Site Visit Worksheet

Instructions:

Workshop attendees will be visiting a grid-connected PV system site. Attendees will break into groups and inspecting the system. Only one worksheet is required to be completed per group.
Each group will first record the system design and system components, then assess the system against the checklist provided. Once workshop attendees have returned to the workshop room, each group will report on their findings, observations and comments.

PV System Inspections Checklist

Location of System	

Solar Array Information

Total Size of Array	kW
Total number of Modules	
Array Ground mounted or roof mounted?	
Array Configuration:	
Number of modules in series (one string)	
Number of these strings in parallel (total)	
Number of modules in series (if different string)	
Number of these strings in parallel (total) (Add more if required	

Solar Modules

Module Brand	
Module Model	
Module Quantity Installed	
Module Power Rating	
Module Voltage Open Circuit	
Module Current Short Circuit	
Do the modules meet the following standards:	Check the label on the back of the module. Tick if they meet the Standard or cross if they do not.
IEC 61215 Terrestrial photovoltaic (PV) modules - Design qualification and type approval	☐
IEC 61730 Photovoltaic (PV) module safety qualification.	☐

Inverters

Number of Inverters	
Are all Inverters the same?	
Number of different models/brands of Inverter	
Duplicate the following for each different brand/model of inverter.	
Inverter Brand	
Inverter Model	
Does the inverter meet the following standards:	Check the label on the side of the inverter(s). Tick if they meet the Standard or cross if they do not.
IEC 62109 Safety of power converter for use in photovoltaic power systems.	☐
AS/NZS4777.2: 2015 Grid connection of energy systems via inverters Inverter requirements	☐
Inverter ac Power Rating	
Inverter Nominal ac Current	
Inverter Ingress Protection Rating	
Is the Inverter Galvanically Isolated	
Number of MPPTs	
Inverter MPPT 1 dc Voltage Range Lower limit	
Inverter MPPT 1 dc Voltage Range Upper limit	
Inverter dc Maximum Voltage	
MPPT 1 Maximum dc input current	
Number of parallel strings attached to MPPT 1	
Maximum current from strings less than maximum input current of MMPT 1	
Number of modules in series in each string	
String Vmp is greater than the minimum MPPT 1 voltage window at 75 °C	
String Voc is less than the inverter maximum dc input voltage at 10 °C	
Inverter MPPT 2 dc Voltage Range Lower limit	
Inverter MPPT 2 dc Voltage Range Upper limit	
Inverter dc Maximum Voltage	
MPPT 2 Maximum dc input current	
Number of parallel strings attached to MPPT 2	
Maximum current from strings less than maximum input current of MMPT 2	
Number of modules in series in each string	
String Vmp is greater than the minimum MPPT 2 voltage window at 75 °C	
String Voc is less than the inverter maximum dc input voltage at 10 °C	
Inverter dc maximum input Current	
Maximum array current connected to inverter less than maximum dc input current of inverter	

Array Structure

Brand	
Model	
Meets Wind Loading Requirements for location	

The information on the isolators will be dependent on the actual system configuration.

DC Isolators

DC Isolator Voltage	
DC Isolator Current	
DC Isolator Location (circle)	Adjacent to Inverter/Elsewhere
DC Isolator Non-Polarised	☐

AC Isolators

AC Isolator Rating	
AC Isolator Inside Switchboard	☐
AC Isolator Next to Inverter	☐

String Cables

Cross Section Area of String Cables	mm^2
Current Carry Capacity of String Cables	A
Maximum Current on each string	A

Array Cables- If String Cables join Combiner Box

Cross Section Area of Array Cables	mm^2
Current Carry Capacity of Array Cables	A
Maximum Current on from Array	A

Voltage Drop

Maximum Length of String cables	m
Maximum Voltage Drop in string cables	V
String Vmp	V
Maximum voltage drop (string cables) as %	%
Maximum Length of array cables	m
Maximum Voltage Drop in array cables	V
Array Vmp	V
Maximum voltage drop (array cable) as %	%
Total dc voltage drop from array to inverter	V
Total maximum voltage drop from array to inverter	

General Wiring and Installation Work

Item	Clause	Description	Compliant	Notes
1	AS/NZS 3000 1.5.3.1	There are no exposed LV live parts on any installed equipment.		
2	AS 3000 1.6 & 1.7	All electrical equipment for the system is installed in accordance with AS/NZS3000		
3	AS/NZS 3000 4.1.3	Inverter is of appropriate IP rating for its location.		
4	AS/NZS 3000 3.7.2.3	There are no visible loose connections in LV cables.		

