



Australian Government

MEM23125A Evaluate maintenance systems

Release 1

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Modification History

Release 1 - New unit. Replaces MEM23094A, but not equivalent.

Unit Descriptor

This unit of competency covers the evaluation of maintenance management systems, including analysing the effect of any action or breakdown on achieving strategic objectives. The unit requires evaluation of maintainability and reliability of assets, maintenance management systems, personnel participation, monitoring, responding to indicators, prioritising action, sustainability, lean systems maintenance requirements, work health and safety (WHS) compliance, risk minimisation, facilities and services maintenance, costing and data analysis, and performance indices.

Application of the Unit

This unit applies to evaluation of both corrective and preventative maintenance systems for plant, facilities and services used in industry. Evaluations may be required for variety of purposes and may apply to evaluations of a maintenance system for a whole process, plant or enterprise. The unit is suitable for operations managers, maintenance personnel and those pursuing maintenance or manufacturing, engineering or related technical qualifications and careers.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MEM23004A	Apply technical mathematics
MEM14088A	Apply maintenance engineering techniques to equipment and component repairs and modifications
MEM14092A	Integrate maintenance fundamentals into an engineering task

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.

Elements and Performance Criteria

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| 1 | Determine scope of maintenance processes | 1.1 | Determine parameters of maintenance management system to be evaluated |
| | | 1.2 | Assess engineering principles, skills and techniques required by tasks |
| | | 1.3 | Assess software and software techniques required for evaluation task |
| | | 1.4 | Identify stakeholders to be consulted |
| | | 1.5 | Determine compliance requirements of WHS and regulatory requirements, codes of practice, standards and risk assessment requirements for maintenance processes |
| | | 1.6 | Investigate sustainability implications of maintenance processes |
| 2 | Identify principles and techniques required by evaluation | 2.1 | Review trends in maintenance practice and equipment with particular emphasis on integrated management systems |
| | | 2.2 | Review maintenance system and implementation strategies for relevance to evaluation |
| | | 2.3 | Identify features and functions of maintenance information systems |

- 3 Evaluate maintenance management systems
 - 3.1 Evaluate organisational maintenance safety and risk management procedures
 - 3.2 Evaluate maintenance processes for sustainability
 - 3.3 Evaluate asset reliability, maintainability and performance against against lean indices, production targets and system design parameters
 - 3.4 Audit plant, facilities, services and systems for provision of parts and consumables, adequacy of labour, skills and technical support
 - 3.5 Evaluate maintenance system data generation and collection and reporting for performance analysis required for process improvement
 - 3.6 Evaluate the use of maintenance management software
 - 3.7 Evaluate manual and automated condition monitoring, testing and analysis
 - 3.8 Evaluate implementation of maintenance management systems techniques, including up-time preparations, spares availability, tooling and equipment readiness
 - 3.9 Evaluate asset categorisation, maintenance scheduling and prioritising
 - 3.10 Evaluate implementation of maintenance continuous improvement processes
- 4 Report results
 - 4.1 Record results of scoping, principles and techniques identification and evaluation of maintenance systems
 - 4.2 Provide documentation, such as layouts, schedules, performance analysis and flow charts

Required Skills and Knowledge

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

Required skills

Required skills include:

- identifying WHS, regulatory and risk management compliance requirements for maintenance systems
- investigating sustainability implications of maintenance processes
- identifying and reviewing features and functions of maintenance and information systems, trends and implementation strategies and software
- evaluating organisational maintenance safety and risk management procedures, sustainability, asset reliability and maintainability, lean indices, system design parameters, data generation and collection, reporting, storage and analysis, condition monitoring, implementation, facilities and services maintenance response systems, asset categorisation, maintenance scheduling and prioritising, and continuous improvement
- auditing plant, facilities and services, systems for provision of parts and consumables, and adequacy of labour, skills and technical support for maintenance activities
- reporting and documenting results of scoping, principles and techniques identification and evaluation of maintenance systems, layouts, schedules, performance analysis, flow charts, calculations, programs and files

Required knowledge

Required knowledge includes:

- maintenance requirements of various organisations and industry trends
- features of integrated management systems within organisations and industry trends:
 - monitoring, adjustment, lubrication, consumables, breakdown maintenance required by typical plant equipment and facilities
 - labour and training requirements for typical maintenance systems
 - maintenance performance indices, such as mean time between failure (MTBF) and overall equipment efficiency (OEE), and relationship to maintenance strategies, business financial objectives and maintenance system design criteria, such as life cycle cost and break-even point
 - maintenance management systems, such as terotechnology
 - maintenance management within ILS
- sources of information, software and hardware required by maintenance systems
- systems thinking in relation to maintenance, failure analysis, problem solving and decision making processes, constraint and contingency management
- compliance requirements of WHS, regulations and standards relevant to maintenance

- risk management requirements and analyses for maintenance of plant, including failure mode effects analyses (FMEA)
- maintainability and reliability related to life cycle costing, system design, cost predictions and break-even analysis
- audit processes for plant, facilities and services, provision of parts and consumables, labour, skills and technical support
- maintenance system data generation and collection, reporting and response processes, data storage and performance analysis for process improvement against performance parameters, such as MTBF and OEE
- manual and automated condition monitoring, testing and analysis
- maintenance system and implementation strategies, including corrective, preventative, predictive, precision, proactive, total productive and reliability centred maintenance
- facilities and service maintenance response systems
- asset categorisation and maintenance scheduling and prioritising
- organisational maintenance safety procedures, such as:
 - risk management procedures
 - WHS committees
 - standard operating procedures
 - safe work methods statements (SWMS)
 - material safety data sheets (MSDS)
 - permits
 - standards related to significant maintenance or plant modifications
- terotechnology
- engineering, plant, facilities and services maintenance requirements
- continuous process improvement
- data generation, analysis, storage and feedback
- reporting techniques and documentation required

