



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **UETDRDS48A Analyse and appraise power system fault and outage data**

**Release: 1**

## UETTDRDS48A Analyse and appraise power system fault and outage data

### Modification History

Not applicable.

### Unit Descriptor

#### Unit Descriptor

#### 1) Scope:

##### 1.1) Descriptor

This Competency Standard Unit covers the data gathering and analysis of system outages and plant failures. It includes the recommending of solutions and maintenance plans to ensure system security.

### Application of the Unit

#### Application of the Unit 2)

This Competency Standard Unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training.

### Licensing/Regulatory Information

#### License to practice 3)

The skills and knowledge described in this unit may require a licence/registration to practice in the work place subject to regulations for undertaking of electrical work. Practice in workplace and during training is also subject to regulations directly related to Occupational Health and Safety, electricity/telecommunications/gas/water industry safety and compliance, industrial relations, environmental protection, anti discrimination and training. Commonwealth, State/Territory or Local Government legislation and regulations may exist that limits the age of operating certain equipment.

## Pre-Requisites

**Prerequisite Unit(s)** 4)

**Competencies** 4.1)

Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

Where pre-requisite pathways have been identified. All competencies in the Common Unit Group must be have been completed plus all the competencies in one (1) of the identified Pathway Unit Group(s):

Common Unit Group

Unit Code	Unit Title
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE104A	Solve problems in d.c. Circuits
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in electromagnetic devices and related circuits
UETTD RDS39A	Prepare and manage detailed construction plans for electrical power system infrastructure
UETTDREL11A	Apply sustainable energy and environmental procedures
UETTDREL16A	Working safely near live electrical apparatus
UETTD RIS62A	Implement and monitor the power system organisational OHS policies, procedures and programs

**Prerequisite Unit(s)** 4)

UETTDRIS63A Implement and monitor the power system environmental and sustainable energy management policies and procedures

**Literacy and numeracy skills** 4.2)

Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 “Literacy and Numeracy”

Reading 5      Writing 5      Numeracy 5

**Employability Skills Information****Employability Skills** 5)

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

**Elements and Performance Criteria Pre-Content**

6) Elements describe the essential outcomes of a competency standard unit      Performance Criteria describe the required performance needed to demonstrate achievement of the element.  
Assessment of performance is to be consistent with the Evidence Guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Plan for and coordinate the analysis and appraisal of fault and outage data	<p>1.1 OHS practices/procedures and environmental and sustainable energy procedures, which may influence the analysis and appraisal of fault and outage data, are reviewed and determined.</p> <p>1.2 Purpose of the analysis/appraisal is established and expected outcomes of the work are confirmed with the appropriate personnel.</p> <p>1.3 Organisational established procedures on policies and specifications for the design are obtained or established with the appropriate personnel.</p> <p>1.4 Equipment/tools and personal protective equipment are selected and coordinated based on specified requirements and established procedures</p> <p>1.5 Work is prioritised and sequenced for the most efficient and effective outcome following consultation with others for completion within acceptable timeframes, to a quality standard and in accordance with established procedures</p> <p>1.6 Risk control measures are identified, prioritised and evaluated against the work schedule</p> <p>1.7 Relevant work permits are secured to coordinate the performance of work according to requirements and/or established procedures</p> <p>1.8 Resources including personnel, equipment, tools and personal protective equipment required for the job are identified, scheduled and coordinated and confirmed in a safe and technical working order</p> <p>1.9 Liaison and communication issues with other/authorised personnel, authorities, clients and land-owners are resolved and activities coordinated to carry out work</p> <p>1.10 Site is prepared according to the work schedule and to minimise risk and damage to property,</p>

