**FORM 1 – GENERAL SYSTEM DATA**

|  |  |
| --- | --- |
| **A) Basic System Information** | |
| Project/Site address |  |
| Rated system power (kW DC or kVA AC) |  |
| PV Modules and Inverters (manufacturer, model and quantity) |  |
| Installation date |  |
| Commissioning date |  |
| PV system owner (company name or name of individual owner) |  |
| Owner contact person |  |
| Owner contact telephone number |  |
| Owner contact email address |  |
| Owner mailing address |  |
|  | |
| **B) System Designer Information** | |
| Company name |  |
| Contact person |  |
| Mailing address |  |
| Telephone number |  |
| Email address |  |
|  |  |
| **C) Installer Information** |  |
| Company name |  |
| Contact person |  |
| Mailing address |  |
| Telephone number |  |
| Email address |  |
|  |  |
| **D) Commissioning Information** |  |
| Commissioning party company |  |
| Commissioning party contact person |  |
| Commissioning party mailing address |  |
| Commissioning party telephone number |  |
| Commissioning party email address |  |
|  |  |
| **E) Monitoring Information** |  |
| Monitoring company |  |
| Monitoring company contact |  |
| Monitoring company mailing address |  |
| Monitoring company telephone number |  |
| Monitoring system contact email address |  |
| Type of Monitoring System |  |
| Web address to access monitoring data |  |
| Login details (username & password) |  |
|  |  |
| **F) Local Distribution Company Information** | |
| Company name |  |
| Account number |  |
| Telephone number |  |
| Email address |  |

**FORM 2 – SYSTEM DATA – TECHNICAL SPECIFICATIONS SUMMARY**

|  |  |
| --- | --- |
| 1. **Module Information** | |
| Module model |  |
| Module manufacturer |  |
| Quantity of modules |  |
|  | |
| 1. **Array Information** | |
| Array open circuit voltage (Voc) |  |
| Array short circuit current (Isc) |  |
| Array nominal voltage (Nom V) |  |
| Array power rating (kW DC) |  |
|  | |
| 1. **Inverter Information** | |
| Inverter model |  |
| Inverter manufacturer |  |
| Inverter identification and serial number |  |
| Quantity of inverters |  |
| Total inverter power rating (kW AC) |  |
| Total number of strings |  |
| Number of modules per string |  |
| Array slope (degrees from horizontal) |  |
| Array azimuth (degrees east or west of due south; due south = 0°) |  |
|  | |
| 1. **Mounting Information** | |
| Mounting type | 🞎 Roof mount 🞎 Ground mount 🞎 BIPV  🞎 Other: |
| Method of fixing to roof (eg. ballasted, fixed to structural roof member, etc.) |  |
| Conductor model |  |
| Raceway model |  |
| Junction box model |  |
| Grounding equipment model |  |
| Combiner box model (and fuse type specified) |  |
| Quantity of combiner boxes |  |
| Disconnect model (and fuse type installed) |  |
| Quantity of disconnects |  |

**FORM 3 – SINGLE LINE WIRING DIAGRAM**

A single line wiring diagram, including the following items must be provided (for large systems, this information may be presented in table form):

|  |
| --- |
| **General array specifications** |
| * Module type(s) |
| * Total number of modules |
| * Number of modules per string * Number of strings |
| * Which strings connect to which inverter |
|  |
| **PV string information** |
| * String cable specifications - size and type |
| * String over-current protective device specifications (where fitted) - type and voltage/current ratings |
| * Blocking diode type (if relevant) |
|  |
| **Array electrical details** |
| * Array main cable specifications - size and type |
| * Array junction box / combiner box locations (where applicable) |
| * DC isolator type, location and rating (voltage / current) |
| * Array over-current protective devices (where applicable) - type, location and rating (voltage / current) |
|  |
| **Earthing and overvoltage protection** |
| * Details of all earth / bonding conductors – size and connection points. Including details of array frame equipotential bonding cable where fitted. |
| * Details of any connections to an existing Lightning Protection System (LPS). |
| * Details of any surge protection device installed (both on AC and DC lines) to include location, type and rating. |
|  |
| **AC system** |
| * AC isolator location, type and rating |
| * AC overcurrent protective device location, type and rating |
| * Residual current device location, type and rating (where fitted) |

**FORM 4 – OPERATION AND MAINTENANCE INFORMATION**

|  |  |
| --- | --- |
|  | Procedures for verifying correct system operation. |
|  | Emergency shutdown / isolation procedures. |
|  | Maintenance and cleaning recommendations (if any), including which tasks should be performed by qualified professionals and which can be done by the owner or caretaker |
|  | Considerations for any future building works related to the PV array (e.g. roof works). |
|  | Warranty documentation for PV modules and inverters - to include starting date and period of warranty. |
|  | Documentation on any applicable workmanship, weather-tightness warranties, and/or performance warranties. |

