GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
ELECTRICAL AND MECHANICAL SERVICES DEPARTMENT
3 KAI SHING STREET, KOWLOON, HONG KONG

Sample Specification for Installation of Grid-Connected Solar Photovoltaic System

APRIL 2022 (Rev. 1.1)

機電工程署
EMSD

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NOTES TO RESPONSIBLE PERSONS FOR SOLAR PHOTOVOLTAIC SYSTEMS FOR ADOPTING THIS SAMPLE SPECIFICATION

This sample specification serves to assist responsible persons for solar photovoltaic (PV) systems ("responsible persons" hereafter), e.g. building owners and management agencies, to engage Registered Electrical Contractor for carrying out the installation of solar PV system. Responsible persons may consider using some of the terms and conditions contained in this sample specification for preparation of their own procurement documents for engaging REC for carrying out solar PV installation works.

This document is not meant to suit the needs of all responsible persons, and therefore should not be indiscriminately adopted. Responsible persons must carefully consider their own circumstances, needs and budget, and adjust the specifications according to their desired performance levels. Circumstances to consider may include specific user requirements on other PV system components/equipment, provision of method statement for works, carrying out risk assessment for works, to name but a few.

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[Note: The text in bold *italic* shall be inputted by the responsible persons for solar PV system to suit their own needs.]

SAMPLE SPECIFICATION FOR INSTALLATION OF GRID-CONNECTED SOLAR PHOTOVOLTAIC SYSTEM

1. Definitions and Interpretation

1.1 The following definitions and interpretation shall be adopted in this sample specification:

- "Contract" means the quotation and the acceptance thereof by way of services order or letter of acceptance by the Employer, including the Specifications, drawings, documents of pricing/conditions and other relevant documents as included in the tender.

- "Contractor" means the person, firm or company whose quotation has been accepted by the Employer and includes the Contractor's personal representatives, and successors.

- "Employer" means ***XXX*** **(Name of the entity of responsible person)**.

- "Site" means the lands and other places provided by the Employer for the purpose of the execution of the Works.

- "Specification" means the specifications referred to in the Contract and any modification thereof or addition thereof as may from time to time be furnished or approved in writing by the Employer.

- "Works" means all the works and tasks to be executed, supplied and/or carried out by the Contractor under the Contract.

2. General

2.1 This Contract is to employ a Registered Electrical Contractor (REC) to carry out solar photovoltaic (PV) system installation with the scope of works as specified in Section 4. The equipment installed in the solar PV installation works shall be in compliance with the requirements as specified in Section 5.

2.2 The REC as specified in Clause 2.1 above means an electrical contractor registered under section 33 of the Electricity Ordinance (Cap. 406).

3. Regulations, Standards and Guidelines

3.1 The Contractor shall make reference to the latest edition/ version of the following statutory requirements, codes of practice, publications and specifications in carrying out the Works:

a) Electricity Ordinance (Cap. 406), and other subsidiary legislation(s);

b) Code of Practice for the Electricity (Wiring) Regulations, issued by the Electrical and Mechanical Services Department (EMSD);

c) Codes of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installations and Equipment issued by the Fire Services Department;

d) Technical Guidelines on Grid Connection of Renewable Energy Power Systems, issued by the EMSD;

e) Guidance Notes for Solar Photovoltaic (PV) System Installation, issued by the EMSD;

f) Handbook on Design, Operation and Maintenance of Solar Photovoltaic Systems issued by the EMSD;

g) Electricity supply rules of the relevant power companies;

h) Technical guidelines and testing & commissioning requirements for grid connection, issued by the relevant power companies;

i) Relevant National/ International Standards and Codes of Practices;

j) Occupational Safety and Health Ordinance (Cap. 509) , and other subsidiary legislation(s);

k) Factories and Industrial Undertakings Ordinance (Cap. 59), and other subsidiary legislation(s), including but not limited to Construction Site (Safety) Regulation.

