

1. Learning Specification Details		
Title:	Fault Finding and Diagnostic Techniques	
Code:	LSTTS502A	
Training Package(s) Title and code:	Electricity Supply Industry Transmission, Distribution and Rail Sector Training Package (UET06) – Version 1	
Applicable EKAS Clause Number(s) and title(s) applicable to this LS	T2.11.41	Fault Finding and Diagnostic Techniques
Competency standard units aligned to this Learning Specification	<p>The principles and concepts covered in this part are directly aligned to the following competency standard unit(s) in the above referenced Training Package(s)</p> <ul style="list-style-type: none"> • UETTDRTS04A – Design testing and commissioning procedures for substation and field devices • UETTDRTS05A – Test and maintain metering schemes • UETTDRTS06A – Commission metering schemes • UETTDRTS11A – Maintain, test, and commission voltage regulating equipment • UETTDRTS14A – Install and maintain power system communication equipment <p>Note: Refer to Training Package(s) Volume 2 - 2.2 Essential Knowledge and Associated Skills (EKAS) to competency standard units (CSU) to assist in confirming specific mapping information.</p>	

2. Intention of the Learning Specification					
Purpose	This part will provide the learner with the skills to perform systematic fault isolation and identification by applying diagnostic techniques.				
Suggested duration	It is anticipated 20 hours of structured/supervised learning will be required to impart this part. Note: This duration includes the time taken to impart and assess the learning content areas. It does not include the necessary workplace assessment and experience that augments learning in this part and before competence is determined.				
Learning sequence [Delete inappropriate sentence]	<p>✓ There is no prerequisite to this learning specification.</p> <p>While no pre-requisites have been identified for the purpose of sound educational practices it is suggested that in planning the learning sequence the EKAS Clauses of any listed pre-requisite CSU should be analysed for independency</p> <p>✓ Before undertaking this specification a learner is to have completed the following learning specification(s) or equivalent:</p> <ul style="list-style-type: none"> • [Insert LS Code(s)] – [Insert LS Title(s)] 				
Language, Literacy and Numeracy advice	Learners are best equipped to achieve outcome in this LS if they have reading, writing, and numeracy skills indicated by the following scales. (Refer to Training Package Vol 2 Part 3 for scale definitions)				
	Reading	4	Writing		Numeracy
Intended use of this specification	<p>Learning specifications have been designed:</p> <ol style="list-style-type: none"> 1. for learners who undertake an approved and prescribed competency development program/plan (e.g. apprenticeship, traineeship, cadetship, approved and accredited course/programs), and/or 2. to augment a Work Performance Specification (WPS) for the requisite competency standard unit. <p>Note: Learning specifications may stand alone for delivery purposes. However, where it is used to support competency development against competency standard units such learning specifications will be augmented by a Work Performance Specification. For detailed information refer to the industry approved competency development training model applicable for the respective Training Package – visit EE-Oz website: www.ee-oz.com.au</p>				

3. Learning Specification Content Areas

Content title	Content topics	Learning objectives:
1. Concepts and principles of fault finding	<ul style="list-style-type: none"> • Software/firmware functions awareness • Use of system knowledge and history • Known failure modes and trends • System and subsystems structures • System signals/status indicators • Action threshold warnings versus catastrophic failure • Component ratings/upgrades • Use of handbooks, specifications, fault pathways 	<p>Learners should be able to meet the following learning objectives:</p> <ol style="list-style-type: none"> a. Describe the function of Software and Firmware in relation with intelligent electronic devices (IEDs) b. List typical failures that could cause equipment to malfunction in a particular way c. Interpret technical drawings to identify purpose and function of individual components in complete scheme d. Analyse logic diagrams and settings to predict expected signals/indicators for specific fault conditions e. Group given failures into critical and non-critical groups f. Explain why specific failures are critical or non-critical g. Describe the significance of Primary- and Secondary Plant ratings h. Explain the significance of given resources to track a specific fault condition

