Technical Evaluation Criteria (TEC) for the Rooftop PV + BESS Solution for Sunilaws Office Park

1. Requirement

To provide the Rooftop PV + BESS solution for Eskom Sunilaws Office Park in the Eastern Cape.

2. Evaluation strategy

Tenderer submissions will be evaluated for compliance against the technical requirements categorized as (a) Mandatory Criteria and (b) Objective Criteria.

It is required for the tenderer to submit ALL Mandatory Requirements. Any mandatory non-compliance will render the whole technical submission as non-compliant.

The Objective Criteria submission will be evaluated on a point system.

Tender submissions will also be evaluated on the submitted Test Reports/Certificates.

3. Point scoring for Objective Criteria

a) The Objective Criteria consists of the evaluation of the experience and capability of the tenderer. Provisions of warranties by the tenderer are evaluated as well. There are six items of evaluation. They are either scored at **5 points** or **10 points**.

b) The Objective Criteria consists also of Schedules A&B. It is required for the tenderer to complete Schedule B.
Each correct entry by the tenderer in the Schedule B, will earn the tenderer **one** point. Where there is a submitted deviation in the Deviation Schedule and it is acceptable, the tenderer will earn **one** point.
Words like, “NOTED”, “TBA”, “OK”, etc. must not be used in Schedule B. If these words are used, **zero** point will be received by the tenderer.

c) The Objective Criteria also consists of further technical assessments on the capability of the offered product and solution. It is required for the tender to indicate if his/her offer Complies with, does Not Comply with, is Not Applicable to, or Deviates from the assessed specified technical requirement.
Each correct entry by the tenderer in the further technical assessments, will earn the tenderer **one** point.

d) Each correct test report/certificate submitted by the tenderer will earn the tenderer **one** point.

4. Qualifying points

This technical evaluation forms 100% of the total technical evaluation for the tender.

There are four sub-sets of this evaluation, broken down as follows:

Evaluation of civil work experience	**[10%]**
Evaluation of steel structures construction experience	**[10%]**
Evaluation of LV electrical construction experience, with issuing COC's	**[5%]**
Evaluation of solar rooftop PV construction experience (quantity)	**[10%]**
Evaluation of solar rooftop PV construction experience (capacity)	**[10%]**
Evaluation of the provision of the warranty certificates from the OEM	**[5%]**
Evaluation of the technical specifications for the microgrid	**[50%]**
Schedules A&B	20%
Further technical assessments	15%
Test reports/certificates	15%

The tenderer is required to respond on the mandatory requirements below with a "Yes" or "No" under "Compliant".

Mandatory Criteria (Requirements)

Item no. [#]	Mandatory Requirement	Compliant [Yes/No]
1	All submissions shall be in the English language	
2	Tender submissions need to be in electronic format, with files appropriately labelled and stored in folders. *(Manually submissions may accompany electronic submissions, but they may not replace electronic submissions.)*	
3	Rooftop on carparks, three-phase, 335 kWp Rooftop PV solution	
4	Built with mono crystalline silicon solar panels	
5	Equipped with 500 kWh Lithium-ion batteries (High Voltage type) for the BESS, and with the battery management system	
6	Built with inverter banks, with EACH inverter having at least four (4) MPPT inputs, with each MPPT input rated at 5 kW (to match the existing infrastructure) *(Provide proof)*	
7	Inverter bank is upgradeable	
8	Solar panels mounted on car port structures	
9	All car port steel structures and assemblies to meet the coastal specifications. e.g., hot dip galvanised, etc.	
10	The PV system need to utilise internal or external MPPTs.	
11	The Microgrid should have the ability to be integrated onto the existing Eskom IT infrastructure	
12	The system must be able to operate islanded (with no utility/municipal supply)	
	The PV system must have the capability to export power back to the municipality, at 0% to 100%, through the inverter settings.	
13	There must be no de-rating of performance on output (when no AC or generator present)	
14	Suitably rated 4-pole automatic change-over switches should be provided, with the auxiliary circuit for each fully wired and with indicator lamps	
15	The PV system should have a local HMI for monitoring and control	
16	The fire suppression system needs to be installed in each battery/inverter room	
17	Consultant/Contractor to do **ALL** the PV assembly and LV connections to the Minisubs A&B, kiosks and inverters	
18	Consultant/contractor to do all the civil works for the Microgrid and the galvanised steel frame	
19	Letter of commitment for technical support for aftersales, including repairs on parts, with a warranty period for the entire PV solution assembly and installation of at least 12 months, starting from the date of final hand-over to Eskom.) *(Provide proof)*	
20	At least one proof of civil work experience *(Provide proof)*	
21	At least one proof of electrical work experience *(Provide proof)*	

22	The Consultant/Contractor must be registered with the South African Photovoltaic Industry Association (SAPVIA) Registration, with at least one PV GreenCard-certified installer onsite at at all times during installation, commissioning, and maintenance *(Provide proof)*	

NB: ALL MANDATORY REQUIREMENTS MUST BE MET.

Objective Criteria

1.1 Evaluation of civil work experience [10%]
The tenderer is required to provide proof of experience (at least five projects) in the design and construction of civil works (including concrete foundations).
1.2 Evaluation of steel structures construction experience [10%]
The tenderer is required to provide proof of experience (at least five projects) in the design and construction of steel structures (including that of undercover parking).
1.3 Evaluation of LV electrical construction experience, with issuing COC's [5%]
The tenderer is required to provide proof of experience (at least five projects) in the design and installation of LV electrical circuits and with LV underground cables, and the issuing of the certificates of compliance (CoC) for such works.
1.4 Evaluation of solar rooftop PV construction experience (quantity) [10%]
The tenderer is required to provide proof of experience (at least five projects) in the design and installation of solar rooftop PV systems.
1.5 Evaluation of solar rooftop PV construction experience (capacity) [10%]
The tenderer is required to provide at least one proof of experience in the design and installation of solar rooftop PV systems with the size reaching 150 kW.
1.6 Evaluation of the provision of the warranty certificates from the OEM [5%]
The tenderer is required to provide <u>at least</u> TWELVE months warranty certificates or letters from the OEM for various items used in the solar PV system. The warranty period provided by the OEM's should cover at least 12 months after the items have been handed over to Eskom by the consultant/contractor after installation (Tenderer to obtain the most recent certificate or letter from the OEM): a) 12 months, or more, warranty certificate for the solar panels (*excluding extensive hail damage*) b) 12 months, or more, warranty certificate for the inverters c) 12 months, or more, warranty certificate for the batteries

