implications
- market competitiveness factors
- lean manufacturing principles
- automated design tools
- project planning, scheduling and control techniques, including budgeting and costing
- characteristics of, and differences between, jobbing, flexible and mass production, and continuous process
- implications of maintenance management and human resource systems for engineering-related planning processes
- production information flow required for and from a manufacturing process

- regulatory environment requirements, applicable standards and codes of practice
- process design documentation, drawings, specifications and instructions
- techniques for:
 - continuous improvement
 - problem solving and decision making
 - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • plan and design manufacturing facilities, services, plant, tooling and process, and process control system • interpret features of product and processing options and parameters to the brief or contract • advise client based on discipline knowledge and OHS and regulatory standards • establish budget and control measures and design schedule within design project control plan • research current manufacturing process design techniques, product manufacturability, process design, layout and automation options, lean systems and supply chain value analysis • determine sustainability, OHS, regulatory and risk management requirements • review software options, facilities, services, plant and tooling requirements of products, stock control, warehousing, buffer and emergency stock, material and product flow, transfer operations, information flow and manufacturing process control, process maintenance management, labour requirements and skills distribution • model and calculate using appropriate software and validation techniques • generate and evaluate a range of solutions for feasibility against design criteria • incorporate maintenance management, HR, information management and continuous improvement systems • implement systems thinking, continuous improvement, and constraint and contingency management options • communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design • document design with required drawings, specifications and instructions.
Context of and specific resources for assessment	• Full assessment of this unit would normally need to be undertaken on the job in the context of a commercial design project and software. Assessment of some elements of the manufacturing design process may be possible off the job providing full plant simulation facilities and software are

	available that reflect realistic workplace situations. • The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • 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.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application. • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. • Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

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.

Client	Client may be: internal or external to the designer's organisation
Appropriate technical and professional assistance	Appropriate technical and professional assistance may include: - technical support and advice relating to elements which have intrinsic dangers, for example: - high pressure - energised fluid vessels - high temperatures and heat energy capacity - wiring or devices with high current or voltages above extra low voltage - professional support for technologies, such as: - specialist electric motor drives and controllers - specialist materials, plastics, metal alloys and nano materials - special processes, foundry, alloy welding, heat treatment, sealing and fastening - professional services for: - finance, accounts and tax - insurance and legal - training and human resources (HR)
Parameters to the brief	The design brief may include the design of new manufacturing processes or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include: - daily and seasonal production rates - requirements for shift work - provisions for increasing or reducing production rates - expected quality levels - other special features and limits in the design brief
OHS, regulatory, sustainability and environmental issues	OHS, regulatory, sustainability and environmental issues may include: - OHS Acts and regulations - relevant standards - industry codes of practice - risk assessments

	• registration requirements • safe work practices • minimising ecological and environmental footprint of process, plant and product • maximising economic benefit of process plant and product to the organisation and the community • minimising the negative OHS impact on employees, community and customer • state and territory regulatory requirements
Production systems	Production systems may include: • suppliers • materials handling systems • manufacturing processes • labour force capability • distribution systems
Design methodologies	Design methodologies may include: • design for assembly • design for automated assembly • design for manufacturability • design for quality • design for maintainability • concurrent engineering
Automated design tools	Automated design tools may include: • computer-aided design (CAD) • computer-aided engineering (CAE) • solid modelling • finite element analysis • group technology (GT) • computer-aided process planning (CAPP) • expert system tools • cost analysis and financial modelling tools
Product manufacturability	Product manufacturability may be enhanced by concurrent product and process design. Product design for manufacturability includes: • consideration of manufacturing processes and plant in the product design process, such as the use of group technologies
Continuous improvement	Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.

	Continuous improvement techniques may include: • balanced scorecard • current and future state mapping • measuring performance against benchmarks • process improvement, problem solving and decision making • data management, generation, recording, analysing, storing and use of software • training for improvement system participation • technical training
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Unit Sector(s)

Engineering practice

Custom Content Section

Not applicable.