



**Australian Government**

# **UEENEEH113A Troubleshoot amplifiers in an electronic apparatus**

**Release 3**

## UEENEEH113A Troubleshoot amplifiers in an electronic apparatus

### Modification History

Release	Action	Core/Elective	Details	Points
2	Edit		Insert complete pre-requisite pathway	
3	Update		Correct Prerequisite title UEENEEH114A - Troubleshoot resonance circuits in an electronic apparatus	

### Unit Descriptor

#### Unit Descriptor

#### 1) Scope:

##### 1.1) Descriptor

This unit covers determining correct operation of amplifiers. It encompasses working safely, problem solving procedures, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in amplifier sections/circuits.

### Application of the Unit

#### Application of the Unit 2)

This competency standard unit is intended for development of competency in either entry-level employment based programs incorporated in approved contracts of training or other approved training programs. It may also be used to augment formally acquired competencies.

This unit is intended to apply to any recognised development program that leads to the acquisition of a

formal award at AQF level 3 or higher.

## Licensing/Regulatory Information

### License to practice

3)

The skills and knowledge described in this unit do not require a license to practice in the workplace provided equipment is not connected to installation wiring at voltage above 50 V a.c. or 120 V d.c. However other conditions may apply in some States/Territories subject to regulations related to electrical work.

Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

Note:

1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control, lifting equipment and the like. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.
2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.

## 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

**Prerequisite Unit(s)****4)**

identified Pathway Unit Group(s):

Electrotechnology

Electronics and Communications

Electrical

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

UEENEEH102A Repair basic electronic apparatus faults by replacement of components

UEENEEH139A Troubleshoot basic amplifier circuits

Electrotechnology Pathway Group

Unit Code

Unit Title

UEENEEH169A Solve problems in basic electronic circuits

Electronics and Communications Pathway Group

Unit Code

Unit Title

UEENEEH114A Troubleshoot resonance circuits in an electronic apparatus

Electrical Pathway Group

Unit Code

Unit Title

UEENEEG101A Solve problems in electromagnetic devices and related circuits

UEENEEG102A Solve problems in low voltage a.c. Circuits

**Literacy and numeracy skills 4.2)**

Participants are best equipped to achieve competency in 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 3      Writing 3      Numeracy 3

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

This unit contains Employability Skills

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**

<b>6)</b> 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.
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**Elements and Performance Criteria****ELEMENT****PERFORMANCE CRITERIA**

- |                                       |   |
|---------------------------------------|---|
| 1 Prepare to troubleshoot amplifiers. | 1.1 OHS procedures for a given work area are obtained and understood.       |
|                                       | 1.2 OHS risk control work preparation measures and procedures are followed. |

**ELEMENT****PERFORMANCE CRITERIA**

- |   |                          |  |
|---|--------------------------|--|
|   | 1.3                      | The nature of amplifier fault is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.  |
|   | 1.4                      | Advice is sought from the work supervisor to ensure the work is co-ordinated effectively with others.  |
|   | 1.5                      | Sources of materials that may be required for the work are established in accordance with established procedures.  |
|   | 1.6                      | Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.   |
| 2 | Troubleshoot amplifiers. |  |
|   | 2.1                      | OHS risk control work measures and procedures are followed.  |
|   | 2.2                      | The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures  |
|   | 2.3                      | Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures.   |
|   | 2.4                      | Fault finding is approached methodically drawing on knowledge of amplifiers using measured and calculated values of parameters.  |
|   | 2.5                      | Unexpected situations are dealt with safely and with the approval of an authorised person.   |
|   | 2.6                      | Fault finding activities are carried out efficiently without unnecessary waste of materials or damage to apparatus and the surrounding environment or services and using sustainable energy practices. |

ELEMENT	PERFORMANCE CRITERIA
3 Complete work and document troubleshooting activities.	3.1 OHS work completion risk control measures and procedures are followed.
	3.2 Work site is cleaned and made safe in accordance with established procedures.
	3.3 Justification for solutions used to troubleshooting problems is documented.
	3.4 Work completion is documented and an appropriate person or persons notified in accordance with established procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and troubleshooting amplifiers.

