Title	**Demonstrate knowledge of requirements for connecting photovoltaic arrays**		
Level	**4**	**Credits**	**3**

Purpose	This unit standard covers the knowledge to determine the optimal electrical connections between arrays and other photovoltaic system components. People credited with this unit standard are able to demonstrate knowledge of requirements for connecting photovoltaic arrays.

Classification	Renewable Energy Systems > Renewable Energy Systems - Installation and Maintenance

Available grade	Achieved

Guidance information

1 References
All Australian/New Zealand Standards (AS/NZS) may be found at http://www.standards.govt.nz/;
AS/NZS 3000:2018 Amd3: 2023, *Electrical Installations (known as the Australian/New Zealand Wiring Rules)*;
AS/NZS 5033:2021: *Installation and safety requirements for photovoltaic (PV) arrays*;
and all subsequent amendments and replacements.

2 Definitions
Current regulations and standards – in this unit standard this term is used to refer to the requirements of the above references.
d.c. – direct current.
ELV – extra low voltage.
EMI – electro-magnetic interference.
Enterprise policies and procedures – those practices and procedures that have been promulgated by the company or enterprise for use by their employees.
Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.
LV – low voltage.
MPPT – maximum power point tracking.
PV – photovoltaic.
UV – ultra-violet.

3 Range
- a All measurements are to be expressed in Système Internationale (SI) units, and where required, converted from Imperial units into SI units.
- b Candidates shall be supplied by the assessor with formulae involving more than three quantities.
- c Use of a calculator during assessment is permitted.
- d All activities must comply with any policies, procedures, and requirements of the organisations involved.
- e All activities and evidence presented for all outcomes and performance criteria in this unit standard must be in accordance with legislation, enterprise policies and procedures, ethical code, current regulations and standards, industry practice; and where appropriate, manufacturer's instructions, specifications, and data sheets.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of requirements for connecting photovoltaic arrays.

Performance criteria

1.1 Describe methods used in wiring and connecting PV arrays.

1.2 Outline considerations involved in wiring of series connected PV modules in order to minimise power losses due to shading.

1.3 Explain the properties of photovoltaic systems that make special wiring rules a necessity.

Range low voltage d.c., current limited source, inability to shut down source, inability to use overcurrent protection.

1.4 Describe the requirements of AS/NZS 5033 relating to connection of photovoltaic arrays.

Range reverse current protection, cable requirements, system layout, isolation devices, string fusing, mechanical protection.

1.5 Prepare a PV array wiring diagram.

1.6 Explain considerations involved in choosing the location of regulators/MPPTs, d.c. control board and batteries.

1.7 Determine the optimal cable route between system components to minimise the route length.

1.8 Describe requirements for mechanical protection and UV protection of roof mounted cables.

1.9 Explain the relationship between enclosed loop area and EMI and the need to minimise enclosed loop area.

1.10 Describe array and sub-array isolation, isolator ratings appropriate to inverter topology (galvanically isolated, transformerless), earthing, and labelling requirements as specified in AS/NZS 5033.

Range d.c. current breaking capacity, single and dual pole isolation, earthed and non-earthed arrays, signage requirement, main and sub array.

1.11 Describe overcurrent and reverse current protection requirements.

Range number of parallel strings, cable size, short circuit current, module fuse rating.

1.12 Outline requirements for emergency services signage.

1.13 Describe array frame earthing requirements.

Range array configuration (earthed, non-earthed), inverter type (galvanically isolated, transformerless), lightning protection requirements.

1.14 Describe interconnection methods for the safe intra-connection of LV arrays.

Range requirement to safely break up into ELV parts, use of solar couplers, touch safe couplers, arcing, effect of disconnection under load, additional care required when disconnecting isolated arrays.

Planned review date	31 December 2026

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	21 July 2011	31 December 2015
Review	2	17 July 2014	31 December 2020
Review	3	24 October 2019	N/A
Rollover and Revision	4	27 March 2025	N/A

Consent and Moderation Requirements (CMR) reference	0003

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

Comments on this unit standard

Please contact Waihanga Ara Rau Construction and Infrastructure Workforce Development Council qualifications@waihangaararau.nz if you wish to suggest changes to the content of this unit standard.