<p>2. Techniques to perform fault finding</p>	<ul style="list-style-type: none"> • Principles of analytical questioning • Techniques in drawing valid conclusions from first observations • Concepts of broad first-line testing • Disassembly/reassembly techniques and care • Techniques for isolation to appropriate level encompassing <ul style="list-style-type: none"> • half-split • module/function isolation (kernel technique) • substitution • diagnostic software • Requirements for the use of manuals, system diagrams/plans, drawings, handbooks, specifications and fault pathways 	<ul style="list-style-type: none"> a. Demonstrate how a client/operator will be questioned to obtain specific information b. Explain how to link valid conclusions from first observations in a given situation c. Demonstrate how broad first-line testing will be used to identify a faulty component d. Demonstrate how a device will be disassembled and re-assembled during fault finding e. Explain the different isolation techniques used to isolate to an appropriate level f. Demonstrate how a given fault condition will be identified and isolated/fixed, by using given resources
<p>3. Considerations to minimise cost and downtime</p>	<ul style="list-style-type: none"> • Factors affecting field versus workshop repair costs • Scheduling minor/major repair activities, downtime • Implications of temporary repairs • Consideration of/responsibility for, avoidance of further damage • Relative costs of repair and replacement encompassing <ul style="list-style-type: none"> • remaining life • ongoing maintenance • additional benefits of replacement equipment, e.g. improved productivity, quality 	<ul style="list-style-type: none"> a. Identify the factors which can affect the cost of field- or workshop repairs b. Draw up a maintenance schedule for maintaining specific primary or secondary equipment c. Discuss the implications of temporary repairs to equipment d. Describe how further damage will be avoided during temporary repairs e. Discuss the factors that will influence the decision to replace or repair equipment

-
- | | | |
|--|---|--|
| 4. Data interpretation, reports and recommendations | <ul style="list-style-type: none">• Interpretation of specific test results: cause/effect• Data interpretation, expected versus actual• Recording and reporting/advising• Feedback to design/production/installation processes | <ul style="list-style-type: none">a. Explain how specific test results will be used to interpret the fault conditionb. Describe how data will be used to decide if a fault condition existsc. Write a formal report to explain a given fault conditiond. Give an informal presentation to a third party, explaining findings and recommendations on a fault condition |
|--|---|--|
-

4. Assessment Strategy

Assessment methods

Assessment for this learning specification shall be progressive, reflecting a holistic approach for the purpose and outcomes intended in this learning and assessment specification.

To ensure content reliability, assessment should be cumulative and progressive and in accordance with the industry-preferred *Competency Development Learning and Assessment Policy Guide*¹ - *Assessment Event*.

(Note: A sample template of Assessment Events is attached at Appendix 1 for use by EKAS LS Developers)

To ensure content validity, assessment methods and instruments should be designed in accordance with the industry-preferred *Competency Development Learning and Assessment Policy Guide* - *Table of Specification*.

(Note: A sample template Table of Specification is attached at Appendix 2 for use by EKAS LS Developers)

Conditions of assessment

Conditions of Assessment - General:

The learning and assessment shall take place in an environment that is conducive to a learner's development, and be in accord with the industry-preferred *Competency Development Learning and Assessment Policy Guide – Conditions of Assessment*.

Conditions of Assessment – OHS/OSH:

The development and assessment of essential knowledge and associated skills is to be arranged in a manner which ensures appropriate control measures of safety and regulatory requirements are in place and observed. The assessment should be in accord with the industry-preferred *Competency Development Learning and Assessment Policy Guide - OHS Conditions of Assessment*. A copy of the guide is available at the following web link: www.ee-oz.com.au, which includes links to all relevant OHS authorities.

Assessment Reporting

To ensure the reporting of assessment outcomes is in accord with the industry-preferred approach it should be in accord with the *Competency Development Learning and Assessment Policy Guide - EKAS Reporting*.

¹ A copy of the guide is available at the following web link: www.ee-oz.com.au

5. Resource requirements

General

Where this learning and assessment specification is used in an approved traineeship, apprenticeship or cadetship program learners should be advised to obtain, where available, respective EE-Oz² **User Guides** (*these detail what training and work performance the learner is required to undertake for the program*).

Resources should be sufficient for learners to carry out learning and assessment activities individually. They should include relevant occupational health and safety Acts, regulations and codes of practice, standards and other applicable guidance material;

- enterprise occupational health and safety policies and procedures, where applicable;
- personal protective equipment; and
- relevant work areas for identification of hazards and control measures.

Suggested Learning Resources/ references:

Suggested minimum resources and references required for quality outcomes are detailed below:

Facilities: [describe facilities to be used]

e.g. Comfortable training room

Equipment: [list required equipment for delivery of training]

e.g. Data projector

² EE-Oz – is ElectroComms and EnergyUtilities Industry Skills Council Ltd trading as EE-Oz Training Standards.

Texts / Manuals: [list required texts, manuals, and documents to be used by the student/trainee]

e.g. Enterprise work manuals/student workbooks/technical manuals

Reference Books: [list references used in development of LS]

e.g. Teacher/trainer guide

**Websites/
internet:**

OHS Reference advice:

Refer to the *Competency Development Learning and Assessment Policy Guide - OHS Conditions of Assessment* guide, which is available at the following web link: www.ee-oz.com.au. The guide includes links to all the relevant OHS authorities' websites within Australia. Users can access appropriate OHS legislative advice and associated guidance material.

Other: [list / describe any other learning aids to be used]

e.g. Video – “*Worker dangers: Don’t be shocked to know them*”

6. EKAS LS - Development

**NETAG, ESI-
NTAG and NGTG**

EE-Oz Training Standards key advisory bodies to the Industry Sector Councils for Electrotechnology/Communications, Electricity, and Gas.

and Maintenance	role
	<p>They are NETAG³, ESI-NTAG⁴ and NGTG⁵.</p> <p>Each is responsible for supporting development, aligning, amending, and approving the EKAS LSs and Work Performance Specifications (WPSs) for the specific sector.</p> <p>Note: Their respective specific roles and responsibilities are further clarified in the EKAS LS and WPS <i>Competency Development Learning and Assessment Policy Guide</i>⁶. The Guide is to be used in concert with this document.</p>

³ NETAG – is the pre-eminent Electrotechnology and Communications RTO network consultative body comprising all State/Territory ITAB Executive Officers and State/Territory ETAG representatives nominated by the State/Territory ITABs from Registered Training Organisations (RTOs) servicing the industry across Australia and is chaired by the EE-Oz Training Standards. It is responsible for providing advice to the Electrotechnology Competency Advisory Council (NECAC) on matters related to technical training and learning strategies/specifications. NETAG meets formally at least twice annually to review Electrotechnology Training Package training and assessment issues. The State/Territory ETAG members are comprised of RTO practitioners and managers in the respective State/Territory. The NETAG also has established a host of discipline based Training Advisory Committees (TACs) to assist it in its deliberations on discipline and technical specific matters, and membership is open to all practitioners and interested technical operatives. Formal protocols on membership have been established for each committee.

⁴ ESI-NTAG – Electricity Supply Industry - National Training Advisory Group is the pre-eminent body for the ESI - Transmission, Distribution and Rail Training Package. It is responsible for providing advice to the EE-Oz Training Standards on matters related to technical training and learning strategies/specifications for the ESI. The ESI-NTAG meets formally at least twice annually to review Transmission, Distribution and Rail Training Package training and assessment issues and its members are comprised of employer and employee representative bodies, RTO practitioners and managers in the respective State/Territory, Regulators, all State/Territory ITAB Executive Officers, and STA representatives. Membership is open to all technical practitioners, interested technical operatives, and stakeholders across Australia and New Zealand. Formal protocols on membership have been established and any one interested should contact EE-Oz Training Standards.

⁵ NGTG – National Gas industry Training Group is the pre-eminent body for the Gas industry Training Package. It is responsible for providing advice to the EE-Oz Training Standards on matters related to technical training and learning strategies/specifications for the Gas industry. The NGTG meets formally at least twice annually to review Gas industry Training Package training and assessment issues and its members are comprised of employer and employee representative bodies, RTO practitioners and managers in the respective State/Territory, Regulators, all State/Territory ITAB Executive Officers, and STA representatives. Membership is open to all technical practitioners, interested technical operatives, and stakeholders across Australia and New Zealand. Formal protocols on membership have been established. Those interested should contact EE-Oz.

⁶ *Competency Development Learning and Assessment Policy Guide* - - A copy of the guide is available at the following web link: www.ee-oz.com.au.

Appendix 1 - Assessment Events (Sample Templates for Developers)

Note: For detailed information on how to complete this section refer to *Competency Development Learning and Assessment Policy Guide*. A copy of the guide is available at the following web link: www.ee-oz.com.au. The number of Assessment Events is dependent on Content being covered. May range from 1 to many.

Number	Summary of each Event	Event Staging When is event in course? e.g. Summative assessment after LS Content Area 1	Weighting % of assessment of total assessment assigned to each event - e.g. 10%	Critical Indicators of Performance Indicate the critical must pass requirements from each of the learning objectives
1	Assessment Event 1	After learning content area x	(#)%	
2	Assessment Event 2	After learning content area y	(#)%	
3	Assessment Event 3	After learning content area z	(#)%	
4	Assessment Event – # (if required) / * if skills assessment	As required	(#)% <i>Pass-Fail recorded only</i>	
5	Assessment Event ## – y (if required)	As required	(#)%	
	Final assessment*	On completion of learning	(#)%	
The final aggregate must be at least - <u>xx</u>%				
<p><i>Note 1:</i> * Where skills are assessed for performance as part of the whole LS this is to be conducted on a pass-fail basis only – e.g. CPR (Cardiac Pulmonary Resuscitation)</p>				
<p><i>Note 2:</i></p> <ol style="list-style-type: none"> 1. RTO to determine % weighting of each theory and practical assessments against all assessments. 2. RTO to determine pass mark for theory and practical assessments (e.g. 80%, 100%). 3. Pass marks for assessments may be detailed in RTO Teacher's/Trainer's Guides or similar document. 4. RTO assessment decision must be based on a holistic approach 				

Note: For detailed information on how to complete this section refer to *Competency Development Learning and Assessment Policy Guide*. A copy of the guide is available at the following web link: www.ee-oz.com.au.

Comments on Assessment Events

Assessment Event 1

Event Type	Assessment 1 - [Describe assessment type] e.g. Theory questions
Staging	[When assessment will take place] e.g. Summative assessment after LS Content Area 1
Types of Items	[List suitable types of assessment items / practical tasks to be completed] e.g. Multiple choice and/or short answer questions, descriptive questions, calculations, diagram completion questions.
Coverage	[Which LS Content Area items does this assessment address?] e.g. LS Content Area 1 (a) to (c)
Duration	[How long will this assessment take?] e.g. 15 minutes
Conditions	[List the conditions of this assessment] e.g. Supervised classroom environment (off the job)

Assessment Event 2

Event Type	Assessment 2 - [Describe assessment type] e.g. Theory questions
Staging	[When assessment will take place] e.g. Summative assessment after LS Content Area 2
Types of Items	[List suitable types of assessment items / practical tasks to be completed] e.g. Multiple choice and/or short answer questions, descriptive questions, calculations, diagram completion questions.
Coverage	[Which LS Content Area items does this assessment address?] e.g. LS Content Area 2 (a) to (c)
Duration	[How long will this assessment take?] e.g. 25 minutes
Conditions	[List the conditions of this assessment] e.g. Supervised classroom environment (off the job)

Assessment Event 3

Event Type	Assessment 3 - [Describe assessment type] e.g. Theory questions
Staging	[When assessment will take place] e.g. Summative assessment after LS Content Area 3
Types of Items	[List suitable types of assessment items / practical tasks to be completed] e.g. Multiple choice and/or short answer questions, descriptive questions, calculations, diagram completion questions.
Coverage	[Which LS Content Area items does this assessment address?] e.g. LS Content Area 3 (a) to (c)
Duration	[How long will this assessment take?] e.g. 55 minutes
Conditions	[List the conditions of this assessment] e.g. Supervised classroom environment (off the job)

Assessment Event x [if required]

