

Title: **MAINTENANCE INSPECTIONS  
FOR SSEGS / MICROGRIDS**

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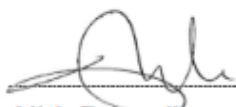
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## **1. Introduction**

This Task Manual was compiled to align with NRS 082 requirements to ensure that all SSEG Plants (including microgrids) in Eskom Distribution are maintained, and to ensure that Occupational Health and Safety Act (OHSA) requirements are met.

## **2. Supporting clauses**

### **2.1 Scope**

#### **2.1.1 Purpose**

The purpose of this Task Manual is to standardize maintenance inspections for SSEG and Microgrid Plants in Eskom Distribution.

#### **2.1.2 Applicability**

This document shall apply throughout Eskom Distribution and to contractors employed by the utility.

## **2.2 Normative/informative references**

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

### **2.2.1 Normative**

- [1] ISO 9001 Quality Management Systems;
- [2] OHSAct, Occupation Health and Safety Act 85 of 1993 and Regulations;
- [3] EPL\_32-727, Safety, Health Environmental & Quality (SHEQ) policy;
- [4] EPC\_32-520, Occupational Health & Safety Risk Assessment Procedure;
- [5] 240-170000064 Performing Maintenance Tasks while employing Covid-19 Preventive Measures - Engineering Instruction
- [6] 240-154263529 COVID-19 Protective Measures to be taken during the COVID-19 (Field Staff) - Work Instruction
- [7] 240-114967625, Operating Regulations for High Voltage systems;
- [8] 240-62196227, Life Saving-Rules;
- [9] 240-120054284, Personal Protective Equipment Standard;
- [10] DST\_34-1954, Supervision of people in electrically hazardous locations;
- [11] 240-70044736, Arc Flash Protective Clothing and Personal Protective Equipment against the Thermal Hazard of an Electrical Arc Specification;
- [12] 240-86100853, Standard for Barricading Prohibited Area and Live Chamber;
- [13] 474-65, Operating Manual of the Steering Committee of Technologies (SCOT)
- [14] 240-170000630 Defect Categories in Inspection Sheets
- [15] 240-44175132, Provision and Use of Personal Protective Equipment.
- [16] DPC\_34-380, Identifying, Analysing, Documenting and Observing Dangerous/Hazardous tasks;
- [17] 34-1507, Procedure for Using A Fall Arrest System.
- [18] DPC\_34-227, Pre-task planning and feedback process.
- [19] DST\_34-1150, Lifting machine operators training

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[20] NRS 082, Recommended Maintenance Policy for Electricity Networks

[21] Manufacturer's manual.

### **2.2.2 Informative**

[22] 32-9, Definition of Eskom documents;

[23] 32-644, Eskom documentation management standard;

[24] 474-65, Operating Manual of the Steering Committee of Wires Technologies (SCOT);

[25] 240-52380420, Steering Committee of Technologies (SCOT) Standards Development and Change Implementation Procedure;

## **2.3 Definitions**

### **2.3.1 General**

All definitions listed in recognised industry glossaries such as NRS 000, ORHVS and the IEV can be used wherever appropriate / applicable.

| <b>Definition</b>               | <b>Description</b>                                                                                                                                                                                                                                      |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Appointed operator</b>       | Means a person, whether an employee or another person, who has been authorised in terms of the ORHVS.                                                                                                                                                   |
| <b>Dangerous/hazardous task</b> | A specific element of work, which has produced and/or which possesses the potential to produce major loss or harm to people, assets, processes/production and/or the environment when performed incorrectly.                                            |
| <b>Risk Assessment</b>          | This process involves the combined functions of hazards identification, risk analysis, risk evaluation, determining the risk control strategy/s and the identification of the risk control measures that will be implemented during the task execution. |
| <b>Task Analysis</b>            | The systematic examination of all dangerous/hazardous tasks (work) in order to identify and quantify all the potential and existing inherent hazards that employees are exposed to while the tasks are being executed.                                  |

### **2.3.2 Disclosure classification**

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

## **2.4 Abbreviations**

| <b>Abbreviation</b> | <b>Description</b>                         |
|---------------------|--------------------------------------------|
| <b>CNC</b>          | Customer Network Centre;                   |
| <b>CMMS</b>         | Computerized Maintenance Management System |
| <b>DBOUS</b>        | Design Base & Operating Unit Support       |
| <b>DB</b>           | Distribution Board                         |
| <b>FAS</b>          | Fall Arrestor System                       |
| <b>MV</b>           | Medium Voltage                             |
| <b>LV</b>           | Low Voltage                                |
| <b>O/H</b>          | Overhead                                   |

| Abbreviation | Description                                     |
|--------------|-------------------------------------------------|
| ORHVS        | Operating Regulations for High Voltage Systems. |
| OHS          | Occupational Health and Safety                  |
| OU           | Operating Unit                                  |
| OEM          | Original Equipment Manufacturer                 |
| PPE          | Personal Protective Equipment;                  |
| PTO          | Principal Technical Official                    |
| STO          | Senior Technical Official                       |
| TRFR         | Transformer                                     |
| NRS          | National Regulatory Standard                    |
| SSEG         | Small Scale Embedded Generator                  |
| DVR          | Digital Video Recorder                          |
| PV           | Photo Voltaic                                   |
| EMS          | Energy Management System                        |
| BMS          | Battery Management System                       |
| SCADA        | System Control and Data Analysis                |
| UPS          | Uninterruptible Power Supply                    |

## 2.5 Roles and Responsibilities

### 2.5.1 M & O CoE shall be responsible for:

- Ensuring that job plans and task lists are configured as per the maintenance Engineering Standard and available in the respective CMMS; and
- Ensuring that job plans and task lists reference the correct task manual.

### 2.5.2 Training Department shall be responsible for:

- Where applicable ensure that the relevant training program is available to support the implementation of the task manual.

### 2.5.3 Plant Department (DX) Managers shall be responsible for:

- Ensure that the CMMS is configured as per the requirement of the Maintenance Implementation Standard and maintenance (including defects and / or modification) is actioned as per the workflow process; and
- Ensuring that the correct maintenance feedback information is captured in the CMMS, is analysed and appropriate action is taken.

### 2.5.4 Zone Management / Specialized Maintenance & Support (DX) shall be responsible for:

- Ensure that maintenance is assigned to staff who are trained, authorized and found competent to perform maintenance on the specific equipment;
- Ensure that the equipment is maintained as per the Work Orders requirements; and

- c) Ensure that the maintenance feedback information is captured into the CMMS and relevant maintenance feedback documentation is attached for future maintenance analysis.

## **2.6 Process for monitoring**

| <b>Document number</b> | <b>Document title</b>                                                                               |
|------------------------|-----------------------------------------------------------------------------------------------------|
| 240-45920887           | Process Control Manual (PCM) for Manage Maintenance Base.                                           |
| 240-52380420           | Steering Committee of Technologies (SCOT) Standards Development and Change Implementation Procedure |
| 240-95116172           | Maintain Wires PCM                                                                                  |

## **2.7 Related/supporting documents**

Not applicable.

## **3. Requirements**

### **3.1 Pre-Planning**

**Note:** Ensure that the relevant / correct PPE is identified and used.

- Assessment at the site to determine the scope of work and the resources that would be required (people, equipment, PPE, etc.)
- Identify all the underground services.
- Plan work and resources.
- Ensure that all necessary documentation is completed / processed (e.g. check lists).

### **3.2 Risk Assessment**

The risk assessment shall cover at least the risk associated with the following: (Where applicable)

- Working in close proximity to energised equipment / parts.
- Working in water environment.
- Roadside work.
- Noise levels and effectiveness of communication.
- Working in elevated positions.
- Condition of poles, structure, hardware and conductors.
- Rating of equipment.
- Public.
- Weather condition.
- Equipment and tools.
- Materials and spares.
- Overall supervision.
- Completion of a workers register.

**Note:** Workers retain the right to refuse to work on the grounds of health, safety and environmental concerns according to 240-82744675.

Conduct an onsite risk assessment prior to commencement of work and continuously thereafter during the task execution by:

- Identifying the existing hazards/risks.
- Treating, transferring, tolerating or terminating the identified risks.
- Ensuring that all workers acknowledge identified risks and hazards by signing a risk assessment form / worker's register.
  - Ensure good light/lighting and visibility at the work site.
  - Ensure that the existing hazards/risks are identified and minimised.
  - Ensure that appropriate PPE and safety equipment are identified, inspected and worn/used during execution of the task.
  - Ensure that all members of staff are included when performing risk assessment.

### **3.3 Personal Protective Equipment**

All personal protective equipment shall be in accordance with 240-44175132 and those identified by risk assessment (DPC34-227).