Compliance with Standards and Guidelines- Array Installation and dc Wiring

Item	Clause	Description	Compliant	Notes
5	AS/NZS 5033:2014 2.2	PV mounting structure and attachment to roof visually inspected and appears to be secure.		
6	AS/NZS 5033:2014 2.2	Any freestanding PV structure was visually inspected and appears to be secure.		
7	AS/NZS 5033:2014 2.2.7	All array supports, brackets, screws and other metal parts are either: (a) of similar material or stainless steel to minimise corrosion; or (b) where dissimilar metals that can have a galvanic reaction are used, they are galvanically isolated		
8	PPA/SEIAPI Guidelines	Roof penetrations and/or the roof top components used in the wiring system including secondary shields, isolator shrouds, conduits and conduit glands are suitably installed, sealed and waterproof		
9	PPA/SEIAPI Guidelines	The PV Array structure allows sufficient clearance to facilitate self-cleaning of the roof to prevent any build-up of leaves and other debris.		
10	PPA/SEIAPI Guidelines	Modules have sufficient ventilation space to minimise temperature rise.		
11	PPA/SEIAPI Guidelines	PV Wiring Losses are less than 3%.		
12	PPA/SEIAPI Guidelines	AC wiring losses are less than 1% between the inverter and the point of connection to the grid		
13	AS/NZS 5033:2014 4.4.1	Disconnection means has been provided to isolate PV array from inverter to allow for maintenance and inspection		

14	AS/NZS 5033:2014 4.3.1 (a)	DC Isolators are rated for DC use		
15	AS/NZS 5033:2014 4.3.1 (b)	All isolators have a voltage rating greater than or equal to PV array maximum voltage		
16	AS/NZS 5033:2014 4.3.1 (c)	The DC Isolator meets the current rating .i.e. If overcurrent protection is not provided, then the current rating of DC isolator is **1.25 x $I_{sc\ Array}$** **OR** If overcurrent protection is provided, then the current rating for DC isolator is equal to the rating of overcurrent device		
17	AS/NZS 5033:2014 3.1	FOR DOMESTIC DWELLINGS The maximum voltage of the array does not exceed 600 VDC		
18	AS/NZS 5033:2014 3.1	The entire PV array and associated wiring and protection have restricted access where the maximum voltage of the array exceeds 600 V dc in a non-domestic installation.		
19	AS/NZS 5033:2014 2.1.5	Modules in the same string are installed in the same orientation within +/- 5 degrees		
20	AS/NZS 5033:2014 5.3.1	The PV array cabling is distinctively marked PV in permanent, legible and indelible English, or where the cable is not distinctively marked, distinctive coloured labels marked 'SOLAR' attached at intervals not exceeding 2 metres		
21	AS/NZS 3000:2007 3.9.4.1; AS/NZS 5033:2014 4.3.6.3.1	Array wiring and wiring to the inverter is protected from mechanical damage. This requires a visual inspection of all cables related to the system and therefore might require checking on the roof.		
22	AS/NZS 3000 1.5.14; AS/NZS 5033:2014 4.3.6.2	Array wiring and wiring to the inverter is protected from UV. This requires a visual inspection of all cables related to the system and therefore might require checking on the roof.		
23	AS/NZS 5033:2014 3.2	Double insulation has been maintained between any live conductor and any earthed or exposed conductive part		
24	AS/NZS 5033:2014 4.3.6.3.2	All dc cable installed within the ceiling space, wall cavity or floor is enclosed in heavy duty [HD] conduit		

25	AS/NZS 5033:12 4.3.7	All dc connectors are of the same type/model from the same manufacturer where they are married at a connection point		
26	AS/NZS 5033:2014 4.3.1 (c)	Array cables meets the current rating .i.e. If overcurrent protection is not provided, then the current rating of DC cable is 1.25 x Isc Array If overcurrent protection is provided, then the current rating for DC cable is equal to the rating of overcurrent device		
27	AS/NZS 3000:2007 3.9.3.3 & 3.3.2.8; AS/NZS 5033:2014 4.3.6.3.1	All cables/wiring in the installation are securely fixed in place to minimise any movement of the cable.		
28	AS/NZS 3000 1.5.14	Any conduit is installed such that they are protected from UV or the conduit is UV stabilised		
29	AS/NZS 3000 1.5.14	Array wiring and inverter wiring is protected from fauna where deemed necessary.		
30	AS/NZS 3000:2007 3.1; AS/NZS 5033:2014 4.3.6.1	Array wiring and wiring to inverter is rated for the voltage and current.		
31	AS/NZS 3000:2007 3.7.3	All joints in cables are enclosed e.g. in junction boxes and/or comply with the exceptions of AS/NZS3000 Clause 3.7.3		
32	AS/NZS 5033:2014 4.4.4.1	Double insulation has been maintained between the positive and negative conductors/terminations within all enclosures		
33	AS/NZS 3000 3.9	There is no evidence of mechanical damage to LV cables.		
34	AS/NZS 5033:2014 4.3.6.2	Wiring from array to isolator/inverter is single conductor cable both insulated and sheathed.		
35	AS/NZS 5033:2014 4.3.6.2	All array cables are (i) temperature rated to the application; or UV resistant if exposed to the environment; or (iii) flexible (multi-stranded) to allow for thermal/wind movement of arrays/modules		