Event Type	Assessment - (x) [if required – Practical task] and/or * Where skills are assessed for performance this is to be conducted on a learner either passing all or failing all, and is to be reported as pas or fail – e.g. CPR
Staging	# times equally spaced throughout the delivery.
Types of Items	May involve home assignments, laboratory reports, short class tests or a combination of these. Describe items to be covered – <i>e.g. Connection of circuits, circuit diagrams, measurement of voltage, current, resistance and power and the interpretation of results.</i>
Coverage	All topics - describe coverage of assessment event – <i>e.g. Connection of circuits, circuit diagrams, measurement of voltage, current, resistance and power and the interpretation of results in series, parallel and series parallel combinations, loading effect of meters, determination of unknown resistance. Increasing levels of complexity ending in series/parallel combination circuits should be employed. The student must be able to connect circuits, predict outcomes and confirm by measurement and tests.</i>
Duration	As required during period of delivery or as required by the skills practice assignments
Conditions	This assessment should take place in a similar environment to that in which the specified skills are developed. The environment should be structured, and primarily intended for learning and practice, and incorporate all the necessary equipment and facilities for learners to develop the requisite knowledge and skills described herein. Such an environment must ensure that appropriate controls, safety, and direct supervision are practiced. Assessments should integrate theory and practical elements and, if off-the-job, be conducted in a properly equipped classroom/laboratory. Other specific conditions should be listed <i>e.g. Non-programmable calculators are permitted</i>

Assessment Event # [additional, if required]

Event Type	Assessment # - [Describe assessment type] e.g. Theory questions
Staging	[When assessment will take place] e.g. Summative assessment after LS Content Area #
Types of Items	[List suitable types of assessment items / practical tasks to be completed] e.g. Multiple choice and/or short answer questions, descriptive questions, calculations, diagram completion questions.
Coverage	[Which LS Content Area items does this assessment address?] e.g. LS Content Area # (a) to (c)
Duration	[How long will this assessment take?] e.g. ## minutes
Conditions	[List the conditions of this assessment] e.g. Supervised classroom environment (off the job)

Final Assessment Event

Event Type	Final <u>Written</u> Assessment
Staging	At end of learning and assessment specification
Types of Items	Multiple choice and/or short answer questions, descriptive questions, calculations.
Coverage	Topic x – z
Duration	# hours
Conditions	This exam is a moderated summative instrument holistically covering the learning and assessment specification purpose statement. The assessment should take place in a suitable location. The assessment should not be a group assessment, i.e. it should focus on the performance of the learner. e.g. Non-programmable calculators are permitted.

AND/OR – can be combined where appropriate

Event Type	Final <u>Practical</u> Assessment
Staging	e.g. On completion of on-the-job training.
Types of Items	e.g. Complete SJA Senior First Aid program
Coverage	e.g. First aid, EAR, and CPR in the workplace
Duration	e.g. Within 1 month of this LS
Conditions	e.g. Must attend recognised SJA program

Appendix 3 – Glossary / Acronym List used in this LS

Term / Acronym	Meaning	Term / Acronym	Meaning
CPR	Cardiopulmonary Resuscitation	RTO	Registered Training Organisation
DEST	Department of Education Science and Training – Australian Government Department	SJA	St John’s Ambulance
EE-Oz Training Standards	trading name of ElectroComms and EnergyUtilities Industry Skills Council an Industry Skills Council declared by the Australian Government (DEST)	TAC	Training Advisory Committee (NETAG has several covering disciplines of Electrical, Electronics, etc.)
EAR	Expired Air Resuscitation	UEE06	Electrotechnology Training Package
EKAS	essential knowledge and associated skills	UEG06	Gas Industry Training Package
ERAC	Electrical Regulators Authorities Council	UET06	Electricity Supply Industry Transmission Distribution and Rail Sector Training Package
ESI	Electrical Supply Industry	WPS	Work Performance Specification
ESI-NTAG	Electricity Supply Industry - National Training Advisory Group		
S/T ITAB - ETAG	State/Territory Industry Training Advisory Body - Electrotechnology Training Advisory Group		
LO	learning objective		
LS	learning specification		
LSCA	Learning Specification Content Area		
NECAC	National Electrotechnology Competency Advisory Council		
NETAG	National Electrotechnology Training Advisory Group		
OSH/OSH	occupational safety and health / occupational health and safety		