### **3.4 Preparation of work site**

- All steps as identified in the analysis of physical material handling are applicable.
- Ensure that tools, equipment and materials are inspected for serviceability prior to use.
- Ensure that no substandard / unserviceable / incorrect tools, equipment or materials are used.

#### **3.4.1 Tools and equipment**

- a) Tools & equipment as recommended by OEM / approved installer.

#### **3.4.2 On Site Risk Assessment**

- a) Perform a proper risk assessment before task commencement or continuously during task execution in accordance with the prescribed procedure and ensure that all members of team are included when performing risk assessment.

**NOTE 1:** When doing an on-site risk assessment ensure that the measures to mitigate and / or minimize the associated risks and hazards are developed before executing the task.

- b) Do not take short cuts to save time.
- c) Ensure that poor visibility due to insufficient light/lighting are addressed during the task execution
- d) Lack of proper communicating ability – language, instructions, signals, etc.
- e) Ensure that the appropriate PPE and safety equipment are identified, inspected and worn / used during execution of the task.
- f) Develop measures to mitigate danger that can be caused by tools, equipment and material being used.
- g) Where required manage the vegetation as per the document “management and maintenance within Eskom land, servitudes and right of way” (240-70172585).

**3.4.2.1 Pandemic related specific safe work assessment**

- a) The following activities shall be performed by persons in charge of work:
- Evaluate maintenance tasks to determine whether safe social distances can be maintained, and other (normal) safe work procedures are not compromised, for example, communication by the PIC with staff in the proximity of live equipment.
  - Perform the normal risk assessment, as per the task manuals, **and** consider the specific risk associated with applying PANDEMIC RELATED preventative measures. Including an additional item in the normal risk assessment, which will include the risk of PANDEMIC RELATED infections. Risks may increase due to PANDEMIC RELATED PPE applied.
  - PPE, as per task manual, shall be utilised as prescribed, **and** PANDEMIC RELATED PPE shall be applied as **additional** safeguards.
- b) Both the safe work procedure (240-170000064) and PANDEMIC RELATED (240-154263529) precautions shall be applied. If one or the other are compromised; health and safety are at risk, then the maintenance activity shall not be started, or shall be stopped (if the task is already in progress), unless appropriate risk mitigating measure can be put in place or be rescheduled after the PANDEMIC restrictions are lifted.

**3.5 Inspection requirements for SSEG / Microgrid Plants****3.5.1 Defect Category codes**

As per 240\_170000630 "Defect Categories in Inspection Sheets", the following category codes shall apply.

| Defect Category | Defect category description                                                                                                                                                                                    | Process             |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| P1              | These types of defects present an immediate risk to safety and asset failure. The appropriate escalation, operating and repair process shall be followed to address the defect within the shortest time frame. | Dispatch            |
| P2              | These types of defects can be addressed as per the scheduling process by the relevant execution department.                                                                                                    | Scheduling          |
| P3              | These types of defects / installations are non-compliant to current standards and are not safety or asset failure related and require Plant Management investigation.                                          | Plant Investigation |

**3.5.2 Maintenance inspections**

The following asset components shall be inspected, and defects captured in Annex A below.

**3.5.2.1 Housing container**

- Check for corrosion due to mods/scratching/metal poorly treated.
- Check for unstable / leaning container (ground mount).
- Check for any signs of damage due to vandalism.
- Check for holes on the housing causing water leaks / dust ingress.
- Check if access points have been compromised due to seals broken, UV degradation of seals, rodents, broken wooden floors, termite activity and fungus damage to floors.
- Check for excessive heat or humidity inside the container caused by failure of air conditioners or the container itself.

#### **3.5.2.2 PV Structure**

- Check for any parts of the PV structure that may have eroded away due to corrosion caused by mods/scratching/metal poorly treated.
- Check for any loose nuts and bolts caused by poor workmanship during assembly or vibrations.
- Check for any missing nuts & bolts & members caused by theft or vandalism.
- Check for any damaged sections caused by storms or strong winds.
- Check that the structure is stable and properly secured.