36	AS/NZS 3000 3.9.4	LV array and inverter cables are not installed near building surfaces as per AS/NZS 3000 requirements		
37	AS/NZS 3000:2007 3.9.8; AS/NZS 5033:2005	Any dc wiring located in the AC switchboard complies with the segregation, insulation and labelling requirements of AS/NZS 3000:2007 and AS/NZS 5033:2005.		
38	AS/NZS 3000 4.1.2 & 4.1.3; AS/NZS 5033 4.3.3.1	dc enclosure/s at the array have a minimum IP 55 rating and have been correctly installed to prevent water ingress		
39	AS 3000 4.1.2 & 4.1.3 and AS/NZS 5033:2014 4.3.3.1	PV cable junction boxes have an IP 54 rating [IP 55 if mounted on the array], and have been correctly installed to prevent water ingress		
40	AS/NZS 5033:2014 3.3.4	Where there is a number of PV array strings, and could result in a potential fault current in any one string greater than reverse current of an individual module - appropriate string protection is provided. [e.g. Fuses or non-polarised circuit breakers]		
41	AS/NZS 5033:2014 3.3.4	Has string overcurrent protection been installed? It will be required if: I_{SC} x (number of strings – 1) > or equal to Module reverse current rating		
42	AS/NZS 5033:2014 3.3.5	The string and sub-array protection current rating is according to clause 3.3.5.		
43	AS/NZS 5033:2014 3.3.5.3	The current rating (I_n) of the PV array overcurrent device is as per the following: $I_n \geq 1.25 \times I_{SC\ ARRAY}$ $I_n \leq 2.4 \times I_{SC\ ARRAY}$		
44	AS/NZS 5033:2014 3.3.5.1; AS/NZS 3000:2007 2.2.4	If string protection is installed, it is rated for dc application and appropriate current.		

45	AS/NZS 5033:2014 4.3.8.2	If string protection is installed, the fuse holders have a current rating equal to or greater than the corresponding fuse		
46	AS/NZS 3000:2007 Clause 5.1.2; AS/NZS 5033:2014 Figure 4.3 & 4.4.2	The PV array mounting frames and modules have an equipotential bond connected to the earthing terminal on the switchboard/distribution board to which the inverter is connected, either directly or via the inverter main earth conductor.		
47	AS/NZS 5033:2014 4.4.2.2	The PV array frame and/ module earthing connections and methods comply with standards requirements		
48	AS/NZS 5033:2014 5.3.2	PV cable junction boxes are labelled 'WARNING: HAZARDOUS DC VOLTAGE'		
49	AS/NZS 5033:2014 3.2	If a transformer-less inverter (non-galvanically isolated) is installed, a functional earth is not connected to the DC positive or negative.		
50	AS/NZS 5033:2014 4.4.2.2	If the PV array is functionally earthed an Earth Fault Interrupter is installed		
51	**PPA/SEIAPI Guidelines**	The dc cables connecting to the inverter are mechanically secured in such a manner that they cannot be inadvertently unplugged from the inverter.		

Compliance with Standards and Guidelines- Inverter, ac cabling and dc and ac Switchgear

Item	Clause	Description	Compliant	Notes
52	AS/NZS 3000 4.1.3 and PPA/SEIAPI Guidelines	Inverter is of appropriate IP rating for its location.		
53	AS 3000 1.7.1 & 1.7.2	Inverter (or any heavy part of system) is installed/mounted safely and there appears no imminent risk of the item falling.		
54	AS 3000 1.7.1 & 1.7.2	Inverter has been installed in a location that has safe access and adequate working space		
55	AS/NZS 3000 1.7.1	There is adequate clearance around the inverter in accordance with inverter manufacturer's recommendation with adequate space and ventilation.		