2.1 Evaluation of the technical specifications for the microgrid [50%]

The tenderer is required to complete Schedule B of the Schedule A&B below. In the case that the tenderer deviates from the requirements of Schedule A *(Completed by Eskom)*, the tenderer needs to qualify the deviation in the Deviation Schedule. The Deviation Schedule entry should be referenced with item number, e.g., M.1.1

A. PHOTOVOLTAIC MODULES(PANELS)

PHOTOVOLTAIC MODULES (PANELS)					
1	**2**	**3**	**4**	**5**	**6**
Item	**SANS 959-1 :2016 subclause**	**Description**	**Unit**	**Schedule A**	**Schedule B**
M.1		**General information on the modules**			
M.1.1		Supplier's name		xxxxxxxxxx	
M.1.2		Country of origin of module		xxxxxxxxxx	
M.1.3		Manufacturer's name		xxxxxxxxxx	
M.1.4		Manufacturer's product code and designation		xxxxxxxxxx	
M.1.5		Tender document number		xxxxxxxxxx	
M.2	**4.2.1**	**PV material/cells**			
M.2.1	4.2.1.1.1	Monocrystalline silicon, polycrystalline, amorphous silicon, other?		xxxxxxxxxx	
	4.2.1.1.2	Supplier, model designation, of PV module		xxxxxxxxxx	
M.2.2	4.2.1.1.2	Manufacturer of PV modules		xxxxxxxxxx	
M.2.3	4.2.1.4	Number of cells in series		36 if conventional monocrystalline or polycrystalline	
M.3	**4.2.1.2**	**Mechanical and electrical features**			
		Performance in accordance with the requirements of SANS 61215, SANS 61646 (or approved similar standard) regarding the following;		xxxxxxxxxx	xxxxxxxxxx
		a) Visual defects		Yes	
		b) Insulation		Yes	
		c) Temperature coefficients of current and voltage		Yes	
		d) Robustness of terminations		Yes	

		e) Ability to withstand torsional stress, mechanical loads, outdoor exposure		Yes	
		f) Ability to withstand impact of hailstones		Yes	
	4.2.1.2	State fill factor of the module	%	xxxxxxxxxx	
M.4	**4.2.1.3**	**Electrical performance at STC[a]**			
M.4.1		Rated watt-peak power	W	xxxxxxxxxx	
M.4.2		Current at maximum power	A	xxxxxxxxxx	
M.4.3		Voltage at maximum power	V	xxxxxxxxxx	
M.4.4		Short-circuit current	A	xxxxxxxxxx	
M.4.5		Open-circuit voltage	V	xxxxxxxxxx	
	4.2.1.3.2	Daily energy output	Wh	xxxxxxxxxx	
	4.2.1.3.2	Charge	Ah	xxxxxxxxxx	
M.4.6		Temperature coefficient of voltage at maximum power	V/ºC	xxxxxxxxxx	
M.5	**4.2.1.4**	**Electrical performance at higher temperatures**			
M.5.1	4.2.1.4.1	Number of cells offered per panel		xxxxxxxxxx	
M.5.2		NOCT[b]	ºC	xxxxxxxxxx	
M.5.3		Maximum-power current at NOCT	A	xxxxxxxxxx	
M.5.4		Maximum-power voltage at NOCT	V	xxxxxxxxxx	
M.5.5		Open circuit voltage at NOCT	V	xxxxxxxxxx	
	4.2.1.3.2	Temperature coefficient of current	A/ºC	xxxxxxxxxx	
	4.2.1.3.2	Temperature coefficient of voltage	V/ºC	xxxxxxxxxx	
M.5.6		Output power under cell temperature of 80 °C, irradiance 1 000 W/m^2	W	> 93 % of P_{max} at STC	
M.5.7		Output maximum power voltage under cell temperature of 80 °C, Irradiance 1 000 W/m^2	V	> 13,8 V	
		Are M.5.6 and M.5.7 calculated or measured?		xxxxxxxxxx	
		Is MPPT intended to be used?		Yes	
[a] STC: Standard test conditions of 1 000 W/m-2 irradiance, air mass 1,5, cell temperature 25 °C. [b] NOCT: Normal operating cell temperature, in conditions 800 W/m-2 irradiance, ambient temperature 20 °C, wind speed 1 ms-1.					
M.6	**4.2.2**	**Diodes and junction box**			
M.6.1		Integral by-pass diodes used?		xxxxxxxxxx	
M.6.2		Weather-proof module connection box?		Yes	
M.6.3		Terminal type and method of attaching cable?		xxxxxxxxxx	

M.7	**4.2.3**	**Frame, mounting facilities and background colour**			
M.7.1		Anodized aluminium frame?		Preferred	
M.7.2		Can be provided with coloured backing (specify colour)		Optional	
M.7.3		Module has unique serial number laminated?		xxxxxxxxxx	
M.7.4		Any additional anti-theft device(s) described.		Optional	
M.7.5		Clear drawings indicating **dimensions** and **mounting hole** locations and sizes attached.		Yes	
M.8		**Data sheets**			
M.8.1		Full manufacturer's data sheets to be supplied and attached (including current-voltage curves at different cell temperatures).		Yes	
M.8.2		Warranty terms and conditions to be fully described in documentation		Yes	
M.9	**4.2.1.8**	**Certification and warranty**			
M.9.1	4.2.1	Modules have approved certification?		Yes	
M.9.2	4.2.1	State certification authority, standard used (e.g. SANS 61215 or SANS 61646) and certificate number.		xxxxxxxxxx	
M.9.3	4.2.1.5	Period of warranty on modules	Years	> 15	
M.9.4	4.2.1.8	Does quality control comply with SANS 9001?		Preferred	

B. BATTERIES

BATTERIES					
1	**2**	**3**	**4**	**5**	**6**
Item	**SANS 959-1 :2016 subclause**	**Description**	**Unit**	**Schedule A**	**Schedule B**
B.1	**4.3.1**	**General information on batteries**			
B.1.1		Supplier's name		xxxxxxxxxx	
B.1.2		Country of origin of batteries		xxxxxxxxxx	
B.1.3		Manufacturer's name		xxxxxxxxxx	