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	A person who demonstrates competency in this unit must be able to evaluate maintenance systems and processes for safe, cost-effective and sustainable operation.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> • investigate sustainability implications of maintenance processes • identify and review features and functions of maintenance and information systems, trends and implementation strategies and software • evaluate safety and risk management, sustainability, asset reliability and maintainability, lean indices, system design parameters, data generation, collection, reporting, storage and analysis, condition monitoring, facilities and services maintenance response systems, asset categorisation, maintenance scheduling and prioritising, and continuous improvement, implementation • audit plant, facilities and services, provision of parts and consumables provision, labour, skills and technical support • report and document results.
Context of and specific resources for assessment	<ul style="list-style-type: none"> • 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, 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	<ul style="list-style-type: none"> • Assessment must satisfy the endorsed Assessment

	<p>Guidelines of the MEM05 Metal and Engineering Training Package.</p> <ul style="list-style-type: none"> • 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 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 not only able 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.

Appropriate technical and professional assistance	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> • technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> • high pressure • energised fluid vessels • high temperatures and heat energy capacity • wiring with high current control voltages above extra low voltage • professional support for technologies, such as: <ul style="list-style-type: none"> • specialist electric motor drives and controllers • specialist materials, plastics, metal alloys and nano
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	<p>materials</p> <ul style="list-style-type: none"> special processes, foundry, alloy welding, heat treatment, sealing and fastening
WHS, regulatory requirements and enterprise procedures	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> WHS Acts and regulations relevant standards codes of practice from Australian and overseas engineering and technical associations and societies ministerial directives risk assessments registration requirements safe work practices state and territory regulatory requirements
Standards and codes	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular maintenance system</p>
Systems thinking	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
Continuous improvement	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> 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 systems participation

	<ul style="list-style-type: none"> • technical training
Constraints and contingencies	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> • financial • organisational, procedural or cultural • physical constraints, such as limits to resources, limits to site access or logistical limitations
Maintenance systems	<p>Maintenance systems include:</p> <ul style="list-style-type: none"> • breakdown maintenance • preventive maintenance • predictive maintenance (on-condition) • precision maintenance • proactive maintenance • reliability centred maintenance • total productive maintenance
Lean systems maintenance	<p>Lean maintenance systems aim at maximising machine and process up-time, minimising waste and costs, maintaining quality and delivery and customer service. Maintenance processes and procedures are subject to continuous improvement and are set to complement engineering business objectives</p>
Integrated maintenance management systems (terotechnology)	<p>Terotechnology is an integrated maintenance management system combining management, financial, engineering and other practices for cost-effective maintenance of assets, such as plant, equipment and facilities. It involves the design for reliability and maintainability, manufacture, installation, commissioning and eventual write-off and replacement of the assets. Data is collected and analysed to assess the reliability, life cycle costs and productivity of the assets against the design criteria.</p> <p>Reliability relates to the productivity of assets, that is, the maintenance of service or product output (quantities) and its quality within cost parameters. In the context of terotechnology, the cost parameters include life cycle costs</p>
Integrated logistic support (ILS)	<p>ILS is the management and technical process through which supportability and logistic support considerations are integrated into the design and taken into account throughout the life cycle of systems/equipment and by which all elements of logistic support are planned, acquired, tested, and provided in a timely and cost-effective manner. Maintenance systems and schedules are part of this process</p>
Maintenance priority	<p>Assets may be prioritised for maintenance according to different criteria and categories, such as:</p>

	<ul style="list-style-type: none"> • critical assets: <ul style="list-style-type: none"> • high cost of replacement • unavailability of replacement or spares • failure will or may immediately endanger life and property • essential to quality • high cost of disruption to production or service delivery • failure would require an immediate response • semi-critical assets: <ul style="list-style-type: none"> • shutdown produces partial loss of capacity • asset is regulated • difficult to repair • alternative asset may be available • some spare parts are stored • medium priority for response • non-critical: <ul style="list-style-type: none"> • breakdown affects minimal production loss • asset used infrequently • parts readily available • lowest priority attended to as time and resources allow
Maintenance activity audit	<p>An audit of plant, facilities and services may be used to identify maintenance requirements with details listed in the maintenance database according to different criteria, such as:</p> <ul style="list-style-type: none"> • criticality, locality, machine type and maintenance activities required • skills and techniques required for corrective actions • sources and availability of spares • specialised corrective skills and techniques for specific equipment
Maintainability	<p>Maintainability refers to the design of product, machines and processes with an objective of reducing maintenance downtime, resources, specialist tools and skills required to maintain reliability. Design techniques may include modular design for ease of replacement, provision of bypass opportunities to isolate the failure for repair while processes continue or provision of substitute equipment</p>
Monitoring and testing	<p>Monitoring and testing may be undertaken for both corrective and proactive and predictive maintenance. Tests may include:</p> <ul style="list-style-type: none"> • manual inspections • instrumented monitoring • lubricant testing (tribology)

	<ul style="list-style-type: none"> • lidar (light for atmospheric particle detection) • gas chromatography • mandatory inspections • performance and condition monitoring • radiographic examination for material imperfections • microwave for non-metallic solid or liquid test • camera and scope techniques
Maintenance system data	<p>Maintenance system data may include:</p> <ul style="list-style-type: none"> • asset ID and plant warranties • procedural documents: <ul style="list-style-type: none"> • monitoring and preventative maintenance schedules • SWMS • MSDS • work permits • monitoring reports and system measurements • maintenance actions and costs • spares inventory control

Unit Sector(s)

Competency field

Unit sector Engineering science

Custom Content Section

Not applicable.