	The following relates to dc isolator beside inverter-it can be part of the inverter as per PPA/SEIAPI guidelines and AS/NZS5033 and IEC standards			
56	AS/NZS 3000:2007 2.4.2; AS/NZS 4777.1:2005 5.4; AS/NZS 5033:2014 4.3.1	The load breaking dc isolator located adjacent to the inverter is correctly rated for actual required DC voltage and current in accordance with AS/NZS5033		
57	AS 3000 2.2.4.2; AS 4777 5.4; AS/NZS 5033 4.3.1	The Isolator [or C/B] at the inverter, connected to the array, is dc rated.		
58	AS/NZS 5033:2014 4.4.1.2, 4.4.1.3 & 4.4.1.5	The dc isolator [or dc C/B] is mounted close to inverter input and the inverter is not in sight or more than three metres from the array.		
59	AS/NZS 3000 2.3.6.3	The dc Isolator [or dc C/B] is lockable in the off position.		
60	AS 3000 4.1.2 & 4.1.3	The dc Isolator at the inverter is correctly wired.		
61	AS/NZS 5033:2014 4.3.5.2	The dc isolator at the inverter is not polarised and activates in all active conductors		
62	AS/NZS 5033:2014 4.3.3.2	The dc isolator/s at the inverter are readily available		
63	AS/NZS 5033:2014 4.4.1.4	If multiple dc isolators are installed at the inverter, they are grouped and ganged so they operate simultaneously or grouped in a common location		
64	AS/NZS 5033:2014 - 5.5.2	If multiple DC isolators are installed at the inverter the correct warning sign indicating the need to operate all DC isolators to isolate the equipment is present		
	ac isolator, ac cabling and signage			
65	AS/NZS 3000:2007 Amdt. 1 – 2009 7.3.4.1 A	If there is not a clear line of sight between the switchboard connected to the inverter and any person working on the inverter, an AC isolator is provided at the inverter		
66	AS 4777.1 5.3.3	AC Circuit Breaker on switchboard is lockable.		
67	AS/NZS 3000:2007 7.3.5.2 & 7.3.8.2.2	An AC circuit breaker is mounted within the switchboard to act as a main switch for the PV/inverter system and to protect the cable from the switchboard to the inverter.		
68	AS 4777.1 5.3.3	The AC circuit breaker is correctly rated to protect the AC cable installed between the inverter and switchboard to which it is connected		

69	AS 4777.1:2005 5.3.2	The AC cables installed between the inverter and the switchboard to which it is connected are rated at a minimum of the inverter's maximum output current		
70	AS/NZS 3000 3.9.4	inverter cables are not installed near building surfaces as per AS/NZS 3000 requirements		
71	AS/NZS 5033:2014 4.4.4.3	Connection of AC and DC components in same enclosure are segregated i.e. there must be physical separation between AC and DC in an enclosure where wiring from both components are terminated.		
72	AS/NZS 5033:2014 5.5.3	Shutdown procedure is correct and is permanently fixed at inverter and/or on main switchboard.		
73	AS/NZS 4777.1:2005 5.5.3	If the solar system is connected to a distribution board, the following sign is located on main switchboard & all immediate distribution boards. 'WARNING DUAL SUPPLY ISOLATE SOLAR SUPPLY AT DISTRIBUTION BOARD (name)'		
74	AS/NZS 4777.1:2005 5.5.2 (b)	The AC circuit breaker in the switchboard is labelled: 'MAIN SWITCH Solar Supply' or similar.		
75	AS 4777.1:2005 5.5.2 (a)	Sign – 'WARNING Dual Supply Isolate Both Normal and Solar Supplies before working on this switchboard' is located on the switchboard.		
76	AS 4777.1:2005 5.5.1	Where the inverter is not adjacent to the main switchboard, inverter location information should be displayed on the switchboard to which the inverter system is directly connected.		
77	AS 4777.1 5.5.1; AS/NZS 5033 6.4	Fire Emergency information is correct and is permanently fixed within the buildings main switchboard. 'SOLAR ARRAY ON … (location) …' sign and includes the correct PV array Voc and Isc ratings		
78	AS/NZS 5033:2014 5.5.2	dc isolator near inverter is appropriately labelled.		
79	AS 4777.1 5.5.2; AS 3000 7.3.8.2.2	Grid supply main switch is labelled 'MAIN SWITCH Normal Supply' or similar.		
80	AS/NZS 5033:2014 5.5.4	Signage "WARNING HAZRADOUS VOLTAGE - AUTHORIZED ACCESS ONLY" is installed if the system voltage is greater than 600V dc on a non-domestic installation		