

Title	Demonstrate and apply knowledge of single-phase and three-phase transformers		
Level	4	Credits	4

Purpose	<p>This unit standard is for people in the electrical and related trades and covers single-phase and three-phase transformer calculations.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> – solve problems involving single-phase transformers; – determine single-phase transformer characteristics by measurement; – demonstrate knowledge of single-phase transformer applications; – demonstrate knowledge of three-phase transformer losses; – demonstrate knowledge of three-phase transformer theory; – take and verify three-phase transformer measurements; and – demonstrate knowledge of single-phase and three-phase transformer safety requirements.
----------------	--

Classification	Electrical Engineering > Core Electrical
-----------------------	--

Available grade	Achieved
------------------------	----------

Explanatory notes

- 1 This unit standard has been developed for learning and assessment off-job.
- 2 This unit standard and unit standards 25072, 29470, and 29473 together meet the assessment requirements of ERAC EPCs 7.
 This unit standard and unit standards 15848, and 29473 together meet the assessment requirements of ERAC EPCs 18.
 This unit standard and unit standard 29473 together meet the assessment requirements of ERAC CEPCs 19.
- 3 Definitions
a.c. – alternating current.
CEPC – Critical Essential Performance Capabilities.
EPC – Essential Performance Capabilities.
ERAC – Electrical Regulatory Authorities Council.
EWRB – Electrical Workers Registration Board.
Industry practice – those practices that competent practitioners within the industry

recognise as current industry best practice.

Safe and sound practice – as it relates to the installation of electrical equipment is defined in AS/NZS 3000:2007, *Electrical Installations (known as the Australian/New Zealand Wiring Rules)*.

4 Range

- a Candidates are to be supplied with formulae involving more than three quantities.
- b Use of a calculator during assessment is permitted.
- c Candidates are expected to express calculated values in the relevant Systeme Internationale (SI) units, including multiples and sub-multiples (pico, nano, micro, milli, kilo, mega, etc) and be able to convert between them.
- d Candidates may refer to current legislation and Standards during assessment.
- e Demonstration of safe working practices and installation in accordance with *safe and sound practice* are essential components of assessment of this unit standard.
- f All activities and evidence presented for all outcomes and evidence requirements in this unit standard must be in accordance with:
 - i legislation;
 - ii policies and procedures;
 - iii ethical codes;
 - iv Standards – may include but are not limited to those listed in Schedule 2 of the Electricity (Safety) Regulations 2010;
 - v applicable site, enterprise, and industry practice; and,
 - vi where appropriate, manufacturers' instructions, specifications, and data sheets.

Outcomes and evidence requirements

Outcome 1

Solve problems involving single-phase transformers.

Evidence requirements

- 1.1 Solve problems involving primary and secondary turns, voltage, and current for resistive loads.

Range $I_P/I_S = N_S/N_P = V_S/V_P$.

- 1.2 Solve simple problems involving transformer ratings for resistive loads and negligible losses.

- 1.3 Explain the difference between volt-amps and watts with reference to reactive and resistive loads.

Outcome 2

Determine single-phase transformer characteristics by measurement.

Range isolating transformer, step-down double-wound transformer, auto-transformer.

Evidence requirements

- 2.1 Measure and record voltages across and currents through a resistive load

connected to each type of transformer.

2.2 Calculate volt-amps, power in load, and turns ratio.

2.3 Explain variations between measured, calculated, and nameplate values in terms of supply variations, transformer losses, and measurement error.

Outcome 3

Demonstrate knowledge of single-phase transformer applications.

Evidence requirements

3.1 Compare double-wound and auto-transformers in terms of physical, mechanical, and electrical properties.

3.2 Describe the requirements of current regulations and standards with respect to transformers.

Range extra-low voltage circuits, electric toys, medical and dental apparatus, high-voltage discharge lamps, restrictions for auto-transformers;
for assessment purposes candidates may refer to current regulations and standards.

Outcome 4

Demonstrate knowledge of three-phase transformer losses.

Evidence requirements

4.1 Explain variable transformer losses in terms of load current, winding resistance, and variation with load.

Range copper loss (I^2R loss), $\propto I^2$.

4.2 Explain constant transformer losses in terms of hysteresis loss, eddy-current loss and state methods of reduction in terms of construction material selection.

4.3 Carry out transformer load and fault calculations.

Outcome 5

Demonstrate knowledge of three-phase transformer theory.

Evidence requirements

5.1 State the relationship between line and phase values of voltage, current, and volt-amps (VA) for star and delta winding configurations.

5.2 Calculate transformer values from given data for different winding configurations.

Range values – primary and secondary voltage and current, turns ratio, VA rating; configurations – star-star, delta-delta, star-delta, delta-star.

- 5.3 Illustrate the effect of load current on the secondary terminal voltage of a transformer with the aid of calculations, and describe the use of tap changing to overcome this effect.
- 5.4 Calculate transformer efficiencies from given data for different values of secondary load.
- 5.5 Describe the purpose of three-phase transformers in terms of domestic, commercial, industrial and electricity supply applications.

Outcome 6

Take and verify three-phase transformer measurements.

Range transformers – star-star, delta-delta, star-delta, delta-star; values – primary and secondary turns, voltage, current, VA.

Evidence requirements

- 6.1 Take measurements and compare results with nameplate values, and explain variations in terms of supply variations, non-linear components, transformer losses, and instrument and measurement errors.

Outcome 7

Demonstrate knowledge of single-phase and three-phase transformer safety requirements.

Evidence requirements

- 7.1 Explain potential hazards associated with transformers.
- 7.2 Explain precautions to be observed when working with transformers.

Replacement information	This unit standard and unit standard 29473 replaced unit standard 15850 and unit standard 15857.
--------------------------------	--

Planned review date	31 December 2019
----------------------------	------------------

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	21 July 2016	N/A

Process	Version	Date	Last Date for Assessment
Revision	2	16 March 2017	N/A

Consent and Moderation Requirements (CMR) reference	0003
--	------

This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact The Skills Organisation at reviewcomments@skills.org.nz if you wish to suggest changes to the content of this unit standard.