GOVERNMENT OF WESTERN AUSTRALIA

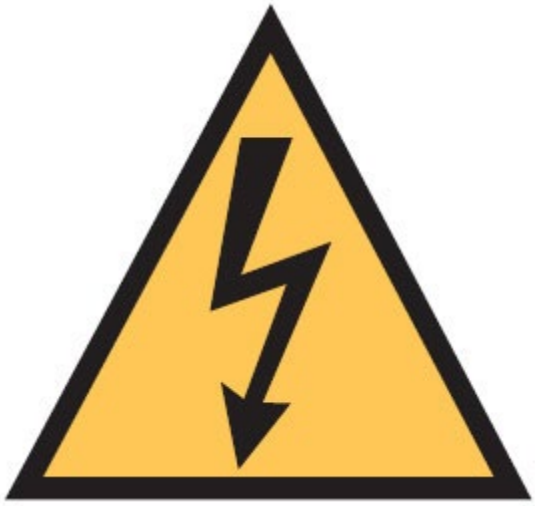
TAFE WA North Metropolitan

RTO Code: 52786

Portfolio of evidence

UEEEL0025

Test and connect transformers



UEE Training Package Support Material

Based on:
National Electrotechnology Industry Standards

North Metropolitan TAFE
V1 July 2022

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Student Name		**Assessment Type**	☐	Questioning (Oral / Written)
Student ID			☒	Portfolio
Lecturer Name		**Student Result (S/NYS)**		

By completing and submitting this signed form to my lecturer, I am stating that:

a. The attached submission is completely my own work
b. I have correctly cited all sources of information used in this work (if required)
c. I understand a copy of my assessment will be kept by the NMTAFE for their records
d. I understand my assessment may be selected for use in the NMTAFE's validation and audit process to ensure student assessment meets requirements

Student Signature		**Date**	

Assessment type (☑):

☐ Questioning (Oral/Written)

☐ Practical Demonstration

☐ 3rd Party Report

☒ Other – Project/Portfolio *(please specify)*

Assessment Resources:

Resources the assessor is to provide:

- Classroom setting as the venue.
- Test paper
- Graph paper

Resources the candidate is to provide:

- Black or Blue pen
- Pencil and eraser
- Scientific calculator (non-programmable)
- Maths drawing set
- AS/NZS 3000: current edition
- AS/NZS 3008.1.1 current edition
- WA Electrical Requirements current edition

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Assessment Instructions:

Task description:

The following Portfolio Assessment relates to the knowledge requirements and performance evidence of the unit. Make sure you complete all questions and practical activities

- To be deemed ***Satisfactory*** you are required to achieve a mark of **100%**
- The following **Knowledge Assessment** is an open book assessment and does not need to be completed under supervision
- The following **Practical Activities** must be completed under supervision in a simulated workplace environment
- If ***Not Yet Satisfactory*** you will be required to re-attempt the **Knowledge Questions** that are marked ***not satisfactory*** and/or any **Practical Activity** marked as **Not Yet Satisfactory**

Student Instructions:

Ensure you have access to all the resources required for this assessment as described below.

1. Read the **Questions** section. If you are not clear about a question, ask your assessor for further information.
2. You may be able to complete the questions verbally. This would need to be negotiated with your assessor**.**
3. Your assessor will provide feedback on your answers, including any questions that may require a further response.
4. If you have specific needs that you would like considered during this assessment, please discuss this with your assessor to identify any possible reasonable adjustments **prior** to commencing the assessment.
5. All diagrams must be neat, labelled and in pencil.
6. All calculations and numerical answers must be shown correct to two decimal places and include both the unit of measurement and metric prefix if applicable.

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

LABORATORY INSTRUCTIONS

Students working in laboratories at North Metropolitan TAFE Campus's do so on the condition that they agree to abide by the following instructions. Failure to observe the safety instructions may result in disciplinary action up to and including cancellation of your training contract with NMTAFE.

1. No circuit is to be plugged in or switched on without the specific permission of the lecturer in charge of the class. A circuit must be switched off, isolated and tested for ZERO VOLTS before any supply leads are removed. The DANGER TAG PROCEDURE must be used at all times.
2. Do not leave any circuit switched on any longer than necessary for testing. Do not leave any circuit switched on unattended.
3. Check each item of equipment before using. Report any broken, damaged or unserviceable equipment to your Lecturer.
4. All wiring must be disconnected at the end of each practical class or as each project is completed.
5. Make all connections in a safe manner with an appropriate connecting device. Unshielded 4mm banana plugs are not to be used for wiring.
6. Switch off, remove the plug from the socket and attach your DANGER TAG to the plug top before working on any project. It is not sufficient to simply turn the switch off.
7. When disconnecting your wiring from a connection made under a screw, undo the screw to remove the wiring, do not cut the wire off.
8. Observe the correct colour code for all wiring projects.
9. Test your circuit for short circuits with your multimeter before asking your Lecturer to switch circuit on. Test the Tester before and after EACH test.
10. Where an activity sheet is issued for a project, complete each step in the Procedure before moving to the next step. Advise your Lecturer when you have completed the activity.
11. Draw ALL DIAGRAMS in PENCIL so that they can be easily changed or corrected. Mark off each connection on your diagram as it is made.
12. Check the range before taking a reading with a multimeter.
13. Make sure that it is YOUR plug before inserting plug into an outlet.
14. Always switch multimeter OFF, or to the highest possible AC VOLTS range when you have finished using it.
15. Report any unexpected situations or events to your Lecturer.

