



Annex 3 - Technical Specifications

**PUBLIC WORKS CONTRACT FOR THE SUPPLY AND INSTALLATION
OF ROOF-TOP SOLAR PHOTOVOLTAIC SYSTEMS ON GENERAL
CONSULATE OF BELGIUM IN JERUSALEM**

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1 General conditions

1.1 General

TS-1 These specifications are to specify the quality of materials, level of workmanship, and methods to be followed and respected in project executing and operation.

1.2 Scope

TS-2 The project's scope includes the complete installation, interconnection, commissioning, and operation of three grid-tied, three-phase photovoltaic (PV) systems on the rooftop of General Consulate of Belgium in Jerusalem. These PV system will be seamlessly integrated with the Jerusalem Directorate of Electricity grid, operating under a net-metering framework, with the electricity company serving as the sole electricity distributor.

1.3 Drawings

TS-3 Within the bid documents, an inventory of drawings is furnished. These drawings encompass the System Layout, Mounting Structure Details, Electric Design, and Grounding Layout for all three systems. It is important to note that any expenses incurred by the contractor in fulfilling the requirements outlined in the drawings will be borne entirely by the contractor, inclusive of all costs and expenses, and will be based on the unit rates as stipulated in the bills of quantity.

1.4 Safety

TS-4 All work should be carried out in strict accordance with local safety regulations and a site-specific safety procedure. This includes the use of personal protective equipment, fall prevention measures, electrical and fire safety protocols, and well-defined emergency response procedures.

1.5 Materials and its equivalent

TS-5 All materials and goods must be according to technical specification. In no instance will environmentally harmful products be used.

TS-6 The contractor is to submit the specification and description of the materials that he intends to supply with all necessary information to the Managing Official to investigate before supplying. These information include, but are not limited to, trade name, manufacturer address and the contractor is to submit samples if asked by the Managing Official.

TS-7 Wherever a trade name or catalogue number to any material or any item of work in the specification or bills of quantities or drawings, this is necessary to specify the level of specification required. The contractor can suggest alternatives for these materials provided it is with the same level of specification, and to obtain the Managing Officials approval.

TS-8 When an alternative material, other than mentioned in the contract, is approved and it was not in the same level of specification, the Managing Official has the right to refuse deduction to the

unit rate of these materials. No increase to the contractor prices should be made if better materials were provided (compared to the required specification).

- TS-9* Wherever, in the bills of quantity or specification or drawings, a trade name is mentioned or materials known by its manufacturer company or distributing company or catalogue number, it is to be automatically understood that the required is these materials or equivalent even if the phrase “or equivalent” is not mentioned.

1.6 Materials’ testing

- TS-10* The Managing Official has the right to ask the contractor to accompany the required materials with a testing certificate from the source either from the manufacturer or a laboratory approved by the Managing Official.
- TS-11* The contractor is to make for the Managing Official and his assistants all necessary assistance and services to test the materials brought to site and checking measurements and weighs and provides on his own expenses whatever need from labor, tools, materials ...etc.

1.7 Material off-loading

- TS-12* The off-loading of materials to the project site will be conducted with meticulous consideration for the unique characteristics of the site. Given the specific working hours and the presence of the consulate, material deliveries will be scheduled to minimize disruption to the surrounding. Deliveries will primarily occur during non-peak hours or, when necessary, under stringent traffic management plans to ensure the safety and convenience of residents and visitors. Additionally, the contractor shall coordinate closely with Contracting Authority to ensure that all off-loading activities align with the Consulate operations, respecting their specialized needs and working patterns.

1.8 Temporary offices and warehouses

- TS-13* The contractor must, from the day of the order to start works, bring or build in the site a movable or temporary office for the use of his staff, the supervision staff and the contracting authority when needed. The office shall be in the size suitable for the contractor’s needs and requirements and he must obtain the prior approval of the Managing Official on this office.
- TS-14* The warehouses needed for the contractor use sufficient to store all construction materials needed for the project including equipment and tools. These warehouses must have all the conditions required to protect the materials from the environmental conditions.
- TS-15* The contractor shall be responsible to guard and maintain all the above-mentioned temporary constructions that are used by the contractor. He shall also be responsible to provide the required services for these constructions.
- TS-16* The contractor shall bear all the costs of constructing these temporary constructions.

1.9 Removing the temporary constructions

- TS-17* All temporary constructions for the contractor use shall be kept in all times in a good condition until all stages of works are completed and finally handed over. Afterwards, the contractor shall remove all these constructions and its residuals and cleaning its locations properly so that they leave no trace. If the contractor didn’t fulfill this obligation, the Managing Official has the right

to execute these tasks on the contractor's account and deduct all the expenses from the contractor's payment and insurance with the Contracting Authority, whatever sum it reach without any legal procedure.