B.1.4		Manufacturer's product code and designation		xxxxxxxxxx	
B.1.5		Nominal voltage of battery bank	V	xxxxxxxxxx	
B.1.6		Nominal voltage of battery unit	V	xxxxxxxxxx	
B.2	**4.3.2**	**Battery type and physical data**			
B.2.1	4.3.2	Battery type		xxxxxxxxxx	
B.2.2	4.3.2	Sealed or vented?		xxxxxxxxxx	
B.2.3	4.3.2	Flooded (liquid), or sealed (gel or absorbed electrolyte)?		xxxxxxxxxx	
B.2.5		Lithium-ion		xxxxxxxxxx	
B.2.6		Dimensions (height, length, width)	mm	xxxxxxxxxx	
B.2.7		Casing colour (translucent) and material		xxxxxxxxxx	
B.2.8		Terminal type, size and material		xxxxxxxxxx	
B.2.9		Are connectors suitable for 4 mm2 cable supplied with the battery?		Yes/No	
B.3	**4.3.4.2**	**Storage and maintenance requirements**			
B.3.1		Actual charge retained	%	≥ 82	
B.3.2	4.3.4.2	Capacity at discharge rate of:		xxxxxxxxxx	xxxxxxxxxx
		a) C_{120} at 20 ºC		Ah	
		b) C_{20} at 20 ºC		Ah	
		c) C_{10} at 20 ºC		Ah	
	4.3.4.2	Values at rated capacity at *C*20 and a discharge time *t* of 20 h		xxxxxxxxxx	
	4.3.4.2	Storage and maintenance requirements		xxxxxxxxxx	
B.4	**4.3.4.3**	**Endurance in cycles**			
B.4.1		Actual endurance in cycles for different daily DOD at 20 °C – see SANS 959-2-2 c (provide characteristic curve)	DOD %, N	xxxxxxxxxx	
B.4.2		Estimated cycle life of the battery (under simulated field conditions)	Years	≥ 3[c]	
[c] *Higher cycle life preferred*.					
B.5		**Top of charge regulation**			
B.5.1		Boost charge	V	xxxxxxxxxx	
B.5.2		Float charge at 20 °C	V	xxxxxxxxxx	
B.5.3		Float charge at 30 °C	V	xxxxxxxxxx	
B.5.4		Float charge at 40 °C	V	xxxxxxxxxx	
B.5.5	4.5.2.6	Load-shed regulation	V	xxxxxxxxxx	

B.5.6		Load-shed at C120, 20 °C, 80 % DOD	V	xxxxxxxxxx	
B.5.7		Load-shed at C120, 20 °C, 60 % DOD	V	xxxxxxxxxx	
B.5.8		Load-shed at C20, 20 °C, 80 % DOD	V	xxxxxxxxxx	
B.5.9		Load-shed at C20, 20 °C, 60 % DOD	V	xxxxxxxxxx	
B.6	**4.3.4.5**	**Charge retention**			
B.6.1		State actual charge (C_R) retained by battery		xxxxxxxxxx	
B.6.2	4.3.5.3	Recommended maximum system DOD		xxxxxxxxxx	
B.7	**4.3.6.1**	**Required labelling on battery**			
B.7.1		Nominal voltage	V	Yes	
B.7.2		Manufacturer's or supplier's type reference		Yes	
B.7.3		Ampere-hour capacity with rate of discharge and end (final) voltage	Ah, V	Yes	
B.7.4		Positive and negative terminals permanently marked		Yes	
B.7.5	4.5.2.6	Date of manufacture (month, year)		Yes	
B.7.6		Unique serial number		Preferred	
Eskom document: - 240-170000103 *LITHIUM IRON PHOSPHATE BATTERIES STANDARD*					
B.8					
B.8.1		Battery management system (BMS) provided		Yes	
B.8.2		Battery racks/cabinets provided		Yes	
B.8.3		Expected life	Yrs	15	
B.8.4		End of life capacity	%	80	
B.8.5		Deterioration rate / capacity loss	%Ah/yr	xxxxxxxxxx	
B.8.6		Number of cycles to 80%		xxxxxxxxxx	
B.8.7		28-day storage capacity	%	≥85	
B.8.8		Charge recovery value	%	≥90	
B.8.9		Short-circuit current (ISC)	kA	xxxxxxxxxx	
B.8.10		Internal resistance (Rdc)	Ω	xxxxxxxxxx	
B.8.11		LFP cells min voltage	V	2.5	
B.8.12		LFP cells max voltage	V	4.2	

C. BATTERY ENCLOSURE

BATTERY ENCLOSURE					
1	**2**	**3**	**4**	**5**	**6**
Item	**SANS 959-1 :2016 subclause**	**Description**	**Unit**	**Schedule A**	**Schedule B**
E.1	**4.4.2**	**Enclosure for the battery**			
E.1.1		Statement of compliance with SANS 959-1 4.4.2		Yes	
E.2	**4.4.3**	**Battery enclosure: ventilation design**			
E.2.1		Natural or mechanical ventilation design?	V	Yes	

D. REGULATOR, CHARGE CONTROLLER AND MPPT

REGULATOR, CHARGE CONTROLLER AND MPPT					
1	**2**	**3**	**4**	**5**	**6**
Item	**SANS 959-1 :2016 subclause**	**Description**	**Unit**	**Schedule A**	**Schedule B**
R.1	**4.5.1**	**General**			
R.1.1		Type of regulator (hysteresis, PWM, linear, other)		xxxxxxxxxx	
R.1.2		MPPT function included		Yes/No	
R.1.3		Manufacturer		xxxxxxxxxx	
R.1.4		Model designation		xxxxxxxxxx	
R.1.5		Charge regulation method		Series/Shunt	