Student's Signature _____ Date: _____

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

DANGER TAG PROCEDURE for ELECTRICAL TRADE LABORATORIES

THE FOLLOWING PROCEDURE IS COMPULSORY

1. The student is to attach a DANGER TAG on to the plug top of the project lead before proceeding with the allocated project. A danger tag must be attached to the plug top at all times, when the lead is NOT plugged into the supply outlet. Plug tops or leads are not to be connected to the supply outlet WHILE A DANGER TAG is attached.

2. The student is to assemble the project according to project instruction procedure and lecturer's directions in its isolated and de-energised state and report to the lecturer as necessary and on completion.

3. The lecturer is to:-
   a. Check the project for safety and
   b. Ensure that the student has performed a safety check, including a short circuit test using the recommended procedure.

4. When the lecturer is satisfied that the project is safe to connect and energise the lecturer is to instruct the student to REMOVE the DANGER TAG from the plug top.

5. The student is to plug in the project and switch it on in the presence of the lecturer.

6. The lecturer is to determine whether or not the project is operating satisfactorily.

7. If the project operates satisfactorily the student may take measurements using correct meters with regard to the safety risks associated with using the particular item of test equipment including;
   a. Selecting correct meter function,
   b. Holding meter probes correctly during measuring with fingers behind knurls (finger guards) at all times.

   This is to be done under general supervision of lecturer. The student is NOT to modify, disassemble or carry out ANY unsafe act.

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

8. If the circuit is to be modified the student must:
   a. Switch the circuit off,
   b. Disconnect the project from the supply,
   c. Attach the DANGER TAG to the plug top,
   d. Report to the lecturer for instructions,
   e. In the lecturer's presence the student is to:-
   f. TEST and VERIFY for ZERO VOLTAGE.
   g. Restart the DANGER TAG procedure from step 2 above.

9. When the student is satisfied that the project has been completed the student is to:-
   a. Switch the project off,
   b. Remove the plug,
   c. Replace the DANGER TAG on the plug top,
   d. Report to the lecturer for instructions,

   In the lecturer's presence the student is to:-
   e. TEST and VERIFY for ZERO VOLTAGE.

   The lecturer is then to instruct the student to:-
   f. Disassemble the project
   g. Remove the DANGER TAG and store the equipment in its designated place.

Failure to follow Danger Tag Procedures when working on practical activities and practical assessments will result in a '**Not yet Satisfactory**' comment recorded for this Unit of Competency

Student's Signature _____ Date: _____

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Complete all Knowledge Questions.