1.10 Temporary and permanent services

- TS-18* The contractor shall, at his own expense, redirect public services if exist (like electricity, water, ...) which he found during work and according to Managing Official's directions and approval. If existing services is connected to or related to or related to the works, the contractor shall maintain and keep in place until handing over the works.
- TS-19* The contractor shall, on his own cost, repair any damages to the public services like telephone, electrical , sewage and water services for the concerned authorities or a third party.
- TS-20* If the concerned authority or the third party decided to repair the damages by itself, or asking any of its representatives to do so, the contractor shall born the cost of these repairs don by the concerned authority or the third party. The Contracting Authority, according to the contract conditions, shall not be responsible for any claims for such actions.

1.11 Site meetings

- TS-21* During executing the works and on a periodical base, site meetings shall be held at the project kick-off and whenever needed for the purposes to coordinate the works and to be sure that it is properly executed according to contract conditions and technical specification. Minutes of the meetings shall be prepared by the Supervision Team or his representative and distributed to all parties and it shall be followed.
- TS-22* The contractor shall present in the meeting detailed of the works intended to be executed in the next two weeks, which shall be discussed and proper instruction shall be given, and these instructions and approval issued in the meeting shall be followed by the contractor.

1.12 Daily reports

- TS-23* The contractor shall submit to the Managing Official (or his representative) a daily report containing the required information on the labor (No.s types & hours), equipment and materials arrived to the site and works executed in that day.

1.13 Photographs of progress of works

- TS-24* The contractor at his own expense shall submit once a month, or as the Managing Officials find suitable, suitable number of colored photographs for the executed works or works under progress as directed by the Managing Official.

1.14 Handing over works and removing residuals

- TS-25* The contractor must hand over all works clean and insure removing all materials or construction residuals or rejected materials or remains in the site in general or in the buildings or nearby. The completion of the works as explained here shall be on the contractor's expense and according to the Managing Official's approval. If the contractor didn't fulfill this obligation, the Managing Official has the right to execute these works on the contractor expense and deduct it from the contractor payments or insurance.

1.15 Measurement of works

TS-26 The Engineering measurement (international measurements) shall be used for all works; all openings and intersection shall be deducted. Actual net distances shall be calculated but not exceeding the measurement reported in the drawings.

1.16 Codes and standards

TS-27 All materials and equipment should be registered with an international recognized norm institution or correspond to an international recognized norm. The standards used shall be IEC, IEEE or approved equivalent.

2 Required documents

2.1 Tender submission stage

TS-28 In their bid submission, the tenderer is required to include all datasheets and catalogs for the primary materials they intend to utilize.

TS-29 The tenderer should submit a valid certificates issued by the Palestine Standards Institution for PV modules and solar inverters.

TS-30 As part of the bid submission, the tenderer must provide their company profile and record of relevant past experience as required in tender documents.

2.2 Contractual stage

TS-31 Before commencing material supply, the Contractor is required to furnish a comprehensive flash test report for all PV modules.

TS-32 Prior to the installation kickoff, the Contractor must submit the final clearance certificate obtained from the Civil Defence Department.

TS-33 Before entering the execution stage, the Contractor shall submit the updated detailed designs that incorporate all necessary modifications and address any comments for final approval.

2.3 Pre commissioning stage

TS-34 The Contractor is required to submit the following reports prior to the system commissioning phase:

1. Grounding system test
2. Isolation test for all wires and cables
3. Voc test for each string

TS-35 Prior to system interconnection, the Contractor is responsible for providing all original warranty certificates.

TS-36 Prior to project closing, the Contractor is responsible for providing all electrical and civil as-built drawings.

3 Material specifications

3.1 PV module

TS-37 Module manufacturer should be one of the tier 1 manufacturers as per Year 2023, Q1.

TS-38 The module should satisfy the following minimum specifications, requirements, and standards:

- Mono- crystalline Half-cell
- Rated power 660 Wp @ STC
- Power Output Tolerance P_{Max} ≤ +3 %
- Module efficiency @ STC ≥ 20%
- Output cables: TUV 1×4.0 mm²
- Frame: Anodized Aluminium Alloy, thickness: Minimum of 35mm
- Strong mechanical support to withstand: 5400 Pa snow load, 2400 Pa wind load
- Minimum System Voltage 1000 VDC
- IP68 junction box or higher
- PV cells should be Application Class A as per IEC 61730
- PV panel manufacturer is certified according to ISO 9001 and ISO 14001
- IEC 61215, IEC 61730, IEC 61701 & IEC 62716 Certifications from TUV SUD
- Anti-Potential Induced Degradation (PID) according to IEC 62804

3.2 Solar inverter

TS-39 High quality grid tie inverters from world known manufacturers (SMA, Solaredge, Fimer, Sungrow, or equivalent) should only be used to guarantee the quality and reliability of the equipment. Those inverters will be mounted outdoors at a shaded location in close proximity to the PV arrays. Minimum specifications required would include:

- Rated AC Power Output: 20 kW
- Efficiency: >98%
- Dual MPPT inputs as minimum, maximum of 2 DC strings per MPPT
- Three Phase commercial string inverters
- Rated Line Voltage 380-400 V
- Rated Frequency 50 Hz
- Noise Emission <65 dB @ 1m
- THD < 3%
- Ambient Temperature Range -25 ~ +60 °C
- Integrated data logger supports string monitoring function, with Intelligent monitoring via APP & Web
- Should be communicative via Wi-Fi, Bluetooth, RS485, or Ethernet
- Suitable for outdoor installation: ≥ IP65 rating
- Compliance with the Israeli grid connectivity standards
- Standards: IEC 62109-1:2010/ PS2691 P1, IEC 62109-2:2011/ PS2691 P2, IEC 62116:2012/PS2692, AS/NZS4777.1:2015/2020

3.3 Monitoring system

TS-40 An advanced monitoring system allowing remote communication and data monitoring of the PV arrays over a secured LAN connection and shall be integrated in the inverter. The monitoring system shall be supplied from the inverters' manufacturer or compatible well-known third party brand to ensure ease of integration and operation.

3.4 Mounting structure

TS-41 The mounting structure shall be made of hot dip galvanized steel and uses standardized profiles as per drawings with plastic profile end-caps and Aluminum clamps/stainless steel bolts & nuts for mounting the PV modules, with minimum clearance between two adjacent panels is 2 cm.

TS-42 All distances and dimensions, both minimum and maximum, must strictly adhere to the specifications outlined in the accompanying drawings.

TS-43 Hot-Dip galvanized plate with minimum dimensions of 150mm*150mm*6mm for fixing the PV mounting structure on the roof, included over reinforced concrete blocks 400mm*400mm*300mm.

TS-44 Structure should be highly resistant against corrosion.

3.5 Panels

3.5.1 All panels

TS-45 Suitable for outdoor use (at least IP65).

TS-46 Galvanized Sheet Metal panel board oven painted 2 mm thickness.

TS-47 Equipped with proper copper grounding busbar.

TS-48 All breakers and SPDs must be of EU or USA origin.

TS-49 Protection equipment must have IEC and TUV certifications.

3.5.2 DC panels

TS-50 All strings must be protected by double poles circuit breaker.

TS-51 Appropriately sized DC circuit breakers double poles according to international standards with a voltage rating of 800 VDC or more.

TS-52 Overvoltage protection according to IEC requirements using proper DC SPD's.

3.5.3 AC panels

TS-53 AC line must be double-protected (i.e. inverter-side AC protection and on the side of existing distribution panel)

TS-54 Appropriately sized 3-pole AC circuit breakers according to international standards.

TS-55 Appropriately sized 4-pole Earth Leakage circuit breaker with sensitivity of 300 mA.

TS-56 Overvoltage protection according to IEC requirements using proper AC SPD's.

3.6 Cables

3.6.1 All cables

- TS-57 Copper, stranded, XLPE/PVC insulated.
- TS-58 Cable cross sectional area must be suitable to maintain minimum voltage drop less than 1%.
- TS-59 Flame retardant according to IEC 60332-1
- TS-60 Life expectancy should be greater than 25 years
- TS-61 IEC/TUV certification.

3.6.1 DC cables

- TS-62 Solar Type, Single-core, Double insulation, UV resistant, Temperature range: -40 ~ +85 °C
- TS-63 Cable cross sectional area: at least 6mm².
- TS-64 Rating of 1000 V minimum,

3.6.2 AC cables

- TS-65 Voltage Rating: 1.0/0.6 KV
- TS-66 Minimum cross sectional area for each system as per Annex drawing.

3.7 Cable trays and accessories

- TS-67 All PV modules cables shall be fixed properly by durable cable ties and accessories.
- TS-68 All cables from PV strings to inverters, and from inverter to electrical panel which exposed to sun and weather conditions must be inserted in cable protecting UV resistant flexible conduits.
- TS-69 All cables on ground must be protected by perforated metal cable trays.
- TS-70 All cable trays shall be galvanized, grounded and covered.
- TS-71 Compatible accessories must be used to raise the trays off the ground, and to fix them on walls and ceiling as necessary. All trays must be installed and fixed in place at appropriate height above ground of at least 5cm.

3.8 Grounding system

- TS-72 The earthing system should be done according to IEC requirements and according to internationally accepted standards.
- TS-73 The system resistance should be less than 3 ohms from any location.
- TS-74 Each PV module shall be grounded (to steel structure) using at least 6 mm² cross section cables.
- TS-75 Steel structure & Inverter shall be grounded using at least 10 mm² cross section cables.
- TS-76 All metal components including cable trays must be grounded using at least 10 mm² cross section cables.
- TS-77 Main earthing cable used to connect the main earthing bus bar and the earthing electrodes must be of copper at least 10 mm² cross section area.