**ELEMENT****PERFORMANCE CRITERIA**

		commerce, and individuals in accordance with established procedures
	1.11	Personnel participating in the work, including plant operators and contractors, are fully briefed and respective responsibilities coordinated and authorised where applicable in accordance with established procedures
	1.12	Positioning of road signs, barriers and warning devices is planned in accordance with requirements
2	Carry out and coordinate the analysis and appraisal of fault and outage data	2.1
		Circuit/systems modelling is used to evaluate alternative proposals as per established procedures.
		2.2
		OHS and sustainable energy principles, functionality and practices to reduce the incidence of accidents and minimise waste are incorporated into the project in accordance with requirements and/or established procedures
		2.3
		Analysis \ Appraisal decisions are made on the basis of safety and effective outcomes according to requirements and/or established procedures
		2.4
		Mathematical models of solutions for system outages and plant failures are used to analyse the effectiveness of the finished project as per requirements and established procedures
		2.5
		Technical advice is given to potential hazards, safety risks and control measures so that monitoring and preventative action can be undertaken and/or appropriate authorities consulted, where necessary, in accordance with requirements and established procedures
		2.6
		Essential knowledge and associated skills are applied to analyse specific data and compare it with compliance specifications to ensure completion of the project within an agreed timeframe according to requirements.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
	2.7 Solutions to non-routine problems are identified and actioned using acquired essential knowledge and associated skills according to requirements
	2.8 Quality of work is monitored against personal performance agreement and/or established organisational and professional standards.
3 Complete and coordinate the analysis and appraisal of fault and outage data	3.1 Final inspections of the analysis/appraisal are undertaken to ensure they comply with all requirements and include all specifications and documentations needed to complete the design brief.
	3.2 Appropriate personnel are notified of completion and reports and/or completion documents are finalised.
	3.3 Reports and/or completion documents are submitted to relevant personnel/organisations for approval and, where applicable, statutory or regulatory approval.
	3.4 Approved copies of documents are issued and records are updated in accordance with established procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**8) Essential Knowledge and Associated Skills (EKAS):** This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of analysing and appraising fault and outage data.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

**KS01-TDS48A**      Power system fault and outage data

Evidence shall show an understanding of the analysis and appraisal power system fault and outage data design of power system zone substations modifications to an extent indicated by the following aspects:

**T1**      Principles of high voltage encompassing:

- Commonwealth/State/Territory legislation, Standards, codes, supply authority regulations and or enterprise requirements associated with working on or near High Voltage
- Electrical and electrostatic principles related to high voltage lines - relationship of current, voltage and resistance as related to transmission lines and relationship of phase voltage and respective line voltages, production of an electric field encompassing: units, effect of distance, potential of an object within the field and the effect of distances to the potential
- HV insulators - construction of a disc insulator, construction of a polymeric insulator, effects of an electrical field on disc insulators, identification of the number of disc insulators needed for a single line voltage, performance of a failed disc insulator on the line and the system, determining the minimum allowable number of discs per string for each line voltage in the system before bare-hand work is to proceed, techniques in detecting a failed disc in a string, techniques in using appropriate tools and equipment to test a string and methods of recording data
- Effects of electrostatic induction on the human body - relationship of the resistance of a human body to different levels of current and voltage, relationship of a human body to an electric field and effects of electrostatic induction on bare-hand work
- Application of Faraday's cage - effects of a body, advantages and description of the Faraday's cage used by bare-hand live-line workers
- Safety precautions working on or near High Voltage electrical apparatus - safe approach distances from live line, identification of OHS hazards, assessing and controlling risks, types, selection, maintenance, storage and uses of personnel protective equipment, permit to work systems and isolation procedures, types and function of specialised live working equipment, safe working policies, procedures and practices when using and operating specialised equipment, methods of using specialised equipment and emergency response and rescue including First Aid etc
- Effects of lightning and switching surges on performance off string insulators -



## REQUIRED SKILLS AND KNOWLEDGE

health effects to workers and methods used to alleviate surges on transmission lines

- Magnetic field - difference between magnetic fields and electrostatic fields, source of magnetic field, techniques in locating, measuring and analysing known sources of magnetic fields, reasons for monitoring magnetic field exposure and techniques used to monitor magnetic fields

T2 Electrical equipment associated with protection and control schemes encompassing:

- Types and applications of electrical equipment encompassing characteristics and capabilities - the following schemes, overcurrent, frame leakage, cooling, buchholz, DC supplies, restricted earth, sensitive earth fault, CB fail, reclose, DC frame leakage, CEL Fail, under frequency load shed and earth fault

T3 Installation of switchgear and associated equipment encompassing:

- Types and function of various switchgear - isolators, air-break switches, gas-filled switches, vacuum type, links, fuses, oil disconnectors, fuse switches circuit breakers, operating characteristics, advantages and disadvantages of different types switchgear, installation procedures, earthing, requirements and techniques
- Types of equipment - transformers, reactors, regulators, capacitors, relays, surge arrestors, fault indicators and mobile generators
- Installation procedures for switchgear and equipment - standards, codes, legislation, supply authority regulations and or enterprise requirements, assembly and erecting procedures, earthing requirements and techniques and pole mounted locations
- Maintenance procedures for switchgear and equipment - diagnosing and rectifying faults according to electricity supply industry standards and procedures
- Testing and commissioning - electricity supply industry standards and procedures

T4 Low voltage switching principles encompassing:

- Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to switching of low voltage to a given schedule
- Requirements for the use of manuals, system diagrams/plans and drawings - types, characteristics and capabilities of electrical apparatus, use, characteristics and capabilities of specialised tools and testing equipment and LV network interconnectors source of possible backfeed
- Low voltage switching techniques - identifying hazards, assessing and controlling risks associated with LV switching operations, electrical access permit(s), operational procedures and earthing procedures
- Personnel protective equipment (PPE) for LV switching

T5 High voltage switching principles encompassing:

- Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to switching of high voltage to a given schedule
- Requirements for the use of manuals, system diagrams/plans and drawings - types, characteristics and capabilities of electrical apparatus, use, characteristics and

## REQUIRED SKILLS AND KNOWLEDGE

capabilities of specialised tools and testing equipment and network interconnectors  
source of possible backfeed

- Role of the HV switching operator
- Operational forms, access authorities and permits associated with HV switching - types of operational forms, access authorities and permits, purpose and procedure for operational forms, access authorities and permits
- Use and operation of equipment associated with HV overhead and substation equipment - test instruments, sticks, interrupters and arc strangles
- Types and categories of HV switchgear
- Application, function and operating capabilities of switchgear
- Restrictions pertaining to HV switching equipment
- Procedures for the isolation of HV transmission main and working earths
- Earthing HV electrical apparatus practices and procedures for access - purposes of “Operational” and additional work part “on-site” earths, factors determining the location and effectiveness of “Operational” earthing, acceptable industry procedures and personal protective equipment
- High voltage switching techniques
- Operate switching apparatus - identifying hazards, assessing and controlling risks associated with HV switchgear operation, systematic and defensive techniques, mobile radio procedures and double isolation procedures

T6 High voltage fault switching principles encompassing:

- Primary causes, effects and types of HV electrical faults
- HV protection devices - main components, types, categories, applications and functions
- Basic principle of operation of HV system protection devices
- Protection co-ordination and protection “zoning”
- HV feeder auto-reclosing suppression - function and application
- Circuit condition requirements and switching considerations when paralleling and separating HV feeders

T7 High voltage distribution transformer principles encompassing:

- Operation of HV distribution transformers - principle governing factors for transformer ratings, protection and alarms, operating limitations and the relationship between transformer and HV fuse rating, purpose and principle operation of HV distribution transformer tap changers, HV distribution transformer and transformer — cable combination switching practices, paralleling requirements, isolation and earthing procedures for access, common distribution transformer and associated electrical apparatus faults
- HV underground switching equipment - arc strangles, switch operation, load break elbows, switching cubicles, canister fuses, bayonet fuses, F and G switching cubicles, voltage indicators and phasing testers

T8 Feeder automation system encompassing:

## REQUIRED SKILLS AND KNOWLEDGE

- Function of feeder automation system and the main components
- Operation procedure for a remote field device from a local control station
- Functions of “System Control and Data Acquisition” (SCADA) (or any other relevant Data Acquisition and Control) systems and its main components
- SCADA system security interlocks and access restrictions
- SCADA system operation when switching apparatus or retrieving data via a remote access device such as; Remote Access Terminal (RAT), Dial Up Voice Annunciated System and Local Control Station
- Function of the main components of a local/remote control system
- Operation of a field devices using SCADA systems via a Remote Access Terminal (RAT), Dial Up Annunciated System and Local Control Station

T9 Methodology in analysing network event records encompassing:

- Commonwealth, State/Territory and local government legislation, supply authority, regulations Standards, codes, and or enterprise requirements applicable to the analysis of critical events
- Requirements for the use of critical event data, manuals, system diagrams/plans and drawings
- Sources of critical event data
- Analyse and assess network event records and relevant data.-the use of event records and data to analyse and develop optimal network restoration strategies taking into account public and employee safety, enterprise reliability guidelines and resource availability
- Safety policies, procedures and precautions related to critical events - Occupational Health and Safety hazards and precautions, identification of OHS hazards, assessing and controlling risks, types, selection, maintenance, storage and uses of personnel protective equipment, checking integrity of the system for minimum disruption, effective communication methods and chain of command and emergency response and rescue including First Aid procedures.