Question 1	A Transformer has two sets of windings, what are their respective names?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 2	Why are transformer laminations insulated from each other?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 3	What are the two main losses in the core of a power transformer, and what is done to minimise these losses?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 4	What is the main operating principle that applies to a Transformer		
Answer	**A**	Eddy Current Flow	
	B	Voltage is mutually induced from one coil to another through the iron core	
	C	DC current is flowing in the secondary winding	
	D	Coils are electrically connected across the iron core	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 5	Two main parts of a transformer are?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 6	Can a transformer work with a DC supply?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 7	A transformer has 200 turns on its primary winding and 48 turns on the secondary winding. The maximum value of the flux in the core is 10 mWb and the frequency is 50 Hz. Calculate the voltage induced in the: **a** primary winding **b** secondary winding.	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 9	What is the difference between a core-type and a shell-type transformer core?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 10	The primary current of a 400V/48 V transformer is 2.5 A. Ignoring losses, what is the secondary current?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 11	Current ratio is …… proportional to the Voltage and Turns ratio	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 12	The configuration where secondary windings wound on top to primary winding is called?		
Answer	A	Sandwich	
	B	Pancake	
	C	Concentric	
	D	Side by side	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 13	What is the phase difference between the primary voltage and the secondary voltage of a transformer?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 14	If the 5KVA rated transformer has 200V in the primary and 50V / 300 turns in the secondary what is the VA rating in the secondary?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 15	Toroidal transformers are what shape?		
Answer	**A**	Rectangle	
	B	Square	
	C	Circular	
	D	C-shape	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 16	Two main methods for cooling power and distribution transformers are?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 17	A transformer rated at 200 kVA has two secondary windings, one producing 3.3 kV the other producing 400 V. If 35 A of current is being supplied by the 3.3 kV secondary, calculate how much current the 400 V secondary can supply?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 18	A transformer takes a magnetising current of 4.5 A and a core loss current of 1 A. Calculate the transformer's: **a** no-load current **b** no-load power factor.	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 19	A transformer rated at 200 kVA has two secondary windings, one producing 3.3 kV the other producing 400 V. If 35 A of current is being supplied by the 3.3 kV secondary, calculate how much current the 400 V secondary can supply.	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 20	A three-phase 33 kV/11 kV power transformer has a power rating of 10 MVA when the type of cooling is ONAN, and 16 MVA when the cooling is OFDAF. Calculate the full-load line current, for both types of cooling, in the: **a** high voltage winding **b** low voltage winding	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 21	Which factors determine the magnitude of induced voltage in the windings of a transformer?		
Answer	**A**	Length of the conductor related to number of turns in the winding	
	B	Strength of the magnetic field related to flux in the core	
	C	Relative motion between the conductor and the field depending on Hz of supply	
	D	All of the above	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 22	What type of transformer loss remains relatively constant over the full output range of a power transformer?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 23	A particular 240 volt single phase step-down shell type transformer has 1200 turns on the primary and 300 turns on the secondary. What is the output voltage on no-load?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 24	The no-load secondary voltage of a power transformer is specified as 33.9 kV (IEC rated). When fully loaded at a power factor of 0.8, the secondary voltage is 33 kV. What is the transformer's percentage voltage regulation?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 25	What is the name of the winding some transformers have to deal with the 3rd Harmonic?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 26	The RMS value of induced voltage in a transformer is		
Answer	**A**	10.6 V	
	B	14.44 V	
	C	44.00 V	
	D	4.44 V	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 27	.What type of test measures iron losses in a transformer?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 28	In principle, what is the main reason for having tappings as part of a transformer?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 29	Transformers are rated by		
Answer	**A**	Watts	
	B	Volts	
	C	Ohms	
	D	Volt-Amps (VA)	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 30	A 3.3 kV/200 V single phase transformer is supplying a full load current of 50 A at a lagging power factor of 0.85. The transformer has an iron loss of 200 W and a full load copper loss of 600 W. Find the full-load efficiency of the transformer.	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 31	What type of test measure copper losses in a transformer	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 32	A short-circuit test on a three-phase 5 MVA 66 kV/3.3 kV transformer showed that 4.1 kV was required to cause full rated current to flow in the windings. Calculate the transformer's: **a** rated primary current **b** percentage impedance.	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 33	A transformer which has a small amount of windings in the primary and a large amount of windings in the secondary is known as a?		
Answer	**A**	Step down transformer	
	B	Step up transformer	
	C	Isolating transformer	
	D	Potential transformer	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 34	Two transformers rated at 2 MVA are connected in parallel to supply a 3.5 MVA load. Transformer A has an impedance of 8.5 per cent and transformer B an impedance of 7 per cent. Determine the load taken by each transformer.	
Answer	Tx_A takes 1.58 MVA, Tx_B takes 1.92 MVA	
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 35	What is the trade name given to an auto-transformer in which you can adjust the output voltage?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 36	What essential safety precaution must be taken when an ammeter is to be disconnected from its associated current transformer {other than switching the power off during disconnection)?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 37	An auto-transformer winding has 400 turns with a tapping giving a secondary winding of 80 turns. The primary voltage is 300 V and a resistive load of 15 ohms is connected to the secondary. Determine the: **a** secondary voltage **b** secondary current **c** primary current **d** current in the common part of the windings	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 38	What is the minimum resistance stated in the AS/NZS 3000:2018 required to pass and insulation resistance test when testing between windings and windings to earth?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 39	A current transformer has a ratio of primary to secondary current of 1500: 5 A and is connected to monitor the current taken by a induction heater. What is the current flowing in the secondary circuit of the transformer if the primary current is 950 A	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

Question 40	What is the name given to the type of transformer used to measure Current and Voltage?	
Answer		
Feedback		☐ Satisfactory ☐ Not satisfactory

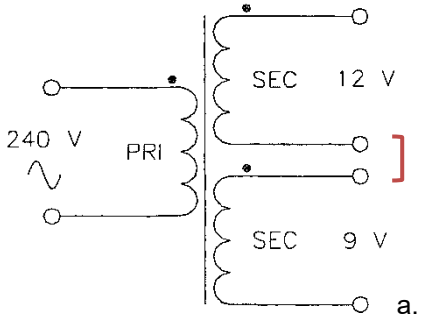
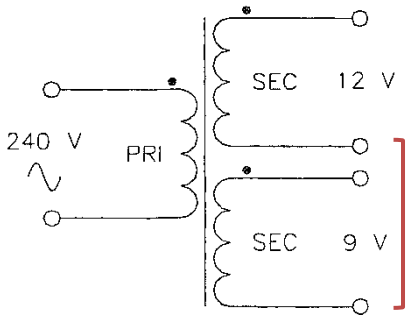
GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question 41	Power transformers being connected in parallel must have the same……		
Answer	**A**	Percentage impedance	
	B	Voltage ratio	
	C	Polarity	
	D	All of the above	
Feedback			☐ Satisfactory ☐ Not satisfactory

Question 42	Complete the connections in the following diagram to show how the secondary windings can be connected to give secondary voltages of: a. 21 volts. 3 volts  a.  b.	
Feedback		☐ Satisfactory ☐ Not satisfactory

END OF THEORY ASSESSMENT

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activities Overview

1. Single Phase Transformer Connections

2. Develop, connect and test a single direct-on-line (DOL) magnetic starter circuit for a 415 volt three phase squirrel cage induction (SCI) motor.