R.2	**4.5.2**	**Electrical parameters**			
R.2.1	4.5.2	Battery operating input voltage	V	xxxxxxxxxx	
R.2.2	4.5.2.2	Maximum battery input current rating	A	≥ 10	
R.2.3	4.5.2.2	Maximum array operating voltage	V	xxxxxxxxxx	
R.2.4	4.5.2.2	Maximum array operating power	W_p	xxxxxxxxxx	
R.2.5	4.5.2.3	Quiescent operating current consumption as a percentage of the array short-circuit at STC	%	< 1	
R.2.6	4.5.2.3	MPPT input/output energy efficiency	%	> 95	
R.2.7	4.5.2.4	Voltage drop across regulator (between battery input and output to load)	V	≤ 0,5	
R.2.8	4.5.2.4	Voltage drop across regulator (between PV array input and output to battery)	V	≤ 0.7	
R.2.9	4.5.2.5	Supply definition of output behaviour in the case of no battery connection.		xxxxxxxxxx	
R.3		**Set points (at a charge of I_{50}, a discharge rate of I_{120} at 25 ºC)**			
R.3.1	4.5.2.6	Set points as by battery manufacturer's formal recommendation (option A of 4.5.2.6.2) or as for option B:		xxxxxxxxxx	xxxxxxxxxx
R.3.2		a) hysteresis type regulator		xxxxxxxxxx	xxxxxxxxxx
R.3.2.1		1) boost charge	V	xxxxxxxxxx	
R.3.2.2		2) float charge disconnect	V	xxxxxxxxxx	
R.3.2.3		3) float charge reconnect	V	xxxxxxxxxx	
R.3.2.4		4) boost charge activation	V	xxxxxxxxxx	
R.3.3		b) PWM or linear regulator		xxxxxxxxxx	xxxxxxxxxx
R.3.3.1		1) boost charge	V	xxxxxxxxxx	
R.3.3.2		2) float charge	V	xxxxxxxxxx	
R.3.3.3		3) boost charge activation	V	xxxxxxxxxx	
R.3.4		c) all types of regulator:		xxxxxxxxxx	xxxxxxxxxx
R.3.4.1		1) load-shed	V	xxxxxxxxxx	
R.3.4.2		2) load reconnect	V	xxxxxxxxxx	
R.3.5	4.5.2.6.5	Compensation coefficients for temperature:		xxxxxxxxxx	xxxxxxxxxx
R.3.5.1		a) Charge voltage, β	mV/ºC/cell	xxxxxxxxxx	
R.3.5.2		b) Discharge voltage, β	mV/ºC/cell	xxxxxxxxxx	
R.3.6		Type of battery voltage sensor		xxxxxxxxxx	

R.3.7		Type and location of the temperature sensor		xxxxxxxxxx	
R.4	**4.5.5**	**Construction**			
R.4.1		Degree of protection (IP rating)		≥ 32	
R.5	**4.5.6**	**SOC/System status indicators**			
R.5.1		Alternative graphical symbols to indicate battery SOC		xxxxxxxxxx	

E. INVERTER

INVERTER					
1	**2**	**3**	**4**	**5**	**6**
Item	**SANS 959-1 :2016 subclause**	**Description**	**Unit**	**Schedule A**	**Schedule B**
I.1	**4.6.1**	**General information on inverters**			
I.1.1		Supplier's name		xxxxxxxxxx	
I.1.2		Country of origin of inverter		xxxxxxxxxx	
I.1.3		Manufacturer's name		xxxxxxxxxx	
I.1.4		Manufacturer's product code and designation		xxxxxxxxxx	
I.1.5		Principle of operation		xxxxxxxxxx	
I.2	**4.6.2**	**Electrical parameters**			
I.2.1		Nominal input voltage of inverter	V	xxxxxxxxxx	
I.2.2		Rated output voltage	V_{RMS}	230	
I.2.3		Output frequency	Hz	50	
I.2.4	4.6.2.3	Continuous rated capacity at ambient temperature of 0 °C to 35 °C	W	> 150	
I.2.5	4.6.2.4	Wave-form shape		Pure sine wave	
I.2.6		Minimum input voltage	V	< 90 % V_{nom}	
I.2.7		Maximum input voltage	V	> 125 % V_{nom}	

I.2.8		Maximum peak-to-peak output voltage	V	xxxxxxxxxx	
I.2.9		Total harmonic distortion at full load (THD)	%	xxxxxxxxxx	
I.2.10	4.6.2.6	Peak-to-peak output voltage	V	xxxxxxxxxx	
I.2.11		Switching in and out of stand-by		xxxxxxxxxx	
I.2.12		Minimum load required to *activate* ON mode	W or A	xxxxxxxxxx	
I.2.13		Minimum load required to *maintain* ON mode	W or A	xxxxxxxxxx	
I.2.14		Current drawn in stand-by mode (at nominal input voltage)	mA	xxxxxxxxxx	
I.2.15		Load-shed control internal, or by external regulator, or relay		xxxxxxxxxx	
I.2.15.1		Load-shed voltage	V	xxxxxxxxxx	
I.2.15.2		Reconnect voltage	V	xxxxxxxxxx	
I.2.15.3		Time delay	s	xxxxxxxxxx	
I.3	**4.6.3**	**Electrical protection**			
I.3.1		Auto-reset after overload or short circuit (provided that fault and/or load have been removed)		Yes/No	
I.3.2		Protected against reverse polarity connection		Yes	
I.3.3		Protection against overcurrent and short circuit		Yes	
I.3.4		Is output winding of the inverter galvanically isolated?		Yes	
I.3.5	4.6.3.5	Protection features in addition to those Specified available		Yes/No	
I.4	**4.6.5**	**Electrical performance**			
I.4.1		Efficiency at resistive loads of 50 % to 100 % of rated capacity.	%	≥ 80	
I.4.2		Overload (surge) capacity (duration of 1 s) (Power)	%	> 200	
I.4.3		Overload (surge) capacity (duration of 10 s) (Power)	%	> 150	
I.4.4		Overload (surge) capacity (duration of 60 s) (Power)	%	> 120	
I.5	**4.6.6**	**Construction**			
I.5.1		Dimensions (supply drawing)	mm	xxxxxxxxxx	
I.5.2		Mass	kg	xxxxxxxxxx	
I.5.3		IP rating of enclosure (if supplied with enclosure)		xxxxxxxxxx	
I.5.4		Operating temperature range (at rated power)	ºC	0 to +45	
I.5.5		Storage temperature	ºC	-10 to 55	
I.5.6		Tolerance to humidity: storage (Relative humidity)		0 % to 100 %	
I.5.7		Tolerance to humidity: operation (Relative humidity)		0 % to 90 %	
I.5.8		Electronic printed circuit boards and other components protected against corrosion?		Yes	

I.5.9		Serial number permanently marked on inverter.		Yes	
I.5.10		All terminals clearly marked		Yes	
I.5.11		Visual indicators provided in addition to those specified.		Yes/No	
I.6	**4.6.8**	**Expected lifetime**			
I.6.1		State expected lifetime	Years	≥ 7	
I.7	**4.6.10**	**Certification, warranty and testing**			
I.5.1		Standards to which manufacturer complies		xxxxxxxxxx	
I.5.2		Does manufacturer's quality control comply with the SANS 9001?		Yes	

