



Technical Standard for IDCOL Domestic Rooftop Solar Projects (DRS)

**Technical Standard Committee
September 2026**

Technical Standard

The proposed system shall comply with the technical specifications given below:

1. Solar Photovoltaic (PV) Module:

- 1.1 Solar PV Module shall be of Tier-1 category.
- 1.2 The following are applicable standards for PV Modules:
 - a. IEC1 61215:2016 or latest: Terrestrial photovoltaic (PV) modules - Design qualification and type approval; 2
 - b. IEC 61701 Ed 3.0 or latest: Salt mist corrosion testing of PV Modules;
 - c. Latest edition of IEC 61730 for safety equipment;
 - d. PID test certificate (Latest edition of IEC 62804 or equivalent);
- 1.3 The following are applicable standards for PV Module Manufacturers:
 - a. ISO 14001 (Environmental Management System) certification;
 - b. OHSAS 18001 or ISO 45001 (Occupational Health and Safety Management System) certification;
- 1.4 Each module shall be factory equipped with at least IP68 junction box with terminal strip that allows safe and long-lasting wiring connection to the module. Where applicable, protective diodes shall be used to avoid the effect of partial shading. Factory test reports of the PV module shall be provided during supply of product.
- 1.5 The photovoltaic module shall have a peak power output of at least 500 Wp or above
- 1.6 All modules shall be product tested and certified from IEC/ISO 17025 certified laboratories.
- 1.7 Only PV modules with bypass diodes shall be used.
- 1.8 Each module shall have permanent labeling indicating at a minimum: Manufacturer, Model Number, Serial Number, Peak Watt Rating, Voltage and Current at peak power, Open Circuit Voltage, Short Circuit Current and Cell Efficiency of each module.
- 1.9 Power tolerance shall be positive for each of the PV modules.
- 1.10 Module Efficiency (η %) shall be minimum 20%
- 1.11 Fill Factor (FF) shall be more than 75%.
- 1.12 Operating Temperature Range shall be 0 °C to + 85 °C.
- 1.13 Solar PV Modules shall be enlisted through IDCOL Technical Standards Committee (TSC) according to IDCOL Solar PV Module Enlistment Process.
- 1.14 Necessary Approval for Solar PV Module under latest active Net Energy Metering (NEM) Guideline needs to be availed before commissioning for the projects with net-metering system.
- 1.15 Warranty:
 - a. Ten (10) year limited PV module warranty
PV Modules(s) shall be warranted to be free from the defects and/or failures specified below for a period not exceeding ten (10) years from the date of sale to the original customer:
 - I. Defects and/or failures due to manufacturing;
 - II. Defects and/or failures due to materials;
 - III. Cracking of the front glass surface due to foreign objects inside the glass; or
 - IV. Non-conformity with specifications due to faulty manufacturing and/or inspection processes.

If the PV Module(s) fails to conform to this warranty, PV module(s) shall be immediately replaced.

b. Limited power output warranty

Limited power output warranty shall be linear for 25 years, where not more than 2.5% degradation in the first year, the power output shall be above 90% of the rated power specified at the time of sale within ten (10) years and the power output shall be above 80% of the rated power specified at the time of sale within twenty-five (25) years. If this standard is not met manufacturer will repair, fix (by putting additional panel) or replace the PV Modules(s) at their own cost or refund the Purchase Price taking into account a yearly depreciation of five percent (5%) of the panel price. In case of a refund of the depreciated price of the panel, the panel will remain with the user, and company will not take it from him/her. The period of power output warranty for these replaced modules(s) will be equal to the remaining warranty period of the originally supplied module(s).

1.16 Pre-shipment test of PV modules:

- Flash test and electroluminescence test need to be conducted for the PV modules.
- Pre-shipment test to be conducted before shipment, after production of PV modules within the country of the manufacturer.
- Sampling and tests need to be conducted by an ISO 17025 certified laboratory. The test report will be shared directly with IDCOL by the testing laboratory. The test report needs to be sent directly to technical.re@idcol.org by the testing laboratory.
- Number of samples for the two tests needs to be selected by the AQL chart mentioned in ISO 2859-1. Both tests need to be performed on all these samples. Sampling level would be S-2. As per AQL 1 for S-2, all the samples need to pass the tests to accept the lot. As per this standard, number of samples will be selected as per the table below:

Sl. No.	Lot Size (Number of panels in the lot)	Sample Size as per S-2
1	02-25	2
2	26-150	3
3	151-1,200	5
4	1,201-35,000	8
5	35,001 and above	13

- If the test reports are not satisfactory, the respective lot of PV modules need to be rejected/cannot be accepted to be shipped.

2. Inverter:

2.1 For IDCOL DRS projects on-grid, off-grid and hybrid inverters can be used.

2.2 Typical technical features of on-grid/grid-tied inverter are as follows:

Aspect	Recommended Requirements for On-Grid Inverter
Total output power (AC)	To be mentioned
Nominal DC Input	To be mentioned
Input DC voltage range	As required for the inverter DC input
Nominal output voltage (AC)	For Single Phase, 230 (-15% to +10%) Volts For Three Phase, 400 (-15% to +10%) Volts
Rated grid frequency	50 Hz
AC frequency range	as per National Grid Code
Maximum Output Current	To be mentioned
Total Harmonic Distortion (THD)	< 3% at rated power
Typical Peak efficiency	≥ 95%
Power factor at rated power	> 0.95
LCD Display Monitor	Shall be available
Data access	Voltage, Current, Power, Frequency, Generation and other basic information shall be accessible
Maximum Power Point Tracker (MPPT) option	Shall be available
Anti-Islanding Protection	Shall be available
Ground fault monitoring	Shall be available
DC reverse polarity protection	Shall be available
AC short circuit current protection	Shall be available
Degree of protection	At least IP 65 (outdoor) or above
Operative ambient temperature range	-20°C to 60°C
Surge Protection Device (SPD)	Shall be available
Maximum relative humidity tolerance	95%
Remote Communication Interfaces	Shall be available through Wi-Fi/RS485/USB/Bluetooth or App based Remote Monitoring System compatible with regular gadgets
Certification	IEC 62109-1, IEC 62109-2, IEC 61727 and IEC 62116.

2.3 Typical technical features of Hybrid inverter are as follows:

Aspect	Recommended Requirements for Hybrid Inverter
Inverter Topology	Hybrid Inverter with bi-directional AC/DC power conversion
Total output power (AC)	To be mentioned
Nominal DC Input	To be mentioned
Input DC voltage range	As required for the inverter DC input
Battery Voltage Range	To be mentioned; compatible with Lithium (LiFePO ₄) battery voltage
Max. Charge/Discharge Current (Battery side)	To be mentioned
Nominal output voltage (AC)	For Single Phase, 230 (-15% to +10%) Volts For Three Phase, 400 (-15% to +10%) Volts
Rated grid frequency	50 Hz
AC frequency range	as per National Grid Code
Maximum Output Current	To be mentioned
Total harmonic distortion (THD)	< 3% at rated power
Typical Peak efficiency	≥ 95%
Power factor at rated power	> 0.95
Switch-over/Backup Transfer Time	≤ 20ms (seamless switch-over)
Operating Modes	Self-consumption, Backup/IPS, Time-of-Use, Export/Zero-export - configurable
LCD Display Monitor	Shall be available
Data access	Voltage, Current, Power, Frequency, Generation, State of Charge (SOC), Battery Charge/Discharge status and other basic information shall be accessible
Maximum Power Point Tracker (MPPT) option	Shall be available
Anti-Islanding Protection	Shall be available
Ground fault monitoring	Shall be available
DC reverse polarity protection	Shall be available
AC short circuit current protection	Shall be available
Degree of protection	At least IP 65 (outdoor) / IP 20 (indoor) or above
Operative ambient temperature range	-10°C to 50°C
Surge Protection Device (SPD)	Shall be available

Maximum relative humidity tolerance	95%
Remote Communication Interfaces	Shall be available through Wi-Fi/RS485/CAN (for BMS communication)/HDMI/USB/Bluetooth or App based Remote Monitoring System compatible with regular gadgets
Parallel Operation	Shall support parallel/multi-unit operation for capacity expansion
Certification	IEC 62109-1, IEC 62109-2, IEC 61727 and IEC 62116.

2.4 Typical technical features of Off-grid inverter are as follows:

Aspect	Recommended Requirements for Off-Grid Inverter
Inverter Type	Pure Sine Wave Off-Grid Inverter with built-in MPPT Solar Charge Controller
Rated output power (AC)	To be mentioned as per load requirement
Nominal DC Input	To be mentioned
PV Input/ DC voltage range	To be mentioned as required for the inverter DC input
Nominal Battery Voltage Range	To be mentioned; compatible with Lithium (LiFePO ₄) or better technology battery voltage
Max. Charge/Discharge Current (Battery side)	To be mentioned
Nominal output voltage (AC)	For Single Phase, 230 (-15% to +10%) Volts
Rated grid frequency	50 Hz
AC frequency range	as per National Grid Code
Typical Peak efficiency	≥ 90%
Switch-over/Backup Transfer Time	≤ 20ms (seamless switch-over)
Operating Modes	Backup/IPS
LCD Display Monitor	Shall be available
Data access	Voltage, Current, Power, Frequency, Generation, State of Charge (SOC), Battery Charge/Discharge status and other basic information shall be accessible
Overload Protection	Shall be available
Short Circuit Protection	Shall be available
Over/Under Voltage Protection	Shall be available
Over Temperature Protection	Shall be available
Auto Restart	Shall be available