3. Develop, connect and test a direct-on-line (DOL) magnetic starter circuit which controls a 415 volt three phase squirrel cage induction (SCI) motor from either of two stop-start stations.

Risk assessment

Consequence		1 **Rare** The event may occur in exceptional circumstances	2 **Unlikely** The event could occur sometimes	3 **Moderate** The event should occur sometimes	4 **Likely** The event will probably occur in most circumstances	5 **Almost Certain** The event is expected to occur in most circumstances
1	**Insignificant** No injuries or health issues	LOW	LOW	LOW	LOW	MODERATE
2	**Minor** First aid treatment	LOW	LOW	MODERATE	MODERATE	HIGH
3	**Moderate** Medical treatment, potential LTI	LOW	MODERATE	HIGH	HIGH	CRITICAL
4	**Major** Permanent disability or disease	LOW	MODERATE	HIGH	CRITICAL	CATASTROPHIC
5	**Extreme** Death	MODERATE	HIGH	CRITICAL	CATASTROPHIC	CATASTROPHIC

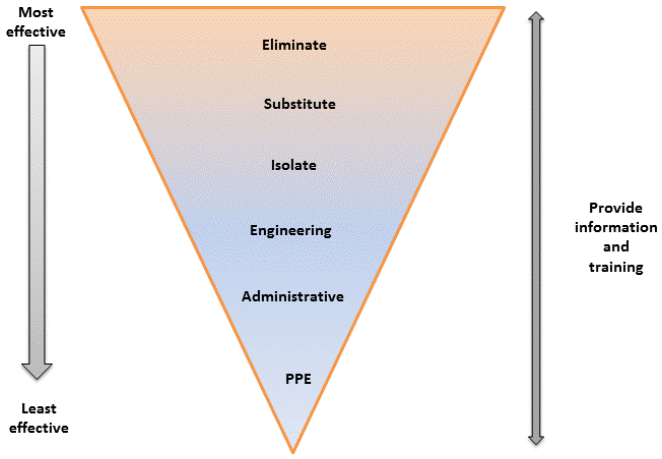
GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

1. **Eliminate** – if it is possible, the hazard should be removed completely. For example, get rid of dangerous machines.
2. **Substitute** – replace something that produces the hazard with something that does not produce a hazard. For example, replacing solvent based paint with water based paint. Risk assessment on the substitution must be conducted to ensure that it will not pose another hazard.
3. **Engineering control** – isolate a person from the hazard by creating physical barrier or making changes to process, equipment or plant to reduce the hazard. For example, install ventilation systems.
4. **Administrative control** – change the way a person works by establishing policies and procedures to minimise the risks. For example, job scheduling to limit exposure and posting hazard signs.
5. Use **personal protective equipment** (PPE) – protect a person from the hazard by wearing PPE. For example, wearing gloves, safety glasses, hard hats and high-visibility clothing. PPE must be correctly fitted, used and maintained to provide protection.



Hierarchy of control

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Safe Work Method Statement

Revised Risk Rating							
Hazard Control Measures							
Risk Rating							
Hazards							
Task Steps							
Task Step #							

Student Signature.....

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 1

Single Phase Transformer

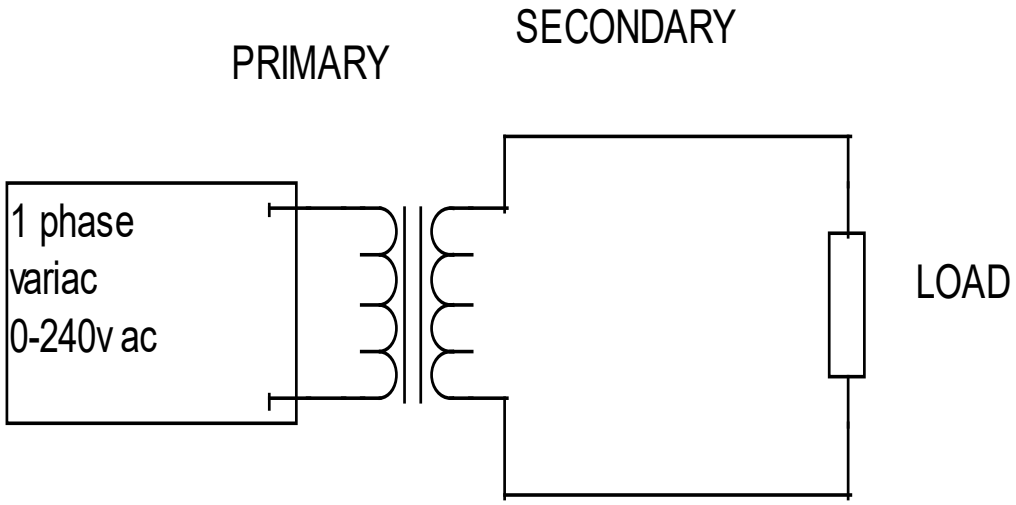
Objective

To verify the voltage relationships in a single phase double-wound step-down transformer.

