Australian Government

Department of Education, Employment and Workplace Relations

MEM234005A Design hydrodynamic pumping systems

Release: 1

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Modification History

New unit

Unit Descriptor

This unit of competency covers the design of new or modified hydrodynamic pumping systems, including the layout; choice of motor and pumps, pipes and valves; the fluid source and delivery requirements of the system. It includes sustainability implications, occupational health and safety (OHS) and regulatory requirements.

Application of the Unit

This unit applies to the design of hydrodynamic pumping systems across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification or modifications of an existing design. It applies to pumping system designers and maintenance personnel, and those pursuing engineering or related qualifications and careers.

Prior experience in the application of scientific principles, evaluation of hydrodynamic systems, mathematics, computer software and file handling is required.

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

1	Clarify the design brief and elaborate the specification	1.1	Establish required features and performance parameters of hydrodynamic pumping system
		1.2	Confirm technical, commercial and environmental parameters to the brief or contract
		1.3	Determine stakeholders to be consulted in design process
		1.4	Assess OHS, regulatory, sustainability or environmental issues relevant to the design task
		1.5	Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility
2	Evaluate design analysis and prepare concept proposals	2.1	Appraise initial qualitative and quantitative analysis of the design task
		2.2	Carry out required detailed modelling and calculations using appropriate software and validation techniques
		2.3	Generate a range of solutions to the design brief, including choice of equipment, layout, fluid source and delivery
		2.4	Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements
		2.5	Determine, social and sustainability implications of solutions
		2.6	Present concept proposals to client

3	Design hydrodynamic pumping system	3.1	Evaluate concept proposals with client
		3.2	Ensure that design solution is optimised with respect to the system specifications
		3.3	Finalise selected design, including equipment, layout, fluid source and delivery, and other features desired by client
		3.4	Ensure preparation of all required documentation, drawings, specifications and instructions
		3.5	Consult with client and stakeholders to obtain sign-off on design
		3.6	Monitor installation and commissioning 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 plant and equipment and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- determining OHS, regulatory and risk management requirements
- investigating and measuring
- investigating faults in existing designs and arriving at solutions
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- designing hydrodynamic pumping systems solution using current design methods
- communicating, negotiating and reviewing with stakeholders and clients throughout the process
- documenting design with drawings, specifications and instructions

Required knowledge

Required knowledge includes:

- research and investigation methods
- 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
- contemporary engineering design methods
- relevant engineering design software
- design, research, modelling and computational methodologies applied to hydrodynamic pumping systems
- documentation, drawings, specifications and instructions
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and regstration requirements
- fundamentals of hydrodynamics, including properties of substances and conservation of energy principles
- types of pumps, such as centrifugal, rotary and reciprocating

- pumping systems specifications, such as head equations, performance curves, valves, flow rates and efficiency
- pump placements
- cavitations
- rotodynamic pump performance parameters and specifications
- series and parallel pumps
- practical pump installations and operation problems
- pumping special fluids, such as viscous fluids, slurries, Newtonian and non-Newtonian fluids

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: • interpret features of plant and equipment and parameters to the brief or contract • advise client based on discipline knowledge and OHS and regulatory standards • research sustainability implications and current industrial design techniques • determine OHS, regulatory and risk management requirements • investigate and measure • model and calculate using appropriate software and validation techniques • generate and evaluate a range of solutions for feasibility against design criteria • design hydrodynamic pumping solution • communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design • document design with drawings, specifications and instructions.
Context of and specific resources for assessment	• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects 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.

Parameters to the design brief	The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include: These may include: • determination of the degree of innovation and creativity expected by the client • design process limits and budgets • product cost limits and budgets • performance specification • equipment availability, capacities and restrictions • specified administrative, communication and approval procedures • 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
Client	Client may be: • internal or external to the designer's organisation
Range of solutions	Range of solutions may include those that: • satisfy the technical requirements of the design brief • are within budget • are able to be manufactured • meet any regulatory requirements • minimise environmental and sustainability impacts
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
System specifications	System specifications may include, but are not limited to: • pump types • system head requirements • pump performance requirements • duty point • flow rates • cavitation issues and control • power and efficiency • energy cost of pumping • valves for flow control • component layout

Unit Sector(s)

Engineering practice

Custom Content Section

Not applicable.