#### **3.5.2.3 PV System**

- Check the PV panel for any cracks or breakages caused by bio / hail damage / vandalism / incorrect installation / negligent vegetation control (stones)
- Check the PV panel for any pollution caused by environmental / industry / poor maintenance / bird droppings.
- Check for any missing or stolen PV panels.
- Check for any failed PV panels caused by hot spots due to poor manufacturing, poor installation, poor handling, transport or due to a failed diode junction box.
- Check for any shady PV panels caused by encroaching vegetation.
- Check PV panel wiring for damaged insulation / wear & tear due to wind vibration, rodent damage, UV degradation and vandalism.
- Check PV panel for any broken wires due to vandalism.
- Check PV panel wiring for broken / damaged connectors due to negligent vegetation control (contact with weed machinery)
- Check PV panel wiring for missing wires due to theft & vandalism.

#### **3.5.2.4 Internal Mechanical supports**

- Check for any broken / damaged cable racks caused by poor workmanship, corrosion or vibration due to wind & transport.
- Inspect the mounting support brackets for any breakage or damages caused by poor workmanship, corrosion or vibration due to wind & transport.
- Inspect the mounting uni-struts for any breakage or damages caused by poor workmanship, corrosion or vibration due to wind & transport.

#### **3.5.2.5 Battery / Storage system (Lithium-Iron (LiFePO4) batteries)**

- Inspect battery racks for any broken / damaged steel members caused by poor workmanship, corrosion or vibration due to wind & transport.
- Check batteries for non-functionality or damages due to poor installation, manufacture defect or inadequate charge / discharge.
- Check the Battery / Storage system Hub for loss of communication caused by poor installation, power failure to hub or manufacture defect.
- Check the Battery / Storage system cabling for any loose connections or damaged cables caused by poor workmanship, overloading, vibration due to transport and rodents.

### 3.5.2.6 Control DB

- Check SCADA system for loss of control due to poor workmanship, vibration due to transport, loss of power supply, overheating, EMC or Software glitch or undetected error.
- Check SCADA system for loss of communications due to poor workmanship, vibration due to transport, loss of power supply, overheating, EMC or Software glitch or undetected error.
- Check the alarm system for any sensor failures caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check the alarm system for any alarm panel failures caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check the alarm system for any Power / battery failures caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check the alarm system for any damaged cables caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check the DVR system for camera failure caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check for DVR failure caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check the DVR system for power supply failure caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check the DVR system for any damaged cables caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge, manufacturer defect or rodents.
- Check the Network switch for any loose connections caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge or manufacturer defect.
- Check the Network switch for any loss in communication caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge or manufacturer defect.
- Check the server for any loose connections caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge or manufacturer defect.
- Check the server for any loss in communications caused by poor workmanship, vibration due to transport, overheating, loss of power supply, power / lightning surge or manufacturer defect.
- Check the Power Supplies for any loose connections.
- Check the Power Supplies for any faults or damages.
- Check the Circuit Breakers for any loose connections.
- Check the Circuit Breakers for any faults or damages.
- Check the Power supply fuses and holders for any loose connections.
- Check the Power supply fuses and holders for any faulty / damaged devices.
- Check the Relays and base for any loose connections.
- Check the Relays and base for any faults or damages.
- Check the Control DB enclosure for any exposure of the internal components.

### **3.5.2.7 AC Switchgear Box + Control Box**

- Check if circuit breakers are operating by switching them ON/OFF.
- Check the operation of the Remote-Control actuator if it switches ON/OFF and provides correct status.
- Check if the Conversion Relay 1 is operating (converting AC signal to DC signal). Look for signs of overvoltage burning the coil and burnt contacts.
- Check if the Load control switch (Relay 2) is operating. Look for signs of overvoltage burning the coil and burnt contacts.
- Inspect the Metering CTs for open circuit and inaccurate transformation.
- Inspect Metering VTs for any operation of the protective fuse device.
- Inspect AC Surge Arrestors
- Inspect VT Fuses
- Check Distribution Blocks (Junction block) for termination failures and loose connections resulting in hot connections.
- Inspect the AC Switchgear Box + Control Box enclosure for any exposure of the internal components.
- Inspect DC Surge Arrestors
- Inspect the copper bus-bars for any termination failures or loose connections resulting in hot connections
- Inspect the High Current Battery Fuses (100-250A)
- Inspect the PV Fuses (10-18A)
- Inspect the Low Current Fuses (1-5A)

