Australian Government

Department of Education, Employment and Workplace Relations

MSATMINS501A Inspect a range of complex measuring instruments

Revision Number: 1

MSATMINS501A Inspect a range of complex measuring instruments

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to apply National Test Procedures to determine whether a complex measuring instrument is suitable for trade use. It involves the ability to perform lengthy calculations to assess instrument performance and conduct tests that may require coordination of a range of resources over long durations in hazardous environments. This unit also involves auditing the performance of verifiers who have previously tested and marked instruments for use.

Application of the Unit

Application of the unit	This unit of competency is applicable to trade measurement inspectors appointed under national measurement legislation who may inspect a range of complex measuring instruments as part of their allocated duties. Complex measuring instruments are used in a wide range of heavy industries. For example, automatic rail weighbridges, belt weighers, totalising hoppers and liquid petroleum gas (LPG) flow meters are used throughout the mining, road/rail freight and petroleum/gas industry sectors. Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These are found at the end of this unit of competency under the section 'This competency in practice'.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for inspection	1.1. Identify and evaluate the type of instrument to be inspected 1.2. Access and correctly interpret documentation required for the inspection 1.3. Identify and access test equipment, products and consumables required for the inspection 1.4. Ensure test equipment is suitable for its purpose in accordance with applicable legislation and organisational procedures 1.5. Store and transport equipment in accordance with organisational procedures and industry best practice 1.6. Access and evaluate any previous test results for the trader 1.7. Identify workplace health and safety issues relevant to the inspection 1.8. Develop an inspection strategy to maximise resources and minimise time required for complex tests
2. Liaise with the trader to schedule complex tests	2.1. Discuss inspection arrangements with site controller where applicable 2.2. Identify relevant local workplace, health and safety issues and implement appropriate control strategies 2.3. Discuss the inspection strategy with the trader to minimise its impact on the trader's normal operations 2.4. Arrange site clearances and suitable scheduling for tests 2.5. Negotiate access to trader's equipment, materials and support personnel required for testing to be available on site 2.6. Arrange for any equipment to be provided by the trader, if required, by the National Test Procedure
3. Initiate inspection	3.1. Identify the site contoller, explain/review the purpose of the inspection and, if required, produce formal identification 3.2. Review inspection strategy to ensure there is minimal disruption to the public and/or trader 3.3. Communicate inspection strategy to all personnel involved 3.4. Identify locations for product return or disposal if applicable

ELEMENT	PERFORMANCE CRITERIA
	3.5. Evaluate the impacts of the operating environment on the instrument performance or test results and, where applicable, implement corrective actions 3.6. Identify operational factors impacting on instrument performance or test result and, where applicable, implement corrective actions
4. Evaluate complex measuring instrument performance	4.1. Identify the maximum permissible errors for the instrument from the legislative requirements 4.2. Manage and review resources to maintain inspection timelines 4.3. Provide effective communication to ensure relevant personnel are informed of variations to the inspection strategy and inspection progress 4.4. Check instrument for compliance with the appropriate Certificates of Approval 4.5. Inspect the instrument in accordance with relevant National Test Procedure and appropriate National Measurement Institute policy
5. Analyse inspection results	5.1. Perform specified calculations to determine a performance result for the instrument with appropriate accuracy, precision and significant figures 5.2. Use graphical and statistical analysis to determine unknowns as necessary 5.3. Ensure calculations are consistent with estimations and reasonable expectations 5.4. Evaluate results against prescribed performance criteria and determine if the instrument is suitable for trade use in accordance with legislative requirements
6. Conduct a verifier performance audit	6.1. Identify the scope of the verifier audit 6.2. Identify the expected outcomes of the verifier audit 6.3. Assess the verifier's performance against the expected outcome 6.4. Analyse any variances from the expected outcomes to identify any isolated or systemic problems
7. Report inspection results	7.1. Display the inspection result on the instrument in accordance with legislative requirements 7.2. Use test reports to present inspection results in the required format 7.3. Complete inspection documentation in accordance with legislative requirements and organisational

ELEMENT	PERFORMANCE CRITERIA
	procedures 7.4. Communicate inspection results within the specified time and in accordance with organisational guidelines 7.5. Recommend follow-up actions as appropriate.
8. Act on non-compliance	8.1. Select applicable enforcement action for the non-compliance in accordance with legislative requirements, organisational policy and procedures 8.2. Inform traders of non-compliances and consequences of failing to have them corrected 8.3. Implement enforcement action in accordance with legislative requirements, organisational policy and procedures 8.4. Maintain the rights of the trader at all times

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- accessing, interpreting and applying a range of documents for the inspection of complex measuring instruments including:
  - national measurement legislation
  - intermediate National Test Procedures
  - Certificates of Approval
  - National Measurement Institute inspection policy
  - Australian Standards
  - industry codes of practice
  - correction tables for volume, density and pressure for a range of liquids
  - national and international design rules
  - pattern approval documents
- accessing and interpreting Certificates of Verification for a wide range of reference standards
- performing inspection over extended durations up to five days in non-routine and hazardous environments
- using advanced communication and negotiation skills to:
  - explain purpose of the inspection
  - inform traders of non-compliances and consequences of failing to rectify
  - access external equipment and resources to complete the inspection
- explain inspection procedures and outcomes to traders, verifiers and managers
- accessing, transporting, setting up, validating, using and maintaining a broad range of test equipment and reference standards
- identifying and evaluating environmental factors that may impact on performance of complex measuring instruments
- organising large equipment to be dispatched ahead of inspection visit
- conducting lengthy tests and recording results with close attention to detail and accuracy
- performing complex calculations involving:
  - fractions, decimals, ratios, proportions and percentages
  - evaluation of formulae containing powers, exponents and logarithms functions
  - use of scientific notation, correct units and correct number of significant figures
  - calculation of uncertainties
  - preparation and interpretation of linear, semi-log and log-log graphs
  - interpretation of statistical quantities, such as mean, median, mode, range, variance and standard deviation

REQUIRED SKILLS AND KNOWLEDGE

- determination of regression line equations and correlation coefficients
- preparation and interpretation of more complex control charts and frequency distribution plots
- analysing performance results over a broad range of operating conditions
- identifying non-compliances with national measurement legislation relating to instrument or verifier performance and initiate appropriate enforcement action including warning, infringement notice, undertaking, injunction and prosecution
- identifying potential trading practice non-compliance with national measurement legislation and initiating an appropriate inspection strategy
- planning complex tasks
- developing/implementing an efficient inspection strategy that minimises disruption to traders, the public, technicians, contractors, employees, colleagues and suppliers
- demonstrating professionalism and maintaining the rights of the trader at all times
- solving unexpected problems and non-routine issues
- working safely which may include applying basic first aid, confined space entry, working with hazardous materials, working safely in hazardous environments, working with heavy machinery, Australian Institute of Petroleum (AIP) cold work clearance permit, safety induction, working at heights and biosecurity issues

Required knowledge

- general chemical and physical principles and concepts including:
  - physical states (solid, liquid gas), weight, mass, gravity and density
  - pressure, pressure differential, backpressure and head pressure
  - fluid flow
  - flashpoint, boiling point and ice point
  - viscosity
  - temperature effects and coefficients of expansion
- basic knowledge of the design, application and function of components used in complex measuring instruments
- knowledge of the operating procedures across a range of environments including laboratories, retail, commercial, office, manufacturing, industrial, mining, construction, medical, chemical, petroleum, farming and abattoirs
- knowledge of metrological terms and terminology specific to complex measuring instruments such as:
  - maximum permissible errors, maximum permissible difference and maximum permissible variation
  - traceability
  - repeatability
  - uncertainty, error of measurement and error of indication
  - meter creep
  - hose dilation

REQUIRED SKILLS AND KNOWLEDGE

- temperature correction
- linearisation
- gas elimination
- national measurement legislation applicable to complex measuring instruments
- detailed knowledge of National Test Procedures and operating procedures for equipment and reference standards used in job role including:
  - purpose of test
  - test conditions and possible environmental impacts on performance of the instrument
  - key preparation/measurement steps in test method
  - calculation steps to give results in appropriate units and precision
  - maximum permissible errors for complex measuring instruments under inspection
- procedures for completing inspection documentation
- organisational policy and procedures for inspecting instruments
- safety principles and procedures relevant to instruments
- basic first aid and site safety induction if required

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	Competency must be demonstrated in the ability to perform consistently at the required standard for any class of complex instrument listed in the Range Statement.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors should ensure that candidates can: • identify, access and apply test procedures • identify and use suitable reference standards • evaluate and adjust the impact of the operating environment on the performance of the instrument • analyse test results to determine the instrument's suitability for verification (trade use) • identify the scope of a verifier performance audit and assess results with expected outcomes • audit the performance of verifiers of complex measuring instruments • identify and implement additional inspection strategies for non-instrument related breaches of national measurement legislation • recognise and act on non-compliance • maintain the security and confidentiality of data in accordance with organisational and regulatory requirements • report results in the required formats and expected timeframe.
Context of and specific resources for assessment	This unit of competency is to be assessed in the workplace or simulated workplace environment. This unit of competency may be assessed with: • MSATMREF301A Use and maintain reference standards. Resources may include: • access to a complex instrument, test equipment and reference standards • computer and relevant software and/or organisation information management system • Certificates of Approval for the instrument