Equipment

Single phase variable voltage a.c. supply (Variac)
Single phase 240 V double wound step down transformer project board
Load board (60 watt incandescent lamp or similar)
Connecting leads.
Multimeter.

Circuit diagram



GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Instructions

Procedure

DANGER TAG PROCEDURE MUST BE FOLLOWED

1. Measure the resistance of the two windings on the double wound step-down transformer and identify the primary winding.
   Record the resistance of both windings in the Results Table.

2. Connect the circuit according to the circuit diagram above.

3. Check for short circuits with a multimeter set on the ohms times 1 range.
   Switch the multimeter off after the check.

4. Have your connections checked by your Lecturer.

5. Set the variable a.c. supply (Variac) to about 25% of its full value and measure the primary and secondary voltages with a multimeter. Record your results in the Results Table.

6. Repeat Step 5 with the Variac set to approximately 50%, 75% and 100% of the supply voltage.

7. Switch the circuit off, remove the plug from the outlet, attach your danger tag to the plug top.

8. Have your results checked by your Lecturer.
9. Return all of the equipment to its proper place.

Primary Resistance	Ω	Secondary Resistance	Ω
Variac Setting	Primary Voltage	Secondary Voltage	Calculated Voltage Ratio
25% Voltage			
50% Voltage			
75% Voltage			
100% Voltage			

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Neat Pencil Sketch

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question	What conclusion can you draw in relation to the ratio between the primary voltage and the secondary voltage for each setting?	
Answer		☐ Satisfactory ☐ Not satisfactory

Question	If the primary voltage was set to 100 volts, what would the secondary voltage be?	
Answer		☐ Satisfactory ☐ Not satisfactory

Question	If the secondary voltage was set to 100 volts, what would the primary voltage be?	
Answer		☐ Satisfactory ☐ Not satisfactory

Question	If there were 500 turns on the primary winding, how many turns would there be on the secondary winding?	
Answer		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Question	If the primary input current was 1 amp, what would the secondary current be?	
Answer		☐ Satisfactory ☐ Not satisfactory

Question	Based on your results, what would the output voltage be if 240 volts was incorrectly applied to the SECONDARY of the transformer?	
Answer		☐ Satisfactory ☐ Not satisfactory

Question	What was the VA rating of the transformer used for this project?	
Answer		☐ Satisfactory ☐ Not satisfactory

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 2

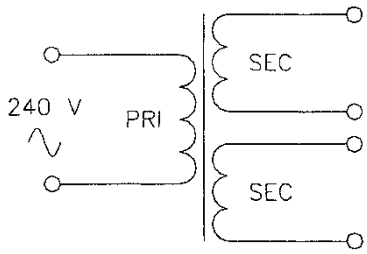
Connecting Transformer Secondaries Series Aiding/Opposing

Objective

To connect the two secondaries of a dual secondary single phase double wound 240 V transformer series aiding and series opposing.

Equipment

A double wound dual secondary transformer (different voltages)
Multimeter
Single phase leads



Circuit

Procedure

Danger Tag Procedure Must be followed

1. Examine the step down double wound transformer supplied and determine which winding is the primary and which windings are the secondaries using a multimeter where necessary. Record the results in Table 1. Switch the multimeter OFF.

Table 1

Resistance of Primary	Ω	Markings	
Resistance of Secondary 1	Ω	Markings	
Resistance of Secondary 2	Ω	Markings	

2. Connect the circuit so that the secondary output voltages can be measured. Check the circuit for short circuits with a multimeter. Have your wiring checked by your Lecturer.

3. Plug the circuit into a 240 volt single phase outlet and record the primary and secondary voltages in Table 2.

Table 2

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Primary Voltage	
Secondary 1 Voltage	
Secondary 2 Voltage	

4. Switch the circuit off and remove the plug from the outlet.

5. Draw a circuit diagram showing how the transformer secondaries must be connected for series aiding output. Calculate the expected output voltage.

Circuit (Series Aiding)

Output Voltage	
Calculated	
Measured	

6. Have your circuit checked by your Lecturer

7. Energise the circuit and measure the total secondary output voltage.

8. Switch the circuit off and remove the plug from the outlet.

9. Draw a circuit diagram showing how the transformer secondaries must be connected for series opposing output. Calculate the expected output voltage.

Circuit (Series Opposing)

Output Voltage	
Calculated	
Measured	

10. Have your circuit checked by your Lecturer

11. Energise the circuit and measure the total secondary output voltage.

12. Switch the circuit off and remove the plug from the outlet.

13. Have your results checked by your Lecturer.

14. Disconnect your wiring and return all of the equipment to its proper place.

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 3

Connecting Single Phase Transformers in Parallel

Objective

To connect the secondaries of two identical 240 V single phase double-wound step-down transformers in parallel.

Equipment

Two identical single phase double-wound step-down transformers (unmarked). Multimeter.
Single phase 240 V power board.

Procedure

Danger Tag Procedure Must be followed

1. Examine the two transformers supplied, and identify the primary and secondary windings using a multimeter.

2. Measure the resistance of each winding and record the results in Table 1.

Table 1

	Resistance (T1)	Resistance (T2)
Primary Winding	Ω	Ω
Secondary Winding	Ω	Ω

3. Draw a circuit diagram showing how the transformers must be connected so that the secondary windings are able to operate in parallel.
   Identify the secondary closing connection on your diagram.

4. Have your circuit diagram checked by your Lecturer.

5. Connect the transformers in accordance with your circuit diagram, leaving the closing connection open in the secondary circuit.

6. Check your circuit for short circuits using a multimeter. Switch the multimeter off after the test.

7. Have your wiring checked by your Lecturer.

8. Energise your circuit and measure the voltage across the closing connection.

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

9. If the voltage across the closing connection is not zero, switch the circuit off and remove the plug from the outlet then proceed to Step 10. If the voltage is zero proceed to Step 11.

10. Reverse the connections to either secondary winding and go back to **Step 7.**

11. If the voltage across the closing connection is zero, switch the circuit off and remove the plug from the outlet. Make the closing connection, then re-energise the circuit.

12. Measure and record the primary and secondary voltages.

Primary Voltage: Se Secondary Voltage:

13: Switch the circuit off and remove the plug from the outlet.

14. Have your results checked by your Lecturer.

15. Return all of the equipment to its proper place.

Practical Questions

1. Would it be safe to connect two single phase transformer secondaries in parallel if they were different voltages?

2. Would you recommend connecting two single phase transformer secondaries in parallel if the voltages were the same but the VA ratings of the transformers were different?

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 3

Current Transformer Connections

, **Objective**

To connect and adjust suitable ammeters to various current transformers.

Equipment
2 kVA· double wound step down transformer
2 current transformers.(CTs) 50/5, 100/5
0 - 5 A a.c. ammeter
2 - ammeter scales to suit CT
2 – a.c ammeters 0 – 100A and 0 – 5A
1 – a.c. tong-tester set on ampere scale
Variable load bank

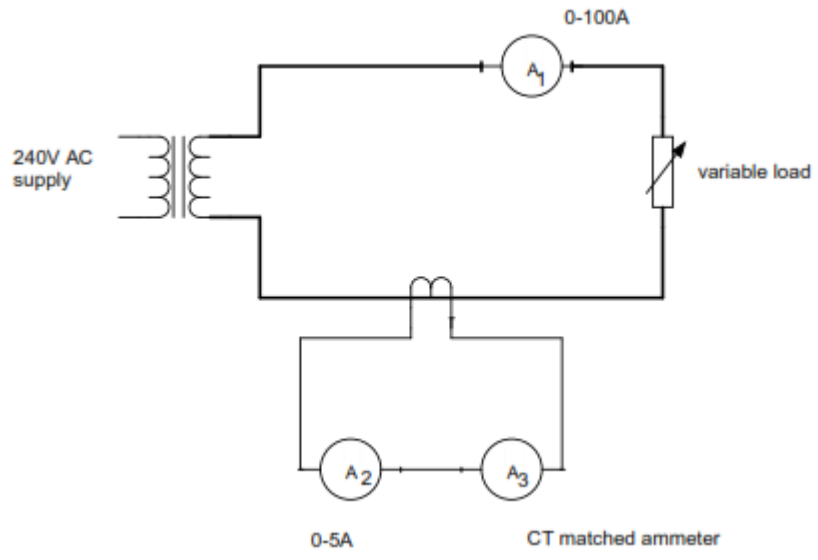
Procedure

DANGER TAG PROCEDURE MUST BE FOLLOWED

1. Identify the current transformer and record the data **below**.

Table 1

	VA Rating	Turns Ratio	Burden
Current Transformer 1			
Current Transformer 2			



Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

2. Connect a 50/5 CT into the circuit below. Ensure that the load is disconnected.

3. Connect the tong-tester in series with the 0 – 100A Ammeter.

4. Have your circuit checked by your Lecturer.

5. Energise the circuit under the NO-LOAD condition.

6. Increase the load for ammeter A1 to read 50 A.

7. Record ammeter readings A1, A2, A3 and the tong-tester in Table 2 below.

8. Switch the circuit off and remove the plug from the outlet and “Danger Tag” plug.
Replace the 50/5 CT with a 100/5 CT and repeat steps 2 to 7.

Change the face-plate to suit the new CT.

Table 2

	Ammeter 1	Ammeter 2	Ammeter 3	Tong-tester
Test 1				
Test 2				

9. Have your circuit checked by your Lecturer.

10. Re-energise the circuit and repeat the test again using TWO turns on the primary and record your results in Table 3 below.

Table 3

	Ammeter 1	Ammeter 2	Ammeter 3	Tong-tester
Test 1				
Test 2				

11. Switch the circuit off and remove the plug from the outlet and “Danger Tag” plug.
Return all of the equipment to its proper place.

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Questions

1. From the results in Table 2 determine the current ratio for each CT and verify your results from Table 1 (show all working).

2. Briefly explain the effect on the output current of a CT when primary turns are increased. How can this method be used to advantage?

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 4

Transformer Testing

Objective

To test transformers for open circuit and insulation faults.

Equipment

Double-wound step-down transformer (unmarked).
Insulation tester.
Multimeter or Ohmmeter.