F. GENERIC

GENERIC - AS PER THE SPECIFICATION FOR SUNILAWS OFFICE PARK ROOFTOP PV + BESS (559-395001089)					
1	**2**	**3**	**4**	**5**	**6**
Item		**Description**	**Unit**	**Schedule A**	**Schedule B**
G.1		**Project Baseline**			
G.1.1		Inverter Peak AC Output for 5 seconds, per PGC (PV + BESS)	kW	180	
G.1.2		Inverter Continuous Passthrough (Direct Grid -> Essential), per PGC	kW	180	
G.1.3		Battery Minimum Cycle Life	Cycles	5000	
G.1.4		Battery voltage		High voltage (HV)	
G.1.5		Seamless and automatic islanding and synchronisation, to and from the grid in the event of an outage.		Comply	
G.1.6		User-configurable prioritisation of PV energy production to either essential loads, or battery storage first, with the excess supplied to the other.		Comply	
G.1.7		Support the feature to export any excess energy to the PGC's grid-facing connection, up to a specified power limit.		Comply	

G.1.8		Support the option to utilise LV/MV connected CTs at the complex's PUCs, to enable control of energy exports.		Comply	
G.1.9		Programmable behaviour to perform scheduled grid charge and discharges in a 24h period, using various setting setpoints and sensors / measurements. This and similar functions will allow for flexible peak-shaving schedules to be programmed.		Comply	
G.1.10		Limiting the rate of discharge		Comply	
G.1.11		Setup of battery SOC limits to start and stop discharging		Comply	
G.1.12		At least six programmable time-periods per day where different charge, discharge, thresholds, export enable / disable, and other settings can be automatically switched between, supporting a minute-resolution time setting.		Comply	
G.1.13		Load shaving during times of peak demand or high TOU tariffs, up to 100% of the BESS' peak AC discharge rate, sustained for its full capacity.		Comply	
G.1.14		All PGCs and PUCs will be at three (3) phases.		Comply	
G.1.15		The solution shall support a 100% unbalanced load.		Comply	
G.1.16		All outdoor equipment shall be suitably rated for exposure to UV rays and highly corrosive conditions (e.g. rated / protected against rust). Where required, equipment shall be located to maximise protection against such elements and may necessitate dedicated covers.		Comply	
G.1.17		Inverters will have both a DC disconnect, and AC disconnect switch (or multiples thereof) for isolation and maintenance purposes.		Comply	
G.1.18		The battery BMS and Controllers shall support communication to external data-loggers using Modbus TCP, or Modbus RTU over TCP for real time data transmission. As such, a network interface shall be provided.		Comply	

Further technical assessments

The following requirements pertain to all parts of the PV system, including the PV modules, batteries, inverters, regulators, etc. These items form parts of the power conversion equipment (PCE). Hence, requirements stated below refer to all of them.

The tenderer is required to indicate with an "X" next to the most appropriate response(s). When the tenderer marks an X next to "Not Compliant", the tenderer should qualify that option with marking an "X" next to "Deviation" and providing the detailed deviation in the Deviation Schedule included with the tender documents. In the case that the tenderer chooses a "Not Compliant" option, but does not also mark next to "Deviation", the tenderer will lose all marks allocated to that requirement. Also, if the tenderer marks an X next to "Deviation", but does not provide detailed deviation in the Deviation Schedule, the tenderer will lose all marks allocated to that requirement. The Deviation Schedule entry should be referenced with item number, e.g., MA.1.

G. MARKINGS

MARKINGS							
MA.1		SANS 69109-1:2012 (CL 5.1.1)					
Except for marking of internal parts, markings are visible from the exterior after installation, or are visible after removing a cover or opening a door without the aid of a tool, if the cover or door is intended to be removed or opened by an operator.							
Complies		Not compliant		Not applicable		Deviation	
MA.2		SANS 69109-1:2012 (CL 5.1.1)					
Markings applying to the equipment as a whole are not put on parts which can be removed by an operator without the use of a tool.							
Complies		Not compliant		Not applicable		Deviation	
MA.3		SANS 69109-1:2012 (CL 5.1.1)					
For rack- or panel-mounted equipment, markings are on a surface that becomes visible after removal of the equipment from the rack or panel.							
Complies		Not compliant		Not applicable		Deviation	

MA.4		SANS 69109-1:2012 (CL 5.1.1)					
Graphic symbols may be used and shall be in accordance with Annex C of SANS 69109-1:2012 or IEC 60417 as applicable. Graphic symbols shall be explained in the documentation provided with the PCE.							
Complies		Not compliant		Not applicable		Deviation	
MA.5		SANS 69109-1:2012 (CL 5.1.1)					
Graphic symbols are explained in the documentation provided with the PCE.							
Complies		Not compliant		Not applicable		Deviation	
MA.6		SANS 69109-1:2012 (CL 5.1.2)					
Markings are located on the PCE and will remain clear and legible under conditions of normal use and resist the effects of cleaning agents specified by the manufacturer.							
Complies		Not compliant		Not applicable		Deviation	
MA.7		SANS 69109-1:2012 (CL 5.1.3)					
The equipment, as a minimum, is permanently marked with: a) The name or trademark of the manufacturer or supplier, b) A model number, name or other means to identify the equipment, c) A serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three-month time period.							
Complies		Not compliant		Not applicable		Deviation	
MA.8		SANS 69109-1:2012 (CL 5.1.4)					
The following ratings, as applicable, are marked on the equipment: a) Input voltage, type of voltage (a.c. or d.c.), frequency, and maximum continuous current for each input; b) Output voltage, type of voltage (a.c. or d.c.), frequency, maximum continuous current, and for a.c. outputs, either the power or power factor for each output; c) The ingress protection (IP) rating.							
Complies		Not compliant		Not applicable		Deviation	
MA.9		SANS 69109-1:2012 (CL 5.1.5)					
Marking is located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and, where fuses of different voltage rating value could be fitted, the fuse voltage rating.							
Complies		Not compliant		Not applicable		Deviation	

MA.10	SANS 69109-1:2012 (CL 5.1.6)						
Push-buttons and actuators of emergency stop devices, and indicator lamps used only to indicate a warning of danger or the need for urgent action, are coloured red.							
Complies		Not compliant		Not applicable		Deviation	
MA.11	SANS 69109-1:2012 (CL 5.1.6)						
A multiple-voltage unit is marked to indicate the particular voltage for which it is set when shipped from the factory. *(The marking is allowed to be in the form of a paper tag or any other non-permanent material.)*							
Complies		Not compliant		Not applicable		Deviation	
MA.12	SANS 69109-1:2012 (CL 5.1.6)						
A unit with d.c. terminals is plainly marked indicating the polarity of the connections, with: a) The signs “+” for positive and “–“ for negative; or b) A pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation.							
Complies		Not compliant		Not applicable		Deviation	
MA.13	SANS 69109-1:2012 (CL 5.1.6.1)						
The means of connection for the protective earthing conductor is marked with: a) Symbol 7 of Annex C of SANS 69109-1:2012; or b) The letters "PE"; or c) The colour coding green-yellow.							
Complies		Not compliant		Not applicable		Deviation	
MA.14	SANS 69109-1:2012 (CL 5.1.7)						
The on and off-positions of switches and circuit breakers are clearly marked. If a pushbutton switch is used as the power switch, symbols 10 and 16 of Annex C of SANS 69109-1:2012 are used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.							
Complies		Not compliant		Not applicable		Deviation	
MA.15	SANS 69109-1:2012 (CL 5.1.7)						