4. Scope of Works

4.1 The Contractor shall provide labour, materials, equipment, transportation and all other necessary resources for the design, supply, delivery to the Site, installation, testing and commissioning of a complete grid-connected solar PV system of, but not limited to; the following works:

a) Structural analysis and waterproofing study;

b) Solar analysis;

c) PV panels;

d) Balance of system, including but not limited to electrical works, power inverters, metering facilities, isolation transformers, cables, switchgear and fuses, combiner boxes, surge arresters, blocking diodes, associated builder's works, cable containments and associated accessories, system performance monitoring system, electrical earthing system, supporting structures and other components as necessary to form a complete grid connected PV installation;

e) Lightning protection system, if required after a risk assessment according to IEC 62305.

4.2 In carrying out the solar PV system installation as specified in Clause 5.1, the Contractor shall provide, but not limited to; the following services in order to fully comply with all relevant statutory obligations and regulations (including the Electricity Ordinance, Cap. 406) together with any amendments made thereto as required by all bodies and authorities for the safe and satisfactory standards of the Works. The Contractor shall arrange for all submissions and allow for all costs relating to statutory inspections and certificates as appropriate and as necessary.

a) Grid connection application to power company, liaison and coordination with the power company;

b) Feed-in Tariff (FiT) Application to power company, liaison and coordination with the power company;

c) Drawing submission/approval and registration to related government departments (as well as registration for Generating Facility – Form GF1 to the EMSD if necessary)

d) Applications and submissions as stipulated in the Guidance Notes for Solar PV System Installation issued by the EMSD.

A checklist to facilitate statutory submission and checking is appended at Appendix A.

4.3 The Contractor shall co-ordinate the works with building management's representatives, employer, existing electrical Contractor, etc. as appropriate, for satisfactory completion of the works.

4.4 The Contractor shall provide relevant testing and commissioning report, as-fitted drawings and operation and maintenance manuals to the responsible person on completion of the works for record

5. Equipment and Installation Requirements

5.1 All materials and equipment of the solar PV system shall be products of manufacturers certified under ISO 9001 quality assurance standard. The solar PV system shall be of proprietary product and have test certificates to prove the performance claimed.

5.2 The PV panels and associated electrical installations shall not be installed at the area of refuge nor the means of escape.

5.3 Adequate access to the inverter(s), power distribution panel(s), isolation transformer and the associated facilities shall be allowed such that the periodical testing, cleaning and maintenance can be carried out.

5.4 The equipment and installation requirements of the solar PV system installation as listed in Clause 4.1 shall comply with the followings as well as other relevant requirements in the latest version of the Code of Practice for the Electricity (Wiring) Regulations:-

a) PV Panels

(1) PV panels shall comply with (i) IEC 61215/ BS EN 61215 and IEC 61730; or (ii) UL 1703; or (iii) equivalent.

(2) The working conditions of the PV panel, including the junction box shall be as below:

- Temperature: -40˚C to 85˚C
- Ingress Protection (IP) : IP65 for junction box

(3) The temperature coefficient of power (Pmax) of PV panel shall not be more than 0.42% / °C.

(4) The front glass shall be high transmission tempered glass with anti-reflective coating with less than 4% of reflectance while the frame shall be anodized.

(5) The PV panels shall be provided with performance warranties that guarantee the panels will produce at least 80% of the rated power after 25 years.

(6) The PV panels shall be provided with at least 10-year product warranty.

(7) The PV panels shall be installed according to the manufacturer's recommendation.

b) Power Inverters

(1) The power inverter(s) shall comply with IEC 62109/BS EN 62109, UL 1741 or equivalent.

(2) The working condition of the power inverter(s) shall be as below:

- Temperature: -20°C to 60°C (the full power without derating : 45 °C);
- Operating humidity: 0 - 95%, non-condensing;
- Ingress Protection (IP) (minimum): IP 54 for outdoor application or IP 41 (or IP21 for higher power rating) for indoor application.

