



Battery Energy Storage System Inspection and Testing Checklists

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1 SCOPE

These Checklists provide information on the Inspection and Testing activities to be carried out by the Applicant contractor at the end of the construction of a BESS, in order to connect it to the Distribution Network in KSA.

Referring to the approved WERA regulations and SEC connection process, the inspection and testing are executed in Step 3 named as “REG Connection” phase. SEC’s responsibilities at this stage will be limited to the following:

- Inspect the REG system to verify the correspondence between the REG system and the documentation provided and approved during the Design Document evaluation stage:
 - Agree with the applicant on the inspection date
 - Completeness of the documentation and its correspondence with the REG system on-site, as per SEC’s inspection checklist.
 - Inspect the presence of Interface Protection and required switches.
 - Witness Compliance test to be performed if necessary, during cold commissioning.
 - Temporary connection granted (known as “Limited Operational Notification”).
- Generation Meter installation if all tests have a positive outcome.

During REG Energization & Operation phase, SEC will have the right to witness the commissioning tests only if deemed necessary. SEC eventually will be responsible for issuing the “Final Operation Notification” and If deemed necessary, SEC is entitled to ask the Eligible Consumer to sign a REG System Operational Agreement. SEC will also check the commissioning report following SEC’s commissioning checklist.

1.1 Companion Documents

The documents listed hereinafter have to be considered a compendium of the current document. Therefore, they should be carefully read in addition to this.

- [1] CESI_SEC-DREG BESS Component Specifications_v3.0 Final.docx
- [2] CESI_SEC-DREG Best Practice for Design for BESS_v3.0. Final.docx
- [3] CESI_SEC-DREG Connection Guidelines for BESS_v3.0 Final.docx
- [4] CESI_SEC-DREG Health and Safety Requirements for BESS_v3.0 Final.docx
- [5] CESI_SEC-DREG Inspection and Testing Guidelines for BESS_v3.0 Final.docx
- [6] CESI_SEC-DREG Manual for the maintenance for BESS_v3.0 Final.docx
- [7] CESI_SEC-DREG Standards for Connection of BESS_v3.0 Final.docx

DISCLAIMER

For understanding the connection process for connection of BESS, users must refer to the common connection process document for REG systems. The connection process for all DREG systems is the same, and hence, all users shall be updated with the REG connection process which is applicable for BESS too.

2 REFERENCE DOCUMENTS

- [1] IEC 60364-6 – Low voltage electrical installations. Part 6: Verifications
- [2] IEC 61010 – Safety requirements for electrical equipment for measurement, control and laboratory use
- [3] IEC 61557 – Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V D.C.
- [4] IEC 61557-7- Equipment for testing, measuring or monitoring of protective measures - Part 7: Phase sequence
- [5] IEC 62271-202 - High-voltage/ low-voltage prefabricated substation
- [6] IEC 61010 – Safety requirements for electrical equipment for measurement, control and laboratory use
- [7] IEC 61140 –Protection against electric shock-Common aspects for installation and equipment
- [8] IEC 60364-1 - Fundamental principles, assessment of general characteristics definitions
- [9] IEC 60364-4 – Protection for Safety-Protection against electric shock
- [10] IEC 60364-5- Selection and erection of electrical equipment Common rules
- [11] IEEE 1547.1-IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
- [12] IEEE 1547-IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
- [13] IEEE 81, IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- [14] Saudi Arabia Building Code (SBC)
- [15] Saudi Arabia Distribution Code

3 TERMS AND DEFINITIONS

Eligible Consumer – Any Person supplied with electricity services for his own consumption. In this context, this term will also be used to refer to a User owning a BESS. This term has also the same meaning of Customer, as defined in the Distribution Code. As per WERA Regulations, a Consumer is considered Eligible when it meets both the requirement of the same Regulations and the Connection Conditions as defined in the Distribution Code.

Inspection – examination of an electrical installation using all the senses in order to ascertain correct selection and proper erection of electrical equipment.

Interface Protection (IP) - The electrical protection required to ensure that either the BESS and/or any BESS Unit is disconnected for any event that could impair the integrity or degrade the safety and reliability of the distribution network.

Loss of Mains (LOM) – Represents an operating condition in which a distribution network, or part of it, is on purpose or in case of fault separated from the main power system with the final scope of de-energization. This denotes also the protection which detects this condition, and it is also known as anti-islanding

Report – aggregate value based on series of records

Switch – Mechanical device capable of making, carrying and breaