**CHAMUNDESHWARI ELECTRICITY SUPPLY CORPORATION LIMITED**

***(A Government of Karnataka Undertaking)***

Quality Certification, Standards and Testing for Grid-connected Rooftop Solar PV Systems/Power Plants

Quality certification and standards for grid-connected rooftop solar PV systems are essential for the successful mass-scale implementation of this technology. It is also imperative to put in place an efficient and rigorous monitoring mechanism, adherence to these standards. The vendor will be solely responsible for compliance of all quality certifications in rooftop solar installations under simplified procedure. All components of grid-connected rooftop solar PV system/ plant must conform to the relevant standards and certifications given below:

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| **Solar PV Modules/Panels** |
| IEC 61215/ IS14286 | Design Qualification and Type Approval for Crystalline SiliconTerrestrial Photovoltaic (PV) Modules |
| IEC 61701 | Salt Mist Corrosion Testing of Photovoltaic (PV) Modules |
| IEC 61853- Part 1/ IS 16170: Part 1 | Photovoltaic (PV) module performance testing and energy rating: Irradiance and temperature performance measurements, and power rating |
| IEC 62716 | Photovoltaic (PV) Modules – Ammonia (NH3) Corrosion Testing (As per the site condition like dairies, toilets) |
| IEC 61730-1,2 | Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing |
| IEC 62804 | Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation. IEC TS 62804-1: Part 1: Crystalline silicon (mandatory for applications where the system voltage is > 600 VDC and advisory for installations where the system voltage is < 600VDC) |
| IEC 62759-1 | Photovoltaic (PV) modules – Transportation testing, Part 1:Transportation and shipping of module package units |
| **Solar PV Inverters** |
| IEC 62109-1, IEC62109-2 | Safety of power converters for use in photovoltaic power systems –Part 1: General requirements, and Safety of power converters for use inphotovoltaic power systemsPart 2: Particular requirements for inverters. Safety compliance (Protection degree IP 65 for outdoor mounting, IP54 for indoor mounting) |
| IEC/IS 61683(as applicable) | Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions) |
| BS EN 50530(as applicable) | Overall efficiency of grid-connected photovoltaic inverters:This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking (MPPT) of inverters, which are used in grid- connected photovoltaic systems. In that case the inverter energizes a low voltage grid of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered. |
| IEC 62116/ UL 1741/ IEEE 1547 (asapplicable) | Utility-interconnected Photovoltaic Inverters - Test Procedure of Islanding Prevention Measures |
| IEC 60255-27 | Measuring relays and protection equipment – Part 27: Product safety requirements |
| IEC 60068-2 (1, 2,14 & 30) | Environmental Testing of PV System – Power Conditioners and Inverters1. IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold
2. IEC 60068-2-2: Environmental testing - Part 2-2: Tests -

Test B: Dry heat1. IEC 60068-2-14: Environmental testing - Part 2-14: Tests - Test N:

Change of temperaturee) IEC 60068-2-30: Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) |
| IEC 61000 – 2,3,5(as applicable) | Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) testing of PV Inverters |
| **Fuse** |
| IS/IEC 60947 (Part1, 2 & 3), EN50521 | General safety requirements for connectors, switches, circuit breakers (AC/DC):1. Low-voltage Switchgear and Control-gear, Part 1: General rules
2. Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers
3. Low-voltage switchgear and Control-gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units
4. EN 50521: Connectors for photovoltaic systems – Safety requirements and tests
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| IEC 60269-6 | Low-voltage fuses - Part 6: Supplementary requirements forfuse-links for the protection of solar photovoltaic energy systems |
| **Surge Arrestors** |
| IEC 62305-4 | Lightening Protection Standard |
| IEC 60364-5-53/IS 15086-5 (SPD) | Electrical installations of buildings - Part 5-53: Selection anderection of electrical equipment - Isolation, switching and control |
| IEC 61643-11:2011 | Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods |
| **Cables** |  |
| IEC 60227/IS 694,IEC 60502/IS 1554(Part 1 & 2)/ IEC69947 | General test and measuring method for PVC (Polyvinylchloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for outdoor installation) |
| BS EN 50618 | Electric cables for photovoltaic systems (BT(DE/NOT)258),mainly for DC Cables |
| **Earthing /Lightning** |
| IEC 62561 Series (Chemical earthing) | IEC 62561-1: Lightning protection system components (LPSC) - Part 1: Requirements for connection componentsIEC 62561-2: Lightning protection system components (LPSC) - Part 2: Requirements for conductors and earth electrodesIEC 62561-7: Lightning protection system components (LPSC) - Part 7:Requirements for earthing enhancing compounds |
| **Junction Boxes** |
| IEC 60529 | Junction boxes and solar panel terminal boxes shall be of the thermo-plastic type with IP 65 protection for outdoor use, andIP 54 protection for indoor use |
| **Energy Meter** |
| IS 16444 or asspecified by the DISCOMs | A.C. Static direct connected watt-hour Smart Meter Class 1 and 2 — Specification (with Import & Export/Net energy measurements) |
| **Solar PV Roof Mounting Structure** |
| IS 2062/IS 4759 | Material for the structure mounting |

Note: Equivalent standards may be used for different system components of the plants.