(3) The power inverter(s) shall be equipped with the following safety and protection features:

- Internal overvoltage protection;
- Grid monitoring;
- Earth fault protection;
- Direct Current (DC) current monitoring;
- DC reverse polarity protection;
- Anti-islanding protection;
- leakage current protection;
- Alternating Current (AC) overcurrent protection;
- DC disconnection;
- Synchronisation check function; and
- Short circuit protection.

(4) Surge protection at the DC side and AC side should be provided;

(5) The power inverter(s) should be provided with Maximum Power Point Tracking (MPPT) function and the aggregated voltage of a PV string shall be within the operating range of the Maximum Power Point (MPP) Tracker.

(6) The number and arrangement of power inverter(s) shall be designed to achieve the highest efficiency for the conversion of the DC power from the PV panel array.

(7) The efficiency of the power inverter(s) shall not be less than 97%.

(8) The power inverter(s) shall have the automatic start up with sufficient solar power and automatic dormancy to reduce energy consumption under idle condition.

(9) The power inverter(s) shall be provided with at least 5-year warranty.

(10) The power inverter(s) shall be installed according to the manufacturer's recommendation.

c) Isolation Transformers

(1) The isolation transformer(s) shall be of power frequency 50Hz and comply with IEC 61558 and IEC 60076-11 or equivalent.

(2) The isolation transformer(s) shall be dry type and fulfill the following requirements:

- Winding material : Copper;
- Connection: Star with Neutral / Star with Neutral;
- Vector Group: YNyn0;
- Insulation : Class 180 (H) according to IEC 60085;
- Rated frequency: 50 Hz;
- Efficiency : >96%;
- Ingress Protection (IP) (minimum) : IP 21 (for indoor) or IP 54 (for outdoor);
- Ambient temperatures : 0°C to 40°C; and
- Temperature rise: 125°C.

d) Cables and Standard Connectors

(1) The power cables shall be double insulated comply with BS EN 50618. The sheath of the cable installed at the outdoor area shall be weather and UV-resistant and tested to ISO 4982-2 method A or EN 50289-4-17 Method A.

(2) The rated voltage of power cables for the solar PV system shall be suitable for conductor operating temperature of -40 °C to +90 °C.

(3) The power cables for PV panels shall be connected by standard connectors which shall be weather and UV resistant.

(4) The ingress protection of the standard connectors shall be IP67 minimum while the operating temperature shall be up to +90 °C.

e) Lightning Protection System

(1) Risk assessment according to IEC 62305 shall be conducted to check if a lightning protection system is required to protect the PV installation. If required, the contractor shall submit a proposal detailing the budget and the installation for the Employer's consideration.

(2) The solar PV system shall be connected to the earthing system to ensure the operation safety. The frames of PV panels and the metallic supporting frames shall be also earthed properly.

(3) Equipotential bonding conductors shall be securely and reliably connected to extraneous conductive parts of the non-electrical services.

f) Others

(1) The major components shall be labelled to meet the power companies' requirements and Code of Practice for the Electricity (Wiring) Regulations.

(2) Other labels and notices as required by the Electricity Ordinance or the Code of Practice for the Electricity (Wiring) Regulations or the power companies shall be provided where appropriate.

(3) The insulation protection of the DC connection shall be of Class II in accordance with IEC 61140.

6. Testing and Commissioning

a) The electrical installation shall be tested and certified to meet the requirements of the Electricity Ordinance and submit a completed WR1 form.

b) The Contractor shall also perform the functional and safety tests in accordance with the technical requirements as stated in the Technical Guidelines on Grid Connection of Renewable Energy Power Systems issued by the EMSD and the testing and commissioning requirements issued by the relevant power companies.

c) The Contractor shall test the solar PV system to demonstrate the installation complying with the specification requirements and manufacturer's recommendations.

d) The output power shall be measured during the test and compared with the expected power to be generated by the solar PV system at the particular time based on the actual weather condition and solar irradiation.

7. Record Documents

The Contractor shall submit a maintenance manual detailing the periodic maintenance procedures and requirements including, but not limited to the following documents to the Employer for information and record:

a) Test certificates of the major components;

b) Layout plans showing the proposed location and area of the solar PV System ;

c) Electrical wiring diagram showing each solar PV system component with indication of the location;

d) Structural calculation endorsed by a Registered Structural Professionals;

e) Contractor's testing and commissioning report;

f) Contractors and equipment suppliers' contact information;

g) Solar PV system project information sheet (see Appendix B).

8. Defect Liability Period

The Contract includes 1-year defect liability period. The Contractor shall be responsible for all aspects of maintenance and normal operation of the solar PV system (except owing to vandalism or accidental damages) during the defect liability period.

Appendix A: Submission Checklist for Installation of Solar PV System

Items		Responsible Party
1.0 General		
a.	Check land use and lease or tenancy conditions	☐ Owner
b.	Check any restrictions as may be stipulated in the Deed of Mutual Covenant, and obtain the agreement from the Owner's Corporation, Mutual Aid Committee or the management company prior to the carry out of the installation works for PV system	☐ Owner
2.0 Electricity Safety and Power Company Submissions		
a.	Submit generating facility registration application (Form GF1), including work completion certificate (Form WR1) to the EMSD, if applicable	☐ Contractor
b.	Submit the grid connection application, including work completion certificate (Form WR1), to power company	☐ Contractor
c.	Feed-in Tariff (FiT) application to power company	☐ Owner assisted by the Contractor
3.0 For Installation on Buildings		
3.1 New Territories Excepted House (NTEH) *(Fulfill the green and amenity facilities requirement stipulated in the Building New Territories Exempted House, issued by the Lands Department)*		
a.	Submit safety certificate signed by an Authorised Person certifying to the Lands Department	☐ Contractor
3.2 Private Building *(Fulfill minor works items 1.50 and item 3.50 requirement under the minor works control system)*		
a.	Minor Works 1.50 – the Prescribed Building Professional and Prescribed Registered Contractor to submit Notice of Commencement, Certificate of Completion, associated documents and photos to the Buildings Department	☐ Contractor
b.	Minor Works 3.50 – the Prescribed Registered Contractor to submit Notice of Commencement, documents, photos to the Buildings Department	☐ Contractor
4.0 For Installations on Idle Lands		
(Fulfill minor works items 1.50 and item 3.50 requirement under the minor works control system)		
a.	Minor Works 1.50 –Prescribed Building Professional and Prescribed Registered Contractor to submit Notice of Commencement, Certificate of Completion, associated documents and photos to the Buildings Department	☐ Contractor
b.	Minor Works 3.50 – the Prescribed Registered Contractor to submit Notice of Commencement, documents, photos to the Buildings Department	☐ Contractor
c.	Waiver application for setting up solar PV systems on private agricultural lands to the Lands Department. The waiver application fee to be paid by the owner separately.	☐ Contractor

Appendix B: Solar PV System Project Information

Address of the Project: _____

System Information

Type of PV Panels:	_____	
Rated Output of each PV Panel:	_____	Wp
Panel Efficiency	_____	%
Peak solar power generated of the PV System:	_____	kWp
Expected Annual Electricity Generation:	_____	kWh
Inverter rating :	_____	kW
System DC Output:	_____	V
System AC Output:	_____	V
System AC Frequency:	_____	Hz

Warranty

Defect Liability Period End (Date):	_____	
Warranty of:		
- PV Panel:	_____	years
- Inverter:	_____	years

Contractor Information

Name of the REC: _____ REC Company Seal:

Registration Number of REC: _____

Contact Number: _____

Name of the REW: _____ Completion Date: _____