TS-78 Earthing systems consists of conduits, cooper wires, glands, pure copper rods with diameter 19 mm and 1.5 meter long, all necessary material and accessories to achieve resistivity of less than 3 Ohm.

4 Related services specifications

4.1 General

- TS-79 The Work shall be done and supervised by licensed Electrical Engineer.
- TS-80 All related work required to rectify damaging during workmanship must be taken into consideration, including reinstatement of cutting, chasing, excavation and any related work with proper finish.
- TS-81 The site location will be handed over to the contractor in a clean condition, and there is no additional need for site cleaning or preparation.
- TS-82 The contractor is required to meticulously adhere to a comprehensive set of safety protocols encompassing both local and international standards. This commitment to safety extends to all personnel involved in the project, ensuring that every worker is well-informed, well-equipped, and consistently mindful of safety considerations.
- TS-83 Heavy and noisy activities are expected to be primarily conducted within the contractor's workshop to minimize disruptions at the site location. However, in cases where it becomes necessary to carry out such activities on-site, they should be restricted to the off-peak Consulate duty hours, and efforts should be made to minimize the noise level to the greatest extent possible. This approach ensures that any on-site work is conducted with due consideration for the Consulate's operational hours and the comfort of the surrounding community.

4.2 Civil defence related work

- TS-84 Meticulously identify and understand all prerequisites mandated by the Civil Defence Department, including the required materials and equipment.
- TS-85 Develop a comprehensive plan encompassing the complete implementation of specified measures and procedures to meet the Civil Defence Department's requirements.
- TS-86 Procure the necessary work permissions from the Civil Defence Department prior to commencing installation activities.

4.3 System installation

- TS-87 Complete system installation, commissioning, and testing appropriately and according to the existing local electricity requirements and grid code.
- TS-88 All installations must strictly adhere to the guidelines outlined in the Annex drawing. This entails rigorous compliance with the designated areas for PV installation, avoiding any shadow-affected zones. Additionally, installations should precisely align with the specified orientation, including tilt and azimuth angles, for each system. Furthermore, it is imperative to uphold the prescribed minimum spacing and offsets as indicated in the drawing.

- TS-89* When drilling into the roof casted foundations to secure the mounting structure, follow these steps:
1. Use a vacuum device promptly to capture any resulting dust.
 2. Apply special isolation material before inserting the screws.
 3. Ensure the area around the penetration is thoroughly sealed to prevent any leaks and damages to the existing roof.
- TS-90* All processed components of the mounting structure must undergo a post-installation treatment using specialized materials or processes to ensure rust-proofing and long-term durability.
- TS-91* All installation work, connections, wiring, and fastening should be performed using appropriate tools in accordance with the manufacturer's recommendations.
- TS-92* Electrical work should be carried out by well-trained electricians, while handling the mounting structure and PV modules should be entrusted to skilled laborers.
- TS-93* The inverter should be easily accessible and protected from direct sunlight and from direct impact of rainfall.
- TS-94* All parts of the solar system (Modules, inverter, protection panels – DC & AC, cables...) must bear warning signs and labels according to local standards and requirements.
- TS-95* Follow the PV manufacturer's guidelines for installation, which includes careful accessory placement to avoid applying pressure in incorrect locations or directions.

4.4 Grid connection

- TS-96* Complete supply, installation and commissioning of a Bidirectional and production kWh meters.
- TS-97* If the electricity was disconnected or lost one phase from the grid side, the Solar System must be stopped working automatically and intermediately. When the diesel generator/UPS is working ,the solar system must be stopped automatically and intermediately.

4.5 System operation & training

- TS-98* The contractor shall undertake the following activities for a duration of two years:
1. Conduct continuous remote monitoring of the system to ensure optimal performance
 2. Perform routine cleaning of the PV modules to sustain efficiency (approximately 5-6 times annually)
 3. Execute both regular and preventive maintenance tasks
- TS-99* Contractor to submit "Operation and Maintenance Manual" which contains all necessary step by step instructions for operation, monitoring, regular inspections, protective maintenance, cleaning, Safety etc.
- TS-100* Drawings, Datasheets, Manuals, SLD, Layout, and all necessary documents for all components should be submitted along with O&M Manual.
- TS-101* Onsite Training for staff and technicians to operate and monitor the PV system.
- TS-102* O&M Manual should be approved by Managing Official prior to perform the Onsite training.

5 Warranties

TS-103 The table below lists the required warranty details and requirements. It is assumed that the bidder agrees with these, unless they state otherwise during the bidding process.

Item	Warranty (Years)
PV Modules	12/25 (Product/Performance)
Inverter	10
Steel Structure	1