Degree of protection	At least IP 65 (outdoor) / IP 20 (indoor) or above
Operative ambient temperature range	-10°C to 50°C
Maximum relative humidity tolerance	95%
Remote Communication Interfaces	Shall be available through Wi-Fi/RS485/CAN (for BMS communication)/USB/Bluetooth or App based Remote Monitoring System compatible with regular gadgets
Parallel Operation	Shall support parallel/multi-unit operation for capacity expansion
Certification	IEC 62109-1 (Safety of power converters) or equivalent BDS.

2.5 Warranty: Minimum of 05 years from manufacturer.

2.6 Expected Life: Minimum 10 years

2.7 Inverter shall be installed in a place where a faultless operation is guaranteed and easily accessible. Inverters shall never be installed in dusty or fire-prone rooms. Furthermore, it is not allowed to mount inverters on flammable materials (e.g. wooden boards).

2.8 Necessary Approval for on-grid/on-grid-hybrid Inverter under latest active Net Energy Metering (NEM) Guideline needs to be availed before commissioning for the projects with net-metering systems.

2.9 All inverters shall be enlisted through IDCOL Technical Standards Committee (TSC) by reviewing the manufacturer's authorization and related ISO certifications, warranty documents, available product certifications i.e. IEC 62109-1:2010 or latest, IEC 62109-2:2011 or latest, IEC 61727:2004 or latest, IEC62116:2014 or latest and/or factory test reports.

3. Battery Energy Storage System (BESS)

3.1 For IDCOL DRS projects Lithium Iron Phosphate (LiFePO_4 / LFP) or better technology Battery Energy Storage System (BESS) can be used.

Aspect	Recommended Requirements for BESS
Battery Chemistry / Cell Type	Lithium Iron Phosphate (LiFePO_4 / LFP) or better technology
Nominal Voltage	To be mentioned as of system requirement (e.g. 12V/12.8V/24V/25.6V/48V/51.2V nominal, compatible with inverter DC bus)
Rated Capacity (Ah)	To be mentioned
Rated Energy (kWh)	To be mentioned
Usable Depth of Discharge (DoD)	Minimum 90%
Cycle Life	Minimum 6,000 Cycles
Max. Continuous Charge/Discharge Rate	Minimum 0.5C (to be mentioned)

Battery Management System (BMS)	Integrated BMS with over-voltage, under-voltage, over-current, short-circuit, over-temperature and cell balancing protection
Communication Protocol	CAN bus / RS485, compatible with major hybrid/off-grid inverter brands
Parallel/Stackable Operation	Shall support parallel stacking for capacity expansion
Operative ambient temperature range	-10°C to 50°C
Maximum relative humidity tolerance	95%
Enclosure / Ingress Protection	IP20 or above (Indoor); IP65 for outdoor installation
Fire/Thermal Safety	Non-flammable, non-explosive cell design; passed Nail Penetration & Thermal Runaway propagation test
Weight	To be mentioned
Certification	IEC 62619 and/or IEC 63056 (Safety of secondary lithium cells/batteries for BESS), UN 38.3 (Transport of Dangerous Goods), UL 1973/UL 9540A or equivalent, CE, Restriction of Hazardous Substances (RoHS)

3.2 Warranty: Minimum of 05 years from manufacturer.

3.3 Expected Life: Minimum 16 years

3.4 BESS shall be installed in a place where faultless operation is guaranteed and easily accessible. BESS shall never be installed in dusty or fire-prone rooms. Furthermore, it is not allowed to mount BESS on flammable materials (e.g. wooden boards).

3.5 BESS shall be enlisted through IDCOL Technical Standards Committee (TSC) by reviewing the manufacturer's authorization and related ISO certifications, warranty documents, available product certifications i.e. IEC 62619 and/or IEC 63056 (Safety of secondary lithium cells/batteries for BESS), UN 38.3 (Transport of Dangerous Goods), UL 1973/UL 9540A or equivalent, CE, RoHS or factory test reports.

4. Energy Meter:

4.1 All the systems (i.e. on-grid, off-grid and hybrid) shall have dedicated Energy Meters.

4.2 Bi-directional/Net metering arrangements shall be ensured for grid connected (on-Grid/on-grid hybrid) systems.

4.3 Energy meter rating shall comply with the system requirement and be verified by designated IEB affiliated Engineer.

4.4 Accuracy class of Energy Meter shall be 0.5 or better.

4.5 Energy meter shall comply with IEC-62053-21-2013.

4.6 Energy meters shall be calibrated.

4.7 CT attached to the system shall be tested as per IEC

4.8 Shall have RF/GSM/PLC based communication option

4.9 Warranty: 3-years replacement warranty in case of any performance deviation.

5. Mounting Structure:

The mounting structure shall be made of 80micron Galvanized Steel member secured at multiple points as necessary with Galvanized nuts-washer-bolts and all the components shall be fully corrosion resistant. In addition, it shall be compatible with the module frames to hold it in the right position on the roof top of the household. The system shall be installed at a suitable height on the roof.

The mounting structure will rigidly hold the Photo-voltaic modules on the roof structure of the household. The structure shall have a clearance of minimum 10 cm for tin shed and 30cm for RCC flat roof between the PV module and the roofing material and shall be rigidly fixed with the roof structure. The structure shall have a mechanism to maintain a tilt of required latitude angle of the particular location for RCC flat roofs of the modules with the horizon and adequate bracing arrangement to brace the modules mount structure with the roof structure. The PV array and mounting structure shall be able to withstand wind load up to 200km/hr. without damage.

The detailed drawings of the mounting structure with all its subsections need to be submitted to prove that the designs are appropriate enough to withstand the above wind load, taking into consideration the following technical data. Module mounting arrangements and all other supporting structures shall comply with BNBC latest edition.

6. Wiring Cable:

- 6.1 DC cables shall comply with IEC 62930: Electrical cables for photovoltaic system with a voltage rating of 1.5kV DC (Single-core cross-linked insulated power cables with cross-linked sheath).
- 6.2 AC cables shall comply with national standards. Cables shall be manufactured and tested according to IEC / BS / VDE standards along with relevant BDS standard.
- 6.3 Cable rating, size and length shall be as per system design requirement.
- 6.4 The length and size of the cables shall be selected to keep the voltage drop (power loss) of the system at a minimum. At full load condition, the maximum allowable voltage drop shall be 2.5% from the panel up to inverter end.
- 6.5 Cable shall be compatible up to the life of the solar PV modules.
- 6.6 DC PV module cables shall be:
 - Suitable for a wide temperature range (e.g. -40 to 100°C)
 - Single core and double insulated in general.
- 6.7 All PV wiring and components shall be fit for purposes and installed to minimize exposure to detrimental environmental effects and are protected from abrasion, tension, compression & cutting forces.
- 6.8 Cables shall be protected from direct sunlight, standing water.
- 6.9 Only UV and weather resistant cables and cable conduits to be used. Outdoor exposed cables to be covered by PVC conduit.
- 6.10 Wiring shall comply with the national standards.

7. Circuit Breakers Mounting Box:

- 7.1 A PVC/Vermin Coted Metal switch box for mounting at least three circuit breakers installed on the box for Controlling the DC & AC Current and others are as spare.

7.2 Circuit breaker rating shall comply with the system requirement and BSTI/IEC/IEEE standards to ensure that circuit breakers can effectively interrupt fault currents and protect against overloads, preventing damage to equipment and ensuring safety.

7.3 The Circuit Breaker shall be of reputed brand with a minimum 01(one) year warranty.

8. Earthing:

8.1 The panels, structure, cable tray and all metal parts in the DC side shall be connected to the earth as per National Electrical Code (NEC).

8.2 In case of bimetallic connection between the structures and the earthing cable, bimetallic lug / WEEB (washer, Electrical Equipment Bond) shall be used.

8.3 Earthing or bonding connections shall be arranged so that the removal of a single module earth connection will not affect the continuity of the earthing or bonding connections to any other module.

8.4 Earthing and grounding layout is to be prepared by the Demand Aggregator (DA)/EPC contractor.

9. Lightning Protection System (LPS) and Surge Protection Devices (SPDs):

LPS and SPDs to be designed and installed in accordance with the NEM Guideline requirements.

10. Remote Monitoring System:

10.1 Every system in the program needs a remote on/off switch, and it shall connect to the Demand Aggregator's (DA)/IDCOL's CRM platform through API. The CRM platform will track each household system's data and online/internet connectivity status and use that information to decide whether the system shall stop or keep running.

10.2 Real time data monitoring and data collection through Online/Remote Monitoring System shall be ensured by DA/EPC contractor for every domestic rooftop solar system.