## Evidence Guide

### EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit of competency and must be read in conjunction with the Performance Criteria and the range statement of the unit of competency and the Training Package Assessment Guidelines.

The Evidence Guide forms an integral part of this Competency Standard Unit and shall be used in conjunction with all component parts of this unit and, performed in accordance with the Assessment Guidelines of this Training Package.

#### Overview of Assessment 9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accord with Industry and, Regulatory policy in this regard.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Hence, sources of evidence need to be 'rich' in nature so as to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practiced. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

**Critical aspects of evidence required to demonstrate competency in this unit 9.2)**

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit is based, shall be considered holistically. Each element and associated Performance Criteria shall be demonstrated on at least two occasions in accordance with the “Assessment Guidelines – UET12UET12”. Evidence shall also comprise:

- A representative body of Performance Criteria demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the Performance Criteria and range; and
  - Apply sustainable energy principles and practices as specified in the Performance Criteria and range; and
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit to such an extent that the learner’s performance outcome is reported in accordance with the preferred approach; namely a percentile graded result, where required by the regulated environment; and
  - Demonstrate an appropriate level of employability skills; and
- Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures; and
- Demonstrated performance across a representative range of contexts from the prescribed items below:

<b>Range of tools/equipment/materials/procedures/workplaces/other variables</b>		
<b>Group No</b>	<b>The minimum number of items on which skill is to be</b>	<b>Item List</b>

	<b>demonstrated</b>	
A	Writing of reports relating to each of the following, recommending relevant action(s):	Zone substation faults Distribution feeders faults Distribution substation faults
B	At least one occasion	Dealing with an unplanned event by drawing on essential knowledge and associated skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

### **Context of and specific resources for assessment 9.3)**

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual analysis and appraisal of fault and outage data

In addition to the resources listed above, in Context of and specific resources for assessment, evidence should show demonstrated competency working realistic environment and a variety of conditions.

### **Method of assessment 9.4)**

This Competency Standard Unit shall be assessed by methods given in Volume 1, Part 3 “Assessment Guidelines”.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this Competency Standard Unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and associated skills described in this unit.

**Concurrent  
assessment and  
relationship with  
other units**      **9.5)**

There are no recommended concurrent assessments with this unit, however in some cases efficiencies may be gained in terms of learning and assessment effort being concurrently managed.

## Range Statement

### RANGE STATEMENT

**10)** This relates to the unit of competency as a whole providing the range of contexts and conditions to which the Performance Criteria apply. It allows for different work environments and situations that will affect performance.

This Competency Standard Unit shall be demonstrated in relation to the analysis and appraisal of fault and outage data and may include the following:

Relevant protection systems, both HV and LV (fuses and circuit breakers); distribution feeders/networks (overhead and underground); substations and transformers; HV switchgear; LV switchgear.

The following constants and variables included in the element/Performance Criteria in this unit are fully described in the Definitions Section 1 of this volume and form an integral part of the Range Statement of this unit:

- Appropriate and relevant persons (see Personnel)
- Appropriate authorities
- Appropriate work platform.
- Assessing risk
- Assessment
- Authorisation
- Confined space
- Diagnostic, testing and restoration.
- Documenting detail work events, record keeping and or storage of information.
- Drawings and specifications
- Emergency
- Environmental and sustainable energy procedures
- Environmental legislation.
- Environmental management documentation.
- Established procedures.
- Fall prevention
- Hazards
- Identifying hazards
- Inspect
- Legislation
- MSDS
- Notification.
- OHS practices
- OHS issues
- Permits and / or permits to work



**RANGE STATEMENT**

- Personnel.
- Quality assurance systems.
- Requirements.
- Safe design principles
- Testing procedures
- Work clearance systems

**Unit Sector(s)**

Not applicable.

**Competency Field**

**Competency Field**            **11)**  
Design