### **3.5.2.8 Inverters**

- Check the output (AC or DC) of Battery Inverters (Master & Slave). Look for: Equipment failure, High temperatures & or failed fans, Surges not clamped by the SA's, Loose connections, Loss of DC input from the battery or suspect firmware type.
- Inspect PV Inverters for output AC. Look for: Equipment failure, High temperatures & or failed fans, Surges not clamped by the SA's, Loose connections, Failure of solar panels, Loss of DC input to the Inverter or suspect Firmware type.
- Inspect UPS Inverters for loss of AC supply caused by tripped circuit breaker, Equipment failure, High temperatures & or failed fans, Surges not clamped by the SA's, Loose connections, Loss of AC & DC input to the Inverter or suspect Firmware type.
- Inspect UPS Inverters for no output AC or DC caused by tripped circuit breaker, Equipment failure, High temperatures & or failed fans, Surges not clamped by the SA's, Loose connections, Loss of AC & DC input to the Inverter or suspect firmware type.

### **3.5.2.9 Aircons**

- Check if aircons provide a stable operating temperature. Look out for: Dirty filters, Dirty fans, Compressor failure or heater failure.

### **3.5.2.10 Container inside temperature sensors**

- Check the temperature sensor inside the container. (Check that the temperature is within acceptable limits). Look for faulty sensor or faulty aircon.

#### 3.5.2.11 Smart Metering & Integrated Load Control

- Check the Smart AMI meter for Faulty Energy Readings or no output power. Look out for a Faulty sensor or a Faulty relay.
- Inspect the Data Concentrator for equipment failure. Look out for a faulty power supply or circuitry failure.
- Inspect the Smart Metering & Integrated Load Control wiring for cable theft and fire/lightning damage caused by High crime rate, Lack of police/ firefighting services available in the area or Failure of circuit breakers or surge protection of cables.

#### 3.5.2.12 Grid tied Transformer

- Check transformer for sound installation.
- Check transformer for overloading.
- Check transformer for blown fuses.
- Check transformer for overheating, broken bushing seals (oil leaks) and vandalism.
- Check transformer for operated S/A, broken earth wires due to lightning & vandalism.
- Inspect transformer bushings for chipped / cracked insulators caused by vandalism, poor handling or lightning.

#### 3.5.2.13 Security Gates / Fences

- Check Security Gates / Fences for damages, theft or vandalism.

### 4. Forms and Records

- The maintenance feedback sheet prescribed in Annex A must be populated and form part of the feedback to the Works Coordinator.
- The Work Order must be populated with the relevant maintenance feedback documentation and attached to the Work Order.
- Information highlighted on the maintenance feedback form must be captured in the WO as per JP requirements.

### 5. Authorization

This document has been seen and accepted by:

| Name and surname | Designation                                       |
|------------------|---------------------------------------------------|
| Aumkar Sukhoo    | Acting Senior Manager Dx Operations & Maintenance |
| Deon Boshoff     | Middle Manager Maintenance Centre of Excellence   |
| Thomas Jacobs    | Chief Engineer DC & Auxiliaries                   |
| Ajith Persadh    | Senior Technologist                               |

### 6. Revisions

| Date       | Rev | Compiler  | Remarks                    |
|------------|-----|-----------|----------------------------|
| March 2025 | 1   | A Persadh | This is the first revision |

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## 7. Development team

The following people were involved in the development of this document.

| Name            | Designation              | Department/OU |
|-----------------|--------------------------|---------------|
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| Ajith Persadh   | Senior Technologist      | MCOE          |

## 8. Acknowledgements

- Renier De Lange
- Carl Van Den Berg
- Philip Groenewald

**Annex A**

(Normative)

**Annex A: SSEG / Microgrid Monthly Inspection Sheet**

| <br><b>Monthly Inspection sheet for SSEGs &amp; Microgrids</b> |                                                                   | <b>Distribution</b>                                                                                                                                                                                                                           |          |                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------|
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|                                                                                                                                                 |                                                                   | Total Pages :                                                                                                                                                                                                                                 |          |                               |
| Cluster / OU:                                                                                                                                   |                                                                   | Defect priority:                                                                                                                                                                                                                              |          |                               |
| CNC Name:                                                                                                                                       |                                                                   | P1 – These types of defects present an immediate risk to safety and asset failure. The appropriate escalation, operating and repair process shall be followed to address the defect within the shortest time frame - Dispatch where required. |          |                               |
| Substation name:                                                                                                                                |                                                                   | P2 – These types of defects can be addressed as per the scheduling process by the relevant execution department.                                                                                                                              |          |                               |
| Work Order Number:                                                                                                                              |                                                                   | P3 - These types of defects / installations are non-compliant to current standards and are not safety or asset failure related and requires Plant Management investigation.                                                                   |          |                               |
| No.                                                                                                                                             | Housing / Container                                               | Condition<br>Good (✓)<br>Bad (✗)                                                                                                                                                                                                              | Comments | Defect Priority & Description |
| 1                                                                                                                                               | Check for corrosion.                                              |                                                                                                                                                                                                                                               |          |                               |
| 2                                                                                                                                               | Check for unstable / leaning container (ground mount)             |                                                                                                                                                                                                                                               |          |                               |
| 3                                                                                                                                               | Check for any signs of damage.                                    |                                                                                                                                                                                                                                               |          |                               |
| 4                                                                                                                                               | Check for holes on the housing causing water leaks / dust ingress |                                                                                                                                                                                                                                               |          |                               |

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|            |                                                                    |                                           |                 |                                          |
|------------|--------------------------------------------------------------------|-------------------------------------------|-----------------|------------------------------------------|
| 5          | Check if access points have been compromised.                      |                                           |                 |                                          |
| 6          | Check for excessive heat or humidity inside the container.         |                                           |                 |                                          |
| <b>No.</b> | <b>PV Structure</b>                                                | <b>Condition<br/>Good (✓)<br/>Bad (✗)</b> | <b>Comments</b> | <b>Defect Priority &amp; Description</b> |
| 7          | Check for any parts of the PV structure that may have eroded away. |                                           |                 |                                          |
| 8          | Check for any loose nuts and bolts.                                |                                           |                 |                                          |
| 9          | Check for any missing nuts, bolts & members.                       |                                           |                 |                                          |
| 10         | Check for any damaged sections.                                    |                                           |                 |                                          |
| <b>No.</b> | <b>PV System</b>                                                   | <b>Condition<br/>Good (✓)<br/>Bad (✗)</b> | <b>Comments</b> | <b>Defect Priority &amp; Description</b> |
| 11         | Check the PV panel for any cracks or breakages.                    |                                           |                 |                                          |
| 12         | Check the PV panel for any pollution.                              |                                           |                 |                                          |
| 13         | Check for any missing or stolen PV panels                          |                                           |                 |                                          |
| 14         | Check for any failed PV panels caused by hot spots.                |                                           |                 |                                          |
| 15         | Check for any shady PV panels caused by encroaching vegetation     |                                           |                 |                                          |
| 16         | Check PV panel wiring for damaged insulation / wear & tear.        |                                           |                 |                                          |

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|------------|--------------------------------------------------------------------|-------------------------------------------|-----------------|------------------------------------------|
| 17         | Check PV panel for any broken wires.                               |                                           |                 |                                          |
| 18         | Check PV panel wiring for broken / damaged connectors.             |                                           |                 |                                          |
| 19         | Check PV panel wiring for missing wires.                           |                                           |                 |                                          |
| <b>No.</b> | <b>Internal Mechanical supports</b>                                | <b>Condition<br/>Good (✓)<br/>Bad (✗)</b> | <b>Comments</b> | <b>Defect Priority &amp; Description</b> |
| 20         | Check for any broken / damaged cable racks.                        |                                           |                 |                                          |
| 21         | Inspect the mounting support brackets for any breakage or damages. |                                           |                 |                                          |
| 22         | Inspect the mounting uni-struts for any breakage or damages.       |                                           |                 |                                          |
| <b>No.</b> | <b>Control DB</b>                                                  | <b>Condition<br/>Good (✓)<br/>Bad (✗)</b> | <b>Comments</b> | <b>Defect Priority &amp; Description</b> |
| 23         | Check SCADA system for loss of control.                            |                                           |                 |                                          |
| 24         | Check SCADA system for loss of communications.                     |                                           |                 |                                          |
| 25         | Check the alarm system for any sensor failures.                    |                                           |                 |                                          |
| 26         | Check the alarm system for any alarm panel failures.               |                                           |                 |                                          |
| 27         | Check the alarm system for any Power / battery failures.           |                                           |                 |                                          |
| 28         | Check the alarm system for any damaged cables.                     |                                           |                 |                                          |