EVIDENCE GUIDE	
	• relevant legislative and organisational procedures.
Method of assessment	The following assessment methods are suggested: • questions to assess understanding of relevant procedures, licensing requirements, trader obligations and remedial actions • review of inspection reports and verifier performance audit reports prepared by the candidate • feedback from supervisors and peers regarding the candidate's ability to inspect the performance of instruments in accordance with legislative and organisational procedures • observation of the candidate conducting an inspection. In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly. Questioning techniques should suit the language and literacy levels of the candidate.
This competency in practice	Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. An inspector has been given the task of inspecting a bulk flowmetering system at an oil company distribution terminal. In preparation, the inspector evaluates the instrument nominated for inspection, identifies and accesses appropriate documentation for the inspection, identifies and accesses equipment, evaluates previous inspection data and develops an inspection strategy.The inspector visits the terminal to discuss the proposed inspection strategy with the site controller. During this discussion, the inspector discovers that access to the instrument has been restricted and modifications will have to be made to the area surrounding the instrument. The site controller engages a contractor to make the necessary modifications and agrees on an inspection strategy that will minimise disruption to terminal operations. On completion of the modifications, the inspector returns to the terminal to inspect the bulk flowmetering system. The site controller has arranged for all the resources

EVIDENCE GUIDE	
	identified at the inspection strategy meeting to be available. Prior to commencing any testing, the inspector holds a meeting with all personnel involved in the inspection and describes the inspection strategy. A fitter who will be operating the instrument identifies a problem and offers a solution. The inspector agrees and adjusts the inspection strategy accordingly.At the completion of the testing, the inspector uses the recorded data in combination with a variety of data derived from correction tables and complex mathematical formulae to determine performance result for the instrument.These results confirm the instrument's performance is outside the acceptable maximum permissible errors. The inspector informs the site controller of the outcome and issues a formal warning explaining that the instrument cannot be used for trade until it has been corrected and verified by a licensed verifier.During a follow up visit, the inspector confirms the instrument has been repaired and verifies it.

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.	
Prescribed performance criteria for instruments	Prescribed performance criteria for instruments may include: • design is in accordance with the appropriate Certificates of Approval • performance meets the criteria described in the Certificates of Approval, National Test Procedure and legislation
Appropriate documentation	Where reference is made to documentation, it is expected the latest version will be used. Appropriate documentation may include: • reference standards • Certificates of Verification • Certificates of Approval for complex instruments • test procedures for verifying complex instruments • organisational test reports • organisational procedures e.g. company quality assurance manual • National Measurement Act • occupational health and safety (OHS) regulations, guidelines and procedures material data safety sheets • equipment manuals and warranty, supplier catalogues and handbooks
Certificates of Approval	Certificates of Approval may include: • any Certificate issued under the National Measurement Regulations approving the pattern of a complex measuring instrument as being suitable for trade
Enforcement action	Enforcement action may include: • formal warnings

RANGE STATEMENT	
	• infringement notice • formal undertaking • injunction • prosecution
Test equipment	Test equipment may include: • reference standards of measurement • equipment other than reference standards of measurement such as weighing instruments, pumping units, control instruments, two way communication, hoses, fittings, rail wagons, trains and tankers • LPG cylinders
Legislation may include	Legislation may include: • national measurement legislation • applicable Commonwealth, state and territory OHS legislation
National Measurement Institute policy	National Measurement Institute policy may include: • test procedure variations between a verification, in-service or audit inspection • bulletin • instruction • determination
National Test Procedures for complex instruments	National Test Procedures for complex instruments may include: • non-automatic weighing machines >3 tonne • LPG dispensers • bulk LPG flowmetering systems • flowmetering systems tested using the master meter or gravimetric methods • automatic rail weighbridges • continuous totalising automatic weighing instruments (belt weighers) • totalising hopper weighing instruments • any other test procedure prescribed by the National Measurement Institute
OHS and environmental management requirements	OHS and environmental management requirements refer to:

RANGE STATEMENT	
	• all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or Federal legislation. These requirements must not be compromised at any time • all operations assume the potentially hazardous nature of samples and require standard precautions to be applied • where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council and State and Territory Departments of Health
Operating environmental impacts	Operating environmental impacts may include: • vibration • wind • heat • dust • electromagnetic interference • out of level
Specified calculations	Specified calculations may include: • calculations involving fractions, decimals, ratios, proportions and percentages • evaluation of formulae containing powers, exponents and logarithms functions • use of scientific notation, correct units and correct number of significant figures • calculation of uncertainties • preparation and interpretation of linear, semi-log and log-log graphs • calculation and interpretation of statistical quantities, such as mean, median, mode, range, variance and standard deviation • determination of regression line equations and correlation coefficients • preparation and interpretation of more complex control charts and frequency distribution plots
Records	Records may include: • test reports

RANGE STATEMENT	
	• safety procedures • a history of equipment calibration and test results
Complex instruments	Inspectors may be required to test and mark any of the classes of instruments from the following list. Complex instruments may include: • non-automatic weighing machines >3 tonne • LPG dispensers • LPG bulk flowmetering systems • flowmetering systems tested using master meter or gravimetric methods • automatic rail weighbridges • continuous totalising automatic weighing instruments (belt weighers) • totalising hoppers weighing instruments • any other complex measuring instrument prescribed by the National Measurement Institute

Unit Sector(s)

Unit sector	Trade Measurement

Competency field

Competency field	

Co-requisite units

Co-requisite units		