10.3 Data shall be accessible over internet using a web browser through secure login.

10.4 Output data files shall be compatible with MS excel.

10.5 Data shall be represented in both tabular and graphical forms.

11. System Design:

11.1 The ratio of total PV module power to total inverter power in each sub-system shall be less than the allowable inverter design parameters.

11.2 Unused roof space/land space excluding the required amount of free space under building code can be used for installation of PV module. The plant area shall not be exposed to any kind of shading from surroundings.

11.3 Engineering, procurement and construction of systems by companies that are certified in accordance with ISO 9001, ISO 14001 and OHSAS 18001 / ISO 45001 or comparable.

11.4 In case of NEM scheme in place, the latest available edition of NEM Guideline needs to be followed when designing the PV plant.

11.5 System DC voltage shall not exceed 1000V.

11.6 Tilt angle shall be determined as per plant requirement and be verified by designated IEB affiliated Engineer. The minimum acceptable limit of tilt angle shall be 5 degrees.

11.7 The DC system shall be designed, specified, and installed to the requirements of IEC 60364 and IEC TS 62548:2013 or latest. System design will be verified by designated IEB affiliated Engineer.

11.8 Available Anti-dust technologies or solutions are recommended for solar PV modules for high dust-prone areas.

12. Signage:

12.1 Due to safety of various operators like maintenance, inspectors, personnel, local distribution network etc., it is necessary to indicate the presence of a PV installation on a site.

12.2 A sign, as shown in Figure 1, shall be fixed at the origin of the PV installation and at the consumer unit or distribution board to which the supply from the inverter is connected.



Figure 1: Sample sign for identification of PV on a site

12.3 A sign, as shown in Figure 2 shall be attached to PV combiner boxes and switches.



Figure 2: Sample sign for live parts

12.4 Disconnection devices shall be marked with an identification name / number according to the PV array wiring diagram.

12.5 All types of switches shall have the ON and OFF positions clearly indicated.

12.6 PV module rows, cables and combiner boxes shall be labelled.

12.7 PV array DC isolator / switch disconnecter shall be identified by sign. If multiple disconnection devices are used that are not ganged, signage shall be provided warning of multiple DC sources and the need to turn off all switch disconnectors to safely isolate equipment. Sample signage is shown in Figure 3 and 4.



Figure 3: Sample sign required adjacent to PV array D.C. isolator / switch-disconnector



Figure 4: Sample sign required where multiple isolator / switch-disconnector devices are used

12.8 Central shutdown system shall be indicated by signs such as shown in Figure 5.

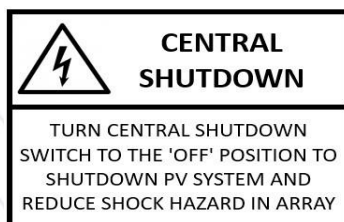


Figure 5: Sample sign for rapid shutdown device

13 Net Metering System:

Net metering system shall be included as per latest active Net Metering Guideline where applicable.

14 Commissioning Test:

The following tests shall be done during commissioning:

- 14.1 Continuity and resistance testing to verify the integrity of grounding and bonding systems, conductors, connections and other terminations.
- 14.2 Polarity testing to verify the correct polarity for PV dc circuits, and proper terminations for dc utilization equipment.
- 14.3 Voltage and current testing to verify that PV array and system operating parameters are within specifications.
- 14.4 Insulation resistance testing to verify the integrity of wiring and equipment and used to detect degradation and faults to wiring insulation.
- 14.5 Performance testing on a sample basis to verify the system power and energy output are consistent with expectations. These tests also require measurements of array temperature and solar irradiance.
- 14.6 Test Reports

Measurements and test results for PV systems shall be clearly summarized in a test report that includes the following information:

- a. System information.
- b. Visual inspection record and observations.
- c. Identification of circuits tested, tests performed, and record of measurements.
- d. Interpretation and summary of results, identifying special maintenance needs or corrective actions.
- e. Name and Signatures of responsible person(s) and date(s) of tests.

15 Operation and Maintenance (O&M):

- 15.1 Detailed O&M manual shall be provided to IDCOL and the client by DA/EPC contractor.
- 15.2 O&M manual shall include, as a minimum, the following items:
 - a. Procedure for verifying whether the system is in correct operation.
 - b. Data collecting procedures from inverter / data logger / energy.
 - c. Operation and data collection procedure of online monitoring system.
 - d. In case of system failure, procedure to identify the type of fault and mitigation method.
 - e. Emergency shutdown / isolation procedures.
 - f. Maintenance and cleaning recommendations.
 - g. Considerations for any future building works related to PV array. For example: roof retrofitting works.