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

#### KS01-EH113A

#### Amplifier fundamentals

Evidence shall show an understanding of amplifier troubleshooting, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

##### T1. Single stage discrete amplifier d.c. characteristics

- Risk and safety
- Field effect transistors (FET) and Bi-junction transistor (BJT) circuit symbols
- Quiescent (Q) point
- Biasing methods for BJT and FETs
- Circuit theory for BJT and FETs
- Verification of performance of BJT and FET amplifier circuits

##### T2. Single-stage discrete amplifier small signal characteristics

- Small signal gain
- Gain measurements
- Overdrive conditions

##### T3. Capacitive coupling in single-stage discrete amplifiers

- Coupling capacitor functions
- Coupling capacitor effect on low frequency response
- Emitter/source bypass capacitor effect on low frequency response
- Verification of circuit operation and frequency response (eg. Bode Plot).

##### T4. Multistage amplifier coupling methods

- Coupling methods
- Total gain
- Bandwidth considerations
- Verification of circuit operation

##### T5. Differential amplifiers

- Differential amplifier concept
- Typical circuit operation
- Differential and common-mode gain
- Common mode rejection



**REQUIRED SKILLS AND KNOWLEDGE**

- Constant current and voltage sources
- Verification of circuit operation

**T6. Negative feedback**

- Concept of negative feedback
- Effects of negative feedback
- Negative feedback configurations
- Amplifier gain and negative feedback

**T7. Introduction to classes of power amplifier operation**

- Power efficiency
- Classes and applications
- Crossover distortion
- Class AB operation
- Heat sinking

**T8. Complimentary symmetry power amplifiers**

- Biasing and crossover distortion
- Power efficiency
- Quasi-complimentary and Darlington output configurations
- Complete amplifier operation
- D.C. operating condition calculations
- Verification of circuit operation

**T9. Other solid state power amplifier design**

- Transformer coupled power amplifiers
- I.C. power amplifiers
- Class D power amplifiers

## Evidence Guide

### EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package. .

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of the 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-preferred model for apprenticeships. However, where summative (or final) assessment is used it must 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.

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. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work influence decisions about how/how much 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 practised. 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 shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence shall also comprise:

- A representative body of work performance 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 statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
  - Demonstrate an appropriate level of skills enabling employment
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Troubleshoot amplifiers as described in 8) and including:

A	Using methodical problem solving methods.
B	Taking measurements correctly and accurately.
C	Calculating parameters correctly and accurately.
D	Providing solution to amplifier problems.

E Providing written justification for the solutions to problems.

F Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a holistic assessment with the above listed items

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

### **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 work as prescribed by this unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to troubleshooting amplifiers.

### **Method of assessment**

#### **9.4)**

This 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 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 skills described in this unit.

**Concurrent  
assessment and  
relationship with  
other units**

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

UEENEEH1 02A Repair basic electronic apparatus faults by replacement of components

UEENEEH1 12A Troubleshoot digital sub-systems

UEENEEH1 14A Troubleshoot resonance circuits in an electronic apparatus

UEENEEH1 15A Develop software solutions for microcontroller based systems

UEENEEH1 16A Find and repair microwave amplifier section faults of electronic apparatus

UEENEEH1 39A Troubleshoot basic amplifier circuits

The critical aspects of occupational health and safety covered in unit UEENEEE101A and other discipline specific occupational health and safety units shall be incorporated in relation to this unit.

## Range Statement

### RANGE STATEMENT

**10)** This relates to the unit 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 troubleshooting an amplifier in at least three types of electronic apparatus.

The troubleshooting must be demonstrated on three types of faults.

Notes:

1. The range of faults may include: distortion, excessive power consumption, low gain and limited frequency responses. 2. Troubleshooting may involve the alteration of an existing amplifier to comply with a specified function and operating parameters.

- Determining the operating parameters of an amplifier section of an electronic apparatus.
- Modifying an existing amplifier section to comply with specified operating parameters
- Developing an amplifier section to comply with a specified function and operating parameters
- Finding and repairing a fault in an amplifier section of an electronic apparatus

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

## Unit Sector(s)

Not applicable.

## Competency Field

Competency Field      **11)**

Electronics