Procedure

DANGER TAG PROCEDURE REQUIRED

1. Examine the transformer supplied, and identify the primary and secondary windings using a multimeter.

2. Measure the resistance of each winding and record the results in Table 1.

Table 1

	Resistances		
Primary			
Secondary			

3. Measure the insulation resistances with a high voltage insulation tester and record the results in Table 2.

Table 2

	Insulation Resistance		
Primary to Frame			
Secondary to Frame			
Primary to Secondary			

4. Have your results checked by your Lecturer,

5. Return all of the equipment to its proper place.

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Questions

1. Would it be safe to connect the transformer to the supply?

2. What is the minimum specified value of insulation resistance between the windings to earth of a single phase transformer connected to a 240V supply?

3. What type of measuring instrument must be used for testing insulation resistance?

4. Were the insulation values obtained in the tests within those specified for transformers?

5. Does an ohmmeter give a satisfactory indication of shorted turns of a transformer winding? Give reasons for your answer.

6. What condition would be indicated if the resistance of a transformer winding was:

   Zero ohms

   Infinity ohms

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 4

Three Phase Transformer Ratios

Objective

To identify the primary and secondary windings of a three phase low voltage transformer and calculate the turns ratio.

Equipment

One three phase step down transformer.
Connecting leads.
Multimeter or suitable voltmeter/s and ohmmeter.
Three phase lead.

Procedure

DANGER TAG PROCEDURE REQUIRED

1. Examine the three phase transformer supplied, identify and measure the ohmic values of the primary and secondary windings.

2. Complete Table 1, draw the circuit diagram with the correct terminal markings shown, and the PRIMARY winding connected in STAR.

Table 1

Resistances	A group coils	B group coils	C group coils
Primary			
Secondary			

Circuit Diagram

Page Break

3. Connect the transformer in accordance with your circuit diagram. Ensure that the transformer frame is EARTHED.

4. Check the circuit for short circuits with an ohmmeter or multimeter.

5. Check with your Lecturer to ensure that:
   a. Your circuit diagram is correct.
   b. All connections are in accordance with the diagram.

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

6. Energise the circuit, measure and record the primary and secondary Coil voltages.

Table 2

	Coil Voltages	
	Primary	Secondary
A Phase		
B Phase		
C Phase		

7. From the voltage readings obtained calculate and record:

a. The voltage ratio ..... : .....

b. The turns ratio ..... : .....

8. Switch the circuit off and remove the plug from the outlet.

9. Disconnect the circuit and return all of the equipment its proper place.

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 5

Three Phase Transformer Connections

Note: Laboratory Project 4-1 must be completed before attempting this project.

Objective

To connect a three phase step down transformer in four different ways – Star : Star, Star : Delta, Delta : Delta & Delta : Star.
Calculate and measure the coil and output voltages of each connection.

Equipment

One three phase step down transformer.
Connecting leads.
Multimeter.
Three phase lead.

Procedure

DANGER TAG PROCEDURE REQUIRED

1. Examine the transformer supplied, and identify the primary and secondary terminals. Record the terminal markings on a circuit diagram.

Circuit Diagram

2. Connect the primary winding in STAR with a three phase lead connected to its line terminals, Ensure that the transformer frame is earthed.

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

3. Check the circuit for short circuits and have your connections verified by your Lecturer.

4. Energise the circuit with from the 415 V three phase supply. Measure the COIL voltages and record the ratios.

Voltage ratio ..... : .....

Turns ratio ..... : .....

Part 2

Have your wiring checked by your Lecturer before switching the circuit on **EACH TIME**. Record your complete results in the following table.

5. Calculate the secondary LINE voltage if the transformer was connected STAR-STAR.

Calculated Secondary Line Voltage: .....

6. Connect the secondary winding in STAR. Measure and record the secondary voltages.

Measured Secondary LINE voltage: .....

Measured Secondary COIL voltage: .....

7. Submit your results to your Lecturer for verification.

8. Calculate the secondary LINE voltage if the transformer was to be connected in the STAR - DELTA configuration.

Calculated Secondary Line Voltage: .....

9. Connect .the secondary in DELTA with the 'closing connection open. Have your connections checked by your Lecturer.

10. Plug the circuit into a three phase outlet and measure the voltage across the closing connection. If the voltage across the closing connection is NOT zero, switch the circuit off and remove the plug from the outlet. Make the necessary circuit adjustment, then measure and record the secondary COIL VOLTS and LINE VOLTS. If there is a voltage across the closing connection ask your Lecturer how to correct it.

Measured Secondary LINE Voltage: .....

Measured Secondary COIL Voltage: .....

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

11. Reconnect the transformer DELTA to DELTA and then DELTA to STAR. Measure and record the COIL. VOLTS and the LINE VOLTS on the primary and secondary for each connection, then record in the results table.

12. Have your results checked by your Lecturer;

13. Switch the circuit off and remove the plug from .the outlet.

14. Disconnect your wiring and return the equipment to its proper place.

Results

Turns Ratio ..... : ..... Voltage Ratio ..... : .....