**FORM 5 – ADDITIONAL DOCUMENTATION LIST**

|  |  |
| --- | --- |
|  | Contracting and financial details |
|  | * Construction contracts |
|  | * Invoices and payments for materials and labor |
|  | * Building permits |
|  | * Inspection certificates |
|  | * Interconnection agreements |
|  | * Special requirements or forms for rebate programs/other incentives |
|  | Data sheets for all types of modules and inverters used in the array |
|  | Data sheet (if available) or relevant documentation for the array mounting system |
|  | Electrical Safety Authority (ESA) inspection |
|  | Equipment manuals |
|  | Copies of all commissioning test results and inspection data |
|  | Site layout that identifies locations of equipment |
|  | Shading analysis (if available) |
|  | Performance estimates provided as part of the project proposal (if available) |

**FORM 6 – SUGGESTED EQUIPMENT**

IEC 61557 and IEC 61010 provide guidance on the measuring instruments and monitoring equipment and methods that are appropriate for the inspection and testing of PV systems. If other measuring equipment is used, it should have comparable performance and safety.

|  |  |
| --- | --- |
|  | Ladder |
|  | Fall protection |
|  | Personal protective equipment |
|  | Level |
|  | Camera |
|  | *One of:* Infrared (IR) thermometer, thermocouple, thermistor |
|  | Pyranometer |
|  | Megohm-meter |
|  | Multi-meter |
|  | AC/DC clamp meter |
|  | Portable data logger (optional) |
|  | Compass |
|  | Inclinometer |
|  | Ground resistance tester |
|  |  |
|  |  |
|  |  |

**FORM 7 – COMMISSIONING INSPECTION CHECKLIST**

Visual inspection should precede testing, and should normally be done prior to energizing the installation.