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|----|---------------------------------------------------------------------------|--|--|--|
| 29 | Check the DVR system for camera failure.                                  |  |  |  |
| 30 | Check for DVR failure.                                                    |  |  |  |
| 31 | Check the DVR system for power supply failure.                            |  |  |  |
| 32 | Check the DVR system for any damaged cables.                              |  |  |  |
| 33 | Check the Network switch for any loose connections.                       |  |  |  |
| 34 | Check the Network switch for any loss in communication.                   |  |  |  |
| 35 | Check the server for any loose connections.                               |  |  |  |
| 36 | Check the server for any loss in communications.                          |  |  |  |
| 37 | Check the Power Supplies for any loose connections                        |  |  |  |
| 38 | Check the Power Supplies for any faults or damages                        |  |  |  |
| 39 | Check the Circuit Breakers for any loose connections                      |  |  |  |
| 40 | Check the Circuit Breakers for any faults or damages                      |  |  |  |
| 41 | Check the Power supply fuses and holders for any loose connections        |  |  |  |
| 42 | Check the Power supply fuses and holders for any faulty / damaged devices |  |  |  |
| 43 | Check the Relays and base for any loose connections                       |  |  |  |
| 44 | Check the Relays and base for any faults or damages                       |  |  |  |

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| 45  | Check the Control DB enclosure for any exposure of the internal components                                                                          |                                  |          |                               |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------|-------------------------------|
| No. | AC Switchgear Box + Control Box                                                                                                                     | Condition<br>Good (✓)<br>Bad (✗) | Comments | Defect Priority & Description |
| 46  | Check if circuit breakers are operating by switching them ON/OFF.                                                                                   |                                  |          |                               |
| 47  | Check the operation of the Remote Control actuator if it switches ON/OFF and provides correct status.                                               |                                  |          |                               |
| 48  | Check if the Conversion Relay 1 is operating (converting AC signal to DC signal). Look for signs of overvoltage burning the coil and burnt contacts |                                  |          |                               |
| 49  | Check if the Load control switch (Relay 2) is operating. Look for signs of overvoltage burning the coil and burnt contacts                          |                                  |          |                               |
| 50  | Inspect the Metering CTs for open circuit and inaccurate transformation                                                                             |                                  |          |                               |
| 51  | Inspect Metering VTs for any operation of the protective fuse device                                                                                |                                  |          |                               |
| 52  | Inspect AC Surge Arrestors                                                                                                                          |                                  |          |                               |
| 53  | Inspect VT Fuses                                                                                                                                    |                                  |          |                               |

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|            |                                                                                                                                                                                                                                                   |                                           |                 |                                          |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------|------------------------------------------|
| 54         | Check Distribution Blocks (Junction block) for termination failures and loose connections resulting in hot connections.                                                                                                                           |                                           |                 |                                          |
| 55         | Inspect the AC Switchgear Box + Control Box enclosure for any exposure of the internal components                                                                                                                                                 |                                           |                 |                                          |
| 56         | Inspect DC Surge Arrestors                                                                                                                                                                                                                        |                                           |                 |                                          |
| 57         | Inspect the copper bus-bars for any termination failures or loose connections resulting in hot connections                                                                                                                                        |                                           |                 |                                          |
| 58         | Inspect the High Current Battery Fuses (100-250A)                                                                                                                                                                                                 |                                           |                 |                                          |
| 59         | Inspect the PV Fuses (10-18A)                                                                                                                                                                                                                     |                                           |                 |                                          |
| 60         | Inspect the Low Current Fuses (1-5A)                                                                                                                                                                                                              |                                           |                 |                                          |
| <b>No.</b> | <b>Inverters</b>                                                                                                                                                                                                                                  | <b>Condition<br/>Good (✓)<br/>Bad (✗)</b> | <b>Comments</b> | <b>Defect Priority &amp; Description</b> |
| 61         | Check the output (AC or DC) of Battery Inverters (Master & Slave). Look for: Equipment failure, High temperatures & or failed fans, Surges not clamped by the SA's, Loose connections, Loss of DC input from the battery or suspect firmware type |                                           |                 |                                          |