Results Table

	Primary				Secondary			
	Line E		Coil E		Line E		Coil E	
	Calc	Meas	Calc	Meas	Calc	Meas	Calc	Meas
STAR: STAR								
STAR: DELTA								
DELTA: DELTA								
DELTA: STAR								

Connections

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

STAR-STAR **STAR-DELTA** **DELTA-DELTA** **DELTA-STAR**

Questions

1. What effect does a 'reversed coil' have on the primary or secondary of a three phase transformer when connected in:

a. Star
b. Delta

2. Describe one method of correcting a reversed coil on a small three phase transformer.

3. Why is it necessary to check the 'closing connection' of a delta connected transformer?

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

4. Briefly describe the procedure for checking the Closing connection on a delta connected three phase transformer

_____

_____

5. Complete the general equations below:

In Star		In Delta	
Coil Volts		Coil Volts	
Line Volts		Line Volts	

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

Practical Activity 6

Transformer Efficiency

Objective

To determine the efficiency of a given single phase transformer.

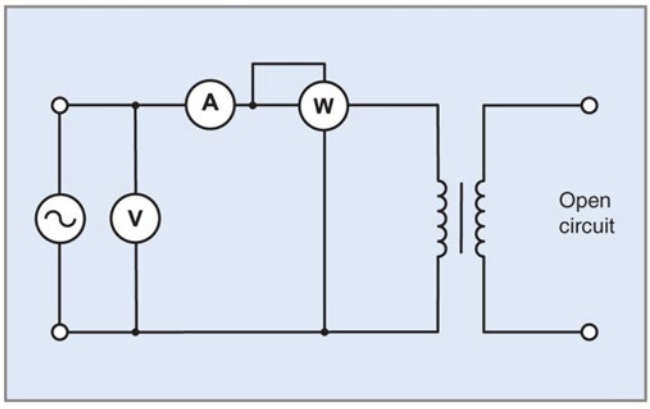
Equipment

One single phase 50 Hz double wound transformer.
Suitable variable transformer (Variac)
Multimeter
Suitable a.c. ammeters
Suitable single phase wattmeter
Single phase lead
Connecting leads.

Procedure

DANGER TAG PROCEDURE REQUIRED

Part A - Open Circuit Test



1. Examine the double wound transformer and record the following details from the nameplate or equivalent in Table 1

Table 1

	Nameplate Data	
1	Primary voltage	
2	Secondary voltage	
3	Transformer VA rating	
4	Secondary full load current	

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

2. Connect the circuit as shown in the circuit diagram. Note that a multimeter is to be used for all voltage readings.

3. Check your circuit for short circuits with a multimeter.

4. Have your wiring checked by your lecturer.

5. Energise the circuit and record the following readings with the secondary open circuited:

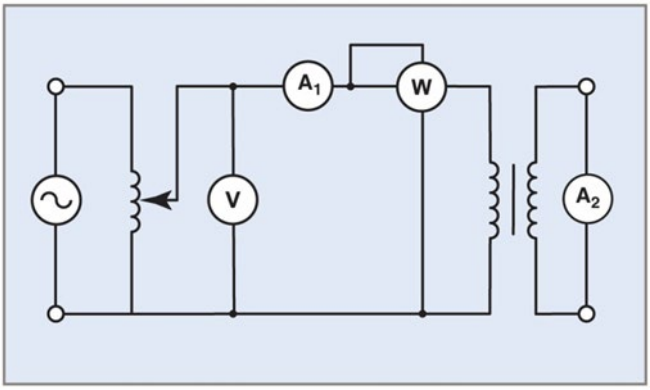
Table 2

	Open Circuit Test Results	
1	Primary Voltage	
2	Primary Current	
3	Input power as indicated on the wattmeter	

6. Switch the circuit off, remove the plug from the outlet and attach your danger-tag to the plug-top.

7. Have your results checked by your lecturer

Part B - Short Circuit Test



1. Re-connect the transformer as shown in the circuit diagram with a short circuit across the secondary winding of the transformer. Note that a multimeter is to be used for all voltage readings.

2. Check the full load current rating of the transformer secondary winding:

Rated full load secondary current: amps.

3. Check your circuit for short circuits with a multimeter.

4. Have your wiring checked by your lecturer.

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

5. Set the Variac to the lowest voltage position. Energise the circuit and increase the primary voltage gradually until the secondary current is equal to the rated full load .current. Measure the primary voltage and input power and record the values in Table 3.

Table 3

	Short Circuit Test Results	
1	Secondary current (I_S)	
2	Measured primary voltage at full load secondary current (V_{PS})	
3	Input power as indicated on the wattmeter	

6. Switch the circuit off, remove the plug from the outlet and attach your danger tag to the plug-top.

7. Have your results checked by your lecturer

9. Disconnect your wiring and return all of the equipment to its proper plac

GOVERNMENT OF WESTERN AUSTRALIA

TAFE WA North Metropolitan

Assessment Portfolio of Evidence

Qualification national code and title	UEE30820 Certificate III in Electrotechnology Electrician
Unit/s national code/s and title/s	UEEEL0025 - Test and connect transformers

END OF PORTFOLIO OF EVIDENCE