The on and off-positions of switches and circuit breakers are clearly marked. If a pushbutton switch is used as the power switch, symbols 10 and 16 of Annex C of SANS 69109-1:2012 are used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.							
Complies		Not compliant		Not applicable		Deviation	
MA.16		SANS 69109-1:2012 (CL 5.1.8)					
Equipment using Class II protective means throughout is marked with symbol 12 of Annex C of SANS 69109-1:2012. Equipment which is only partially protected by double insulation or reinforced insulation does not bear symbol 12 of Annex C.							
Complies		Not compliant		Not applicable		Deviation	
MA.17		SANS 69109-1:2012 (CL 5.1.8)					
Where such equipment, as in M16 above, has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4 of SANS 69109-1:2012) it shall be marked with symbol 6 of Annex C of SANS 69109-1:2012.							
Complies		Not compliant		Not applicable		Deviation	
MA.18		SANS 69109-1:2012 (CL 5.1.9)					
Where required by note 1 of Table 2 of SANS 69109-1:2012 as a result of high temperatures of terminals or parts in the wiring compartment, there is a marking, visible beside the terminal before connection, of either: a) The minimum temperature rating and size of the cable to be connected to the terminals; or b) A marking to warn the installer to consult the installation instructions. *(Symbol 9 of Annex C is an acceptable marking).*							
Complies		Not compliant		Not applicable		Deviation	

H. WARNINGS

WARNINGS							
W.1	SANS 69109-1:2012 (CL 5.2.1)						
Warning markings are visible when the equipment is installed and ready for normal use. If a warning applies to a particular part of the equipment, the marking is placed on, or near to, this part.							
Complies		Not compliant		Not applicable		Deviation	
W.2	SANS 69109-1:2012 (CL 5.2.1)						
Warning markings are legible, and have minimum dimensions as follows: a) Printed symbols are at least 2,75 mm high. b) Printed text characters are at least 1,5 mm high, whether upper case or lower case, and have contrast in colour with the background. c) Symbols or text that are moulded, stamped or engraved in a material have a character height of at least 2,0 mm, whether upper case or lower case, and if not, contrasting in colour from the background, have a depth or raised height of at least 0,5 mm.							
Complies		Not compliant		Not applicable		Deviation	
W.3	SANS 69109-1:2012 (CL 5.2.1)						
If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C of SANS 69109-1:2012. *(Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual.)*							
Complies		Not compliant		Not applicable		Deviation	

I. DOCUMENTATION

DOCUMENTATION							
D.1	SANS 69109-1:2012 (CL 5.3.1)						
The documentation provided with the PCE provides the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment.							
Complies		Not compliant		Not applicable		Deviation	

D.2		SANS 69109-1:2012 (CL 5.3.1)					
The documentation includes the following items: a) Explanations of equipment markings, including symbols used; b) Location and function of terminals and controls; c) All ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements: – Environmental category as per 6.1 (SANS 69109-1:2012) – Wet locations classification as per 6.1 – Pollution degree classification for the intended external environment as per 6.2 – Ingress protection rating as per 6.3 – Ambient temperature and relative humidity ratings – Maximum altitude rating – Overvoltage category assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories;							
Complies		Not compliant		Not applicable		Deviation	
D.3		SANS 69109-1:2012 (CL 5.3.1.1)					
Instructions related to safety shall be in the English language.							
Complies		Not compliant		Not applicable		Deviation	
D.4		SANS 69109-1:2012 (CL 5.3.1.2)					
The documentation shall be provided in electronic format and is to be delivered with the equipment.							
Complies		Not compliant		Not applicable		Deviation	
D.5		SANS 69109-1:2012 (CL 5.3.2)					
The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment.							
Complies		Not compliant		Not applicable		Deviation	
D.6		SANS 69109-1:2012 (CL 5.3.2)					
The information provided in the documentation includes: a) Assembly, location, and mounting requirements;							

b) Ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including instructions that the installation position shall not prevent access to the disconnection means;
c) Ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and external controls, colour coding of leads, or overcurrent protection needed;
d) Explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232);
e) Ventilation requirements;
f) Requirements for special services, for example cooling liquid;
g) Instructions and information relating to sound pressure level if required by 10.2.1 of SANS 69109-1:2012;
h) Where required by 14.8.1.3 of SANS 69109-1:2012, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;
i) Tightening torque to be applied to wiring terminals;
j) Values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceed the max. rated current of the circuit, as per 4.4.4.6;
k) For each input to the PCE, the maximum value of short-circuit current available from the source, for which the PCE is designed;

(NOTE: This input short-circuit current rating applies to ports such as the mains, PV input, and battery circuits, it is not intended for low power signal, control, or communications circuits.)

l) Instructions for protective earthing of the PCE, including the information required by 7.3.6.3.7 of SANS 69109-1:2012 if a second protective earthing conductor is to be installed;
m) For PCE intended to charge batteries, the battery nominal voltage rating, size, and type;
n) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.

Complies		Not compliant		Not applicable		Deviation	

D.7	SANS 69109-1:2012 (CL 5.3.3)

Instructions for use includes ***operating*** instructions necessary to ensure safe operation, including the following, as applicable:
a) Instructions for adjustment of controls including the effects of adjustment;
b) Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;
c) Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and
d) Instructions that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Complies		Not compliant		Not applicable		Deviation	

D.8	SANS 69109-1:2012 (CL 5.3.4)

Instructions relating to ***maintenance*** include the following:

a) Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);
b) Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;
c) Part numbers and instructions for obtaining any required operator replaceable parts;
d) Instructions for safe cleaning (if recommended);
e) Where there is more than one source of supply energizing the PCE, information is provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.

Complies		Not compliant		Not applicable		Deviation	

D.9	SANS 69109-1:2012 (CL 5.3.4.1)

Where battery usage is required, the documentation includes the applicable items from the following list of instructions regarding maintenance of batteries:
(NOTE: The exact wording below does not have to be used as long as the intended information is provided.)

a) Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions.
b) When replacing batteries, replace with the same type and number of batteries or battery packs.
c) General instructions regarding removal and installation of batteries.
d) CAUTION: Do not dispose of batteries in a fire. The batteries may explode.
e) CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.
f) CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:
    1) Remove watches, rings, or other metal objects.
    2) Use tools with insulated handles.
    3) Wear rubber gloves and boots.
    4) Do not lay tools or metal parts on top of batteries.
    5) Disconnect charging source prior to connecting or disconnecting battery terminals.
    6) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).

Complies		Not compliant		Not applicable		Deviation	

D.10	SANS 69109-1:2012 (CL 6)						
The PCE has the environmental conditions ratings for the following, and included in the documentation: a) Environmental category b) Suitability for wet locations or not c) Pollution degree rating d) Ingress protection (IP) rating e) Ultraviolet (UV) exposure rating f) Ambient temperature and relative humidity ratings							
Complies		Not compliant		Not applicable		Deviation	

J. PHYSICAL REQUIREMENTS

PHYSICAL REQUIREMENTS							
PR.1	SANS 69109-1:2012 (CL 13.1)						
Handles, knobs, grips, levers and the like are reliably fixed so that they will not work loose in normal use. Sealing compounds and the like, other than self-hardening resins, have not been used to prevent loosening.							
Complies		Not compliant		Not applicable		Deviation	
PR.2	SANS 69109-1:2012 (CL 13.3.3.3)						
Terminals are provided which accommodate the conductors specified in the installation documentation provided and in the wiring rules applicable at the installation.							
Complies		Not compliant		Not applicable		Deviation	
PR.3	SANS 69109-1:2012 (CL 13.3.3.4)						
Wiring terminals are so designed that they clamp the conductor between metal surfaces with sufficient contact pressure and without damage to the conductor.							
Complies		Not compliant		Not applicable		Deviation	

PR.4		SANS 69109-1:2012 (CL 13.3.3.4)					
Terminals are so designed or located that the conductor cannot slip out when the clamping screws or nuts are tightened.							
Complies		Not compliant		Not applicable		Deviation	
PR.5		SANS 69109-1:2012 (CL 13.3.3.5)					
Terminals associated with a particular input or output circuit are located in proximity to each other.							
Complies		Not compliant		Not applicable		Deviation	
PR.6		SANS 69109-1:2012 (CL 13.3.3.5)					
Terminals for connection to the mains supply circuit are located in proximity to the protective earthing terminal, if any.							
Complies		Not compliant		Not applicable		Deviation	
PR.7		SANS 69109-1:2012 (CL 13.3.3.6)					
Terminals are designed, located, guarded or insulated so that, should a strand of a stranded conductor escape when the conductor is fitted, there is no likelihood of accidental contact between such a strand and other parts if a shock, energy, or fire hazard could result.							
Complies		Not compliant		Not applicable		Deviation	
PR.8		SANS 69109-1:2012 (CL 13.3.3.6)					
To enable servicing of the PCE, a disconnect device or devices are provided to disconnect the equipment from each source of supply that has a hazardous live voltage or exceeds the values for hazardous energy or from which a hazardous live voltage or energy is derived. As an alternative, the installation instructions instruct that a disconnect device for each source of supply be provided as part of the installation and indicates the required type and ratings for the device(s).							
Complies		Not compliant		Not applicable		Deviation	
PR.9		SANS 69109-1:2012 (CL 13.4.1)					
The wiring and connections between parts of the equipment and within each part are protected from mechanical damage during installation. The insulation, conductors and routing of all wires of the equipment are suitable for the electrical, mechanical, thermal and environmental conditions of use. Conductors which are able to contact each other or bare live parts are provided with insulation rated for the highest possible working voltage present.							
Complies		Not compliant		Not applicable		Deviation	
PR.10		SANS 69109-1:2012 (CL 13.4.2)					
A hole through which insulated wires pass in a conductive wall within the enclosure of the equipment is provided with a smooth, well-rounded bushing or grommet or have smooth, well-rounded surfaces upon which the wires bear to reduce the risk of abrasion of the insulation.							

Complies		Not compliant		Not applicable		Deviation	
PR.11	SANS 69109-1:2012 (CL 13.4.2)						
Wires are routed away from sharp edges, screw threads, burrs, fins, moving parts,drawers, and similar parts, which could abrade the wire insulation.							
Complies		Not compliant		Not applicable		Deviation	

K. COMPONENTS

COMPONENTS							
C.1	SANS 69109-1:2012 (CL 14.4)						
Fuse holders with fuses intended to be replaceable by an operator do not permit access to parts that are hazardous live during fuse replacement.							
Complies		Not compliant		Not applicable		Deviation	
C.2	SANS 69109-1:2012 (CL 14.5)						
Devices are constructed so that a change from one voltage or one type of supply to another cannot occur accidentally.							
Complies		Not compliant		Not applicable		Deviation	
C.3	SANS 69109-1:2012 (CL 14.8)						
Equipment containing batteries has been designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.							
Complies		Not compliant		Not applicable		Deviation	
C.4	SANS 69109-1:2012 (CL 14.8.1.1)						
PCE Enclosures for non-sealed and valve-regulated batteries complies with all the following: a) The enclosure or compartment housing the batteries are vented to reduce the accumulation of explosive gasses; b) Arcing parts such as the contacts of switches, circuit breakers, and relays are not located in the battery compartment; c) The battery compartment does not vent into compartments with enclosed spaces that contain arcing parts.							
Complies		Not compliant		Not applicable		Deviation	

C.5		SANS 69109-1:2012 (CL 14.8.2)					
A battery is located and mounted so that the terminals of cells are not able to come into contact with terminals of adjacent cells, or with metal parts of the battery compartment, as the result of shifting of the battery.							
Complies		Not compliant		Not applicable		Deviation	
C.6		SANS 69109-1:2012 (CL 14.8.2)					
Compartments, racks and trays used to contain and support batteries comply with the following as applicable: a) Metallic racks and trays employ non-conductive members directly supporting the batteries or include a continuous insulating material, other than paint, between conductive support members and the batteries. b) The materials used for nonmetallic racks and trays or for a polymeric enclosure or compartment housing a non-sealed or valve-regulated battery are constructed of materials resistant to corrosion by acids or alkalis, as applicable for the battery type.							
Complies		Not compliant		Not applicable		Deviation	

L. INVERTER PARTICULAR REQUIREMENTS

INVERTER PARTICULAR REQUIREMENTS							
IPR.1		SANS 69109-2:2020 (CL 4.4.4.16)					
A stand-alone inverter with a transfer switch to transfer AC loads from the mains or other AC bypass source to the inverter output continues to operate normally and shall not present a risk of fire or shock as the result of an out-of-phase transfer.							
Complies		Not compliant		Not applicable		Deviation	
IPR.2		SANS 69109-2:2020 (CL 4.7.4.2)					
The steady-state AC output voltage shall not be less than 90 % or more than 110 % of the rated nominal voltage with the inverter supplied with its ***nominal value*** of DC input voltage.							
Complies		Not compliant		Not applicable		Deviation	
IPR.3		SANS 69109-2:2020 (CL 4.7.4.3)					
The steady-state AC output voltage shall not be less than 85 % or more than 110 % of the rated nominal voltage with the inverter supplied with ***any value within the rated range*** of DC input voltage.							
Complies		Not compliant		Not applicable		Deviation	

IPR.4	SANS 69109-2:2020 (CL 4.7.4.4)						
The AC output voltage shall not be less than 85 % or more than 110 % of the rated nominal voltage for more than 1,5 s after application or removal of a resistive load equal to the inverter's rated maximum continuous output power in stand-alone mode, with the inverter supplied with its nominal value of DC input voltage.							
Complies		Not compliant		Not applicable		Deviation	
IPR.5	SANS 69109-2:2020 (CL 4.7.4.5)						
The steady-state AC output frequency shall not vary from the nominal value by more than +4 % or –6 %.							
Complies		Not compliant		Not applicable		Deviation	
IPR.6	SANS 69109-2:2020 (CL 4.7.5.2)						
The AC output waveform of a sinusoidal output stand-alone inverter shall have a total harmonic distortion (THD) not exceeding of 10 % and no individual harmonic at a level exceeding 6 %.							
Complies		Not compliant		Not applicable		Deviation	
IPR.7	SANS 69109-2:2020 (CL 5.3.2.8)						
The documentation for an inverter shall include the following: a) If output circuit bonding is required but is not provided integral to the inverter, the required means shall be described in the installation instructions, including which conductor is to be bonded and the required current carrying capability or cross-section of the bonding means; b) If the output circuit is intended to be floating, the documentation for the inverter shall indicate that the output is floating.							
Complies		Not compliant		Not applicable		Deviation	
IPR.8	SANS 69109-2:2020 (CL 5.3.2.10)						
The installation instructions shall include an explanation of how to properly make connections to (where applicable), and use, the electrical or electronic fault indication.							
Complies		Not compliant		Not applicable		Deviation	

Test schedule

The tests required are based on:

a) The SANS standards included in the table below, or
b) Other relevant standards, or
c) In-house related test methods.

1	2	3	4	5
Item	**Components**	**Test Properties**	**Specification**	**Report Number**
PV modules (solar panels)				
1	PV modules (solar panels)	Visual inspection	SANS 959-2-1:2017 (CL 4.2)	
2	PV modules (solar panels)	Performance at standard test conditions (STC)	SANS 959-2-1:2017 (CL 4.3)	
3	PV modules (solar panels)	Insulation	SANS 959-2-1:2017 (CL 4.4)	
4	PV modules (solar panels)	Temperature coefficients	SANS 959-2-1:2017 (CL 4.5)	
5	PV modules (solar panels)	Normal operating cell temperature (NOCT)	SANS 959-2-1:2017 (CL 4.6)	
6	PV modules (solar panels)	Performance at NOCT	SANS 959-2-1:2017 (CL 4.7)	
7	PV modules (solar panels)	Terminations	SANS 959-2-1:2017 (CL 4.8)	
8	PV modules (solar panels)	Mechanical load	SANS 959-2-1:2017 (CL 4.9)	
9	PV modules (solar panels)	Light soaking *(not applicable for crystalline modules)*	SANS 959-2-1:2017 (CL 4.10)	
10	PV modules (solar panels)	Hail	SANS 959-2-1:2017 (CL 4.12)	
Batteries				
11	Batteries	Charge retention	SANS 959-2-2:2016 (CL 4.5)	
12	Batteries	Cycle endurance	SANS 959-2-2:2016 (CL 4.6)	
13	Batteries	Charge efficiency	SANS 959-2-2:2016 (CL 4.7)	
14	Batteries	Visual inspection	SANS 959-2-2:2016 (CL 4.8)	
15	Batteries	Capacity	SANS 959-2-2:2016 (CL 4.9)	
16	Batteries	Mechanical endurance	SANS 959-2-2:2016 (CL 4.10)	
17	Batteries	Cycle endurance in extreme PV applications	SANS 959-2-2:2016 (CL 4.11)	
Regulators, charge controllers and MPPTs				
18	Regulators and charge controllers	Voltage drop test *(Not applicable for MPPTs)*	SANS 959-2-3:2016 (CL 4.7.3)	
19	Regulators, charge controllers and MPPTs	Reverse polarity connection test	SANS 959-2-3:2016 (CL 4.7.4)	

20	Regulators, charge controllers and MPPTs	Overload protection	SANS 959-2-3:2016 (CL 4.7.5)	
21	Regulators, charge controllers and MPPTs	Protection against reverse current	SANS 959-2-3:2016 (CL 4.7.6)	
22	Regulators, charge controllers and MPPTs	Protection against overcurrent at the PV array input	SANS 959-2-3:2016 (CL 4.7.7)	
23	Regulators, charge controllers and MPPTs	Regulator protection and load protection against high PV voltages	SANS 959-2-3:2016 (CL 4.7.8)	
24	Regulators and charge controllers	Loss measurements (quiescent operating current consumption) *(Not applicable for MPPTs)*	SANS 959-2-3:2016 (CL 4.7.8)	
25	Regulators, charge controllers and MPPTs	Acoustic, electromagnetic and electrostatic emissions and susceptibility	SANS 959-2-3:2016 (CL 4.9)	
Inverters				
26	Inverters	Short-circuit survival	SANS 959-2-4:2017 (CL 4.9)	
27	Inverters	Loss measurements	SANS 959-2-4:2017 (CL 4.10)	
28	Inverters	Acoustic noise emission	SANS 959-2-4:2017 (CL 4.11)	
29	Inverters	Electromagnetic interference	SANS 959-2-4:2017 (CL 4.12)	
30	Inverters	Radiated susceptibility	SANS 959-2-4:2017 (CL 4.13)	
31	Inverters	Electrostatic discharge	SANS 959-2-4:2017 (CL 4.14)	
32	Inverters	Load	SANS 959-2-4:2017 (CL 4.18)	
33	Inverters	Mechanical	SANS 959-2-4:2017 (CL 4.19)	