Solar Panel Installation Details (1000 sq ft – 5000 sq ft)

1) Legal Requirements-

Depending on state policies and DISCOM guidelines, the following approvals and compliances are generally required across India:

A. Documentation & Approvals

- **Property Ownership Proof / NOC**
  - If the property is rented, an **NOC from the owner** is mandatory.
- **Load Sanction Document**
  - Verify connected load—important for rooftop net-metering eligibility.
- **Net Metering Application**
  - Apply through respective DISCOM portal (MSEDCL / BESCOM / TANGEDCO etc.).
  - Submit system design, capacity, inverter datasheet, and safety compliance.
- **Electrical Inspector Approval (If required)**
  - Needed for >10 kW in some states or for HT/LT connections.
- **Structure Stability Certificate**
  - For commercial buildings or large installations; issued by a certified structural engineer.
- **Local Municipal Permissions**
  - Mainly required for heritage or restricted zones; otherwise generally exempt.

B. Technical Compliance-

- **MNRE-approved Solar Modules** (ALMM if applicable)
- **IEC-certified Inverters & Protections**
  - IEC 61730, IEC 61215 for modules
  - IEC 62109 for inverters
- **Safety Requirements**
  - ACDB, DCDB, SPD, earthing, lightning protection, and isolators must meet IS standards.
- **Fire Safety Norms**
  - Follow local fire department guidelines for cable routing and clear access pathways.

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2) Installation Process-

A. Pre-Installation Survey

- Roof measurement (1000–5000 sq ft)
- Structural health assessment
- Shading analysis using tools Compass-based method
- Load-bearing calculation
- Finalizing module layout & inverter location

B. Material Planning

- Solar modules (Mono PERC / TOPCon)
- Inverters (String / Micro Inverters / Hybrid)

- Mounting structure (GI Hot Dip / Aluminium)
- ACDB & DCDB
- Earthing kit and LA
- Cables (DC: 4–6 sq mm, AC: 2.5–16 sq mm depending on capacity)

C. Step-by-Step Installation

1. **Marking & Layout**
    - Define panel rows considering tilt (10–25° depending on location).
    - Ensure walkways for maintenance.
2. **Structure Installation**
    - Fix base supports with ballast or chemical anchoring.
    - Maintain row spacing to avoid inter-row shadow.
3. **Module Mounting**
    - Fix panels using mid-clamps, end-clamps & stainless steel fasteners.
    - Ensure torque tightening as per manufacturer guidelines.
4. **DC Wiring**
    - Connect modules in series/parallel to form strings.
    - Route cables through UV-resistant conduits.
    - Install DCDB with SPD, isolator & fuses.
5. **Inverter Installation**
    - Mount at a shaded, ventilated location.
    - Connect DC input, AC output, earthing & communication cables.
6. **AC Wiring**
    - Connect AC output to ACDB.
    - Route cable to main LT panel for grid synchronization.
7. **Earthing & Lightning Protection**
    - **2–3 Nos. Earthing pits** (GI/chemical):
        - Module earthing
        - Inverter earthing
        - LA earthing
    - Install Lightning Arrester on rooftop.
8. **Safety and Labeling**
    - Danger boards, cable tags, system SLD, generation meter labeling.

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3) Testing & Commissioning Process-

A. Pre-Commissioning Tests

- **Open Circuit Voltage (Voc) & Short Circuit Current (Isc)** testing for each string
- **Insulation Resistance Test** (Megger test)
- **Earth Resistance Test**
- **Polarity Check** for DC cables
- **Inverter Parameter Check**
    - Grid voltage
    - Frequency
    - Fault monitoring

B. System Commissioning

1. Switch ON ACDB & DCDB.

2. Start inverter and synchronize with the grid.
3. Verify real-time generation on inverter display/app.
4. Check for alarms or abnormal readings.
5. Submit commissioning report to DISCOM for net-meter installation.

C. Net Metering Commissioning

- DISCOM engineer inspects system
- Net meter is installed & sealed
- System is officially connected to the grid

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4) Maintenance of Solar System-

A. Routine Maintenance

Task	Frequency	Details
Module Cleaning	Every 10–15 days	Clean with soft water & microfiber brush
Visual Inspection	Monthly	Check cables, clamps, structures
Inverter Monitoring	Weekly	Check generation data & logs
Earthing Check	Quarterly	Earth resistance < 1 ohm preferred
Structure Tightness Check	Every 6 months	Torque tightening of nuts & bolts
SPD / Protection Check	Every 6–12 months	Replace if surge-damaged

B. Annual Maintenance

- Thermography inspection for hotspots
- Inverter service & firmware updates
- Replacement of damaged cables/connectors
- Overall performance audit

C. Expected Lifespan

- **Solar Modules:** 30+ years
- **Inverters:** 8 to 10 years
- **Structures:** 15–20 years (hot-dip galvanized)