IEC6034-6 provides the requirements for the inspection and commissioning of any electrical installation. The following checklists are specific to the inspection and commissioning of PV installations.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Yes** | **No** | **N/A** | **Comments** |
| **Electrical installation** | | | | |
| All components are properly and permanently connected (especially junction boxes and leads). |  |  |  |  |
| Equipment complies with applicable standards, including IEC 60364-6. |  |  |  |  |
| Equipment is easily accessible for maintenance. |  |  |  |  |
| All wiring is connected. |  |  |  |  |
| Installed wire and conduit sizes match the plans. |  |  |  |  |
| All electrical building penetrations are permanently flashed or sealed as per plan detail. |  |  |  |  |
| Wiring systems are protected against wind, ice formation, extreme temperatures, and solar radiation. |  |  |  |  |
| Fire stops are installed at all fire barrier penetrations. |  |  |  |  |
| Permanent utility power is connected. |  |  |  |  |
| The internet is connected. |  |  |  |  |
| **Mechanical installation** | | | | |
| The array is ventilated as per the plan detail. |  |  |  |  |
| The array frame is secured to the building as per plan detail |  |  |  |  |
| All fasteners used on aluminum structures or module frames are stainless or as detailed in plan drawing. |  |  |  |  |
| Steel rack elements are hot-dipped galvanized or better. |  |  |  |  |
| Dissimilar metals are isolated. |  |  |  |  |
| Electrical metallic tubing (EMT) or rigid metal conduit (RMC) is used on the roof. |  |  |  |  |
| All system components are protected against weather damage and corrosion. |  |  |  |  |
| All modules have been inspected for any defects including delamination. |  |  |  |  |
| Mechanical and structural systems conform to the plans. |  |  |  |  |
| String layout matches the as-built string diagram. |  |  |  |  |
| Small systems: if no string diagram exists, the string locations are marked on the roof plan. |  |  |  |  |
| Large systems: if no string diagram exists, the integrator has been notified. |  |  |  |  |
| **DC system** | | | | |
| DC components rated for continuous DC operation. |  |  |  |  |
| All DC components rated to operate at Voc STC x 1.25. |  |  |  |  |
| All DC components rated to operate at Isc STC X 1.25 |  |  |  |  |
| DC switch disconnect is properly fitted. |  |  |  |  |
| AC and DC cables are separated. |  |  |  |  |
| DC cables are adequately protected. |  |  |  |  |
| PV string cables, PV array cables and PV DC main cables have been selected and erected so as to minimize the risk of earth faults and short-circuits |  |  |  |  |
| High voltage DC cabling ( > 120 V) is in trunking / not accessible |  |  |  |  |
| PV rated cables |  |  |  |  |
| Systems with string over-current protective devices: |  |  |  |  |
| * String overcurrent protective devices are correctly fitted and specified to the requirements of IEC 60364. |  |  |  |  |
| * Rated for DC operation at the fault energies present |  |  |  |  |
| * Rated for operation at Voc STC x # of modules in string x 1.15 |  |  |  |  |
| Plug and socket connectors mated together are of the same type and from the same manufacturer. |  |  |  |  |
| Where a PV system has a direct connection to earth on the DC side (functional earth), a functional earth fault interrupter is provided to the requirements of IEC 60364. |  |  |  |  |
| **AC system** | | | | |
| Utility AC disconnect can be locked in the ‘off’ position only. |  |  |  |  |
| Inverter protection settings comply with local regulations. |  |  |  |  |
| Inverter type and power match the system design documents. |  |  |  |  |
| Inverter power is appropriate for the size of the array.  Low limit: 0.7 x array power rating  High limit: 1.2 x array power rating |  |  |  |  |
| Inverter can withstand maximum voltage (Voc) and current (Isc) of the array. |  |  |  |  |
| Means of isolating the inverter are provided on the AC side. |  |  |  |  |
| Isolation and switching devices are connected such that PV installation is wired to the “load” side and the public supply to the “source” side. |  |  |  |  |
| **Safety** | | | | |
| ESA Permit has been signed. |  |  |  |  |
| Electrical design is adapted properly. |  |  |  |  |
| All live parts are adequately insulated/protected. |  |  |  |  |
| Working clearances are satisfactory. |  |  |  |  |
| The system has been properly grounded at necessary locations. |  |  |  |  |
| Surge protection devices are installed as per plan. |  |  |  |  |
| Area of all wiring loops kept as small as possible. |  |  |  |  |
| Array frame equipotential bonding installed to local codes. |  |  |  |  |
| Equipotential bonding conductors are laid parallel to and bundled with the DC cables. |  |  |  |  |
| Lockout/tagout procedures are in place |  |  |  |  |
| **Labeling** | | | | |
| Canadian Electric Code (CEC) required labeling is present and made from durable materials. |  |  |  |  |
| “DG SOURCE (DC) DISCONNECT” |  |  |  |  |
| “DG SYSTEM (AC) DISCONNECT” |  |  |  |  |
| “DG SYSTEM (UTILITY) DISCONNECT” |  |  |  |  |
| “WARNING TWO POWER SOURCES” |  |  |  |  |
| “WARNING MULTIPLE POWER SOURCES” |  |  |  |  |
| All circuits, protective devices, switches, junctions, and terminals are properly labeled. |  |  |  |  |
| Array combiner fuse type and rating is labeled in each array combiner. |  |  |  |  |
| System diagram is displayed on-site in an accessible location as per CEC requirement. |  |  |  |  |
| Inverter protection settings and installer details displayed on site. |  |  |  |  |
| Emergency shutdown protocol is displayed on-site in an accessible location. |  |  |  |  |
| AC and DC isolators are appropriately labeled. |  |  |  |  |
| Any fused disconnect has the fuse type and rating labeled. |  |  |  |  |
| **Aesthetics** | | | | |
| Module lines are straight and in line with roof features. |  |  |  |  |
| Painting is satisfactorily completed. |  |  |  |  |
| Array skirts are installed acceptably. |  |  |  |  |
| Inverter fences/enclosures are built as planned. |  |  |  |  |
| **Required photographs** | | | | |
| Arrays (from the front and rear if possible, or at from least 2 angles) |  |  |  |  |
| One close up of module label |  |  |  |  |
| Racking system and connection point flashing detail |  |  |  |  |
| Inverters (installation and name plate) |  |  |  |  |
| Conduit runs (all supports, roof, wall, ceiling) |  |  |  |  |
| Combiner boxes (installation and name plate) |  |  |  |  |
| Disconnects DC and AC (installation and name plate) |  |  |  |  |
| Interconnection (meter and service disconnect and metering cabinet) |  |  |  |  |
| Building penetrations |  |  |  |  |
| Fire stop penetrations |  |  |  |  |
| Noteworthy observations |  |  |  |  |

**FORM 8 – PV ARRAY TEST REPORT**

The tests below must be performed for each inverter or string. Copy this page as needed.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date: |  | | | | Reference number: |  |
| Installation address: | | | |  | | |
| Inspector: | |  | | | | |
| Test instruments: | | |  | | | |
| 🞎 Initial verification 🞎 Periodic verification | | | | | | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ELECTRICAL MEASUREMENTS** | | | | | | | | | |
| String | String reference |  | |  | | |  |  |  |
| Module model |  | |  | | |  |  |  |
| Number of modules |  | |  | | |  |  |  |
| Array parameters (as specified) | Voc at STC |  | |  | | |  |  |  |
| Iscat STC |  | |  | | |  |  |  |
| String  over-current  protective device | Type |  | |  | | |  |  |  |
| Rating (A) |  | |  | | |  |  |  |
| DC Rating (V) |  | |  | | |  |  |  |
| Capacity (kA) |  | |  | | |  |  |  |
| String wiring | Type |  | |  | | |  |  |  |
| Phase (mm²) |  | |  | | |  |  |  |
| Earth (mm²) |  | |  | | |  |  |  |
| String test | Voc (V) |  | |  | | |  |  |  |
| Isc (A) |  | |  | | |  |  |  |
| Irradiance (W/m2) |  | |  | | |  |  |  |
| Polarity check | |  | |  | | |  |  |  |
| Array insulation resistance | Test voltage (V) |  | |  | | |  |  |  |
| Pos – Earth (MΩ) |  | |  | | |  |  |  |
| Neg – Earth (MΩ) |  | |  | | |  |  |  |
| Earth continuity (where fitted) | |  | |  | | |  |  |  |
| Array isolator | Rating (A) |  | |  | | |  |  |  |
| Rating (V) |  | |  | | |  |  |  |
| Location |  | |  | | |  |  |  |
| Functional check |  | |  | | |  |  |  |
| Inverter | Make & model |  | |  | | |  |  |  |
| Serial number |  | |  | | |  |  |  |
| Functioning OK |  | |  | | |  |  |  |
| **PERFORMANCE MEASUREMENTS**  The values below will be used for performance verification below as per excel “PV Power Calculator” | | | | | | | | | |
| DC operating voltage | |  | |  | | |  |  |  |
| DC operating current | |  | |  | | |  |  |  |
| AC operating voltage | |  | |  | | |  |  |  |
| AC operating current | |  | |  | | |  |  |  |
| Irradiance in the plane of the array (W/m2) | |  | |  | | |  |  |  |
| Cell temp (°C) | |  | |  | | |  |  |  |
| **PERFORMANCE VERIFICATION** | | | | | | | | | |
| DC output within 5% of expectations | |  | |  | | |  |  |  |
| AC output within 5% of expectations | |  | |  | | |  |  |  |
| **Infrared imaging** | | **Yes** | **No** | | **N/A** | **Comments** | | | |
| **NOTE:** It is recommended that thermal images of the array be taken. Ensure images are taken when the system is running near full power, with irradiance in the plane of the array greater than 400 W/m2. | | | | | | | | | |
| All modules from the front | |  |  | |  |  | | | |
| All termination points of conductors in array combiners, disconnects, and inverters | |  |  | |  |  | | | |
| Comments: | | | | | | | | | |

Source: IEC 62446 Ed.2, Grid connected PV systems – Minimum requirements for system documentation, commissioning tests and inspection

**FORM 9 – REQUIRED OWNER TRAINING**

The owner of the PV system should be familiarized with the following aspects of system operations.

|  |  |
| --- | --- |
|  | System layout |
|  | Important processes |
|  | Locations of disconnects |
|  | Inverter operation |
|  | Monitoring system operation (including relevant passwords and URLs for web-based systems) |
|  | Documentation (manuals, warranties, contracts) |
|  | Maintenance schedule |

**FORM 10 - PV SYSTEM VERIFICATION CERTIFICATE**

This form is based on the model verification certificate in IEC 62446 Ed. 2

|  |  |
| --- | --- |
| **Inspection and testing** | |
| Owner |  |
| Installation address |  |
| Test date |  |
| 🞎 Initial verification 🞎 Periodic verification |  |
| Name of commissioning party [or: inspector] |  |
| Address of commissioning party [or: inspector] |  |
| Description of installation  (list the key components installed) |  |
| Rated power (kW DC) |  |
| Location of system |  |
| Circuits tested |  |
| IEC 60364-6 [Or other standard] inspection report reference |  |
| IEC 60364-6 [Or other standard] test report reference |  |
| PV array inspection report reference |  |
| PV array test report reference |  |

|  |  |  |
| --- | --- | --- |
| **Required actions** | | |
| **Required action** | **Assigned to** | **Expected date of completion** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Customer affirmation** | | |
| * I have been trained regarding the operation and maintenance of the PV system and have been provided with relevant documentation. * The PV system has been commissioned to my satisfaction. | | |
| Name: | Signature: | Date: |
| **Commissioning party affirmation** | | |
| * I have commissioned the PV system in accordance with these *Commissioning Inspection and Testing Checklists for Grid-Connected PV Systems* and relevant manufacturer guidelines. * *Other statements* | | |
| Name: | Signature\*: | Date: |
| \*The extent of liability of the signatory(s) is limited to the work described above. | | |
| Next inspection recommended after not more than: | | |
| Comments: | | |