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|            |                                                                                                                                                                                                                                            |                                           |                 |                                          |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------|------------------------------------------|
| 62         | Inspect PV Inverters for output AC. Look for: Equipment failure, High temperatures & or failed fans, Surges not clamped by the SA's, Loose connections, Failure of solar panels, Loss of DC input to the Inverter or suspect Firmware type |                                           |                 |                                          |
| 63         | Inspect UPS Inverters for loss of AC supply.                                                                                                                                                                                               |                                           |                 |                                          |
| 64         | Inspect UPS Inverters for no output AC or DC.                                                                                                                                                                                              |                                           |                 |                                          |
| <b>No.</b> | <b>Aircons</b>                                                                                                                                                                                                                             | <b>Condition<br/>Good (✓)<br/>Bad (✗)</b> | <b>Comments</b> | <b>Defect Priority &amp; Description</b> |
| 65         | Check if aircons provide a stable operating temperature. Look out for: Dirty filters, Dirty fans, Compressor failure or Heater failure                                                                                                     |                                           |                 |                                          |
| <b>No.</b> | <b>Temp sensor inside the container</b>                                                                                                                                                                                                    | <b>Condition<br/>Good (✓)<br/>Bad (✗)</b> | <b>Comments</b> | <b>Defect Priority &amp; Description</b> |
| 66         | Check the temp sensor inside the container. (Check that the temp is within acceptable limits). Look for Faulty sensor or Faulty aircon                                                                                                     |                                           |                 |                                          |
|            |                                                                                                                                                                                                                                            |                                           |                 |                                          |

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| No. | Smart Metering & Integrated Load Control                                                                                                                                                                                                                   | Condition<br>Good (✓)<br>Bad (✗) | Comments | Defect Priority & Description |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------|-------------------------------|
| 67  | Check the Smart AMI meter for Faulty Energy Readings or no output power. Look out for a Faulty sensor or a Faulty relay                                                                                                                                    |                                  |          |                               |
| 68  | Inspect the Data Concentrator for equipment failure. Look out for a faulty power supply or circuitry failure                                                                                                                                               |                                  |          |                               |
| 69  | Inspect the Smart Metering & Integrated Load Control wiring for cable theft and fire/lightning damage caused by High crime rate, Lack of police/ fire fighting services available in the area or Failure of circuit breakers or surge protection of cables |                                  |          |                               |
| No. | Grid tied Transformer                                                                                                                                                                                                                                      | Condition<br>Good (✓)<br>Bad (✗) | Comments | Defect Priority & Description |
| 70  | Check for sound installation                                                                                                                                                                                                                               |                                  |          |                               |
| 71  | Check for overloading                                                                                                                                                                                                                                      |                                  |          |                               |
| 72  | Check for blown fuses                                                                                                                                                                                                                                      |                                  |          |                               |
| 73  | Check for overheating, broken bushing seals (oil leaks) and vandalism                                                                                                                                                                                      |                                  |          |                               |

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|-----|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------|------|------|------|------|----------|-------------------------------|
| 74  | Check for operated S/A, broken earth wires due to lightning & vandalism                                                                  |                                  |      |      |      |      |      |          |                               |
| 75  | Inspect Trfr bushings for chipped / cracked insulators caused by vandalism, poor handling or lightning                                   |                                  |      |      |      |      |      |          |                               |
| No. | Security Gates / Fences                                                                                                                  | Condition<br>Good (✓)<br>Bad (✗) |      |      |      |      |      | Comments | Defect Priority & Description |
| 76  | Check Security Gates / Fences for damages, theft or vandalism.                                                                           |                                  |      |      |      |      |      |          |                               |
| No. | Battery / Storage system<br>(Lithium-Iron (LiFePO4) batteries)                                                                           | Condition                        |      |      |      |      |      | Comments | Defect Priority & Description |
|     |                                                                                                                                          | Good (✓) Bad (X)                 |      |      |      |      |      |          |                               |
|     |                                                                                                                                          | BMS1                             | BMS2 | BMS3 | BMS4 | BMS5 | BMS6 |          |                               |
| 77  | Inspect battery racks for any broken / damaged steel members.                                                                            |                                  |      |      |      |      |      |          |                               |
| 78  | Check batteries for non-functionality or damages.                                                                                        |                                  |      |      |      |      |      |          |                               |
| 79  | Check the Battery / Storage system Hub for loss of communication caused by poor installation, power failure to hub or manufacture defect |                                  |      |      |      |      |      |          |                               |
| 80  | Check the Battery / Storage system cabling for any loose connections or damaged cables.                                                  |                                  |      |      |      |      |      |          |                               |

|                      |  |
|----------------------|--|
| Inspected by: (Name) |  |
|----------------------|--|

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|                           |  |
|---------------------------|--|
| Inspected by: (Signature) |  |
| Date Inspected            |  |
| Supervisor's Name         |  |
| Supervisor's Signature    |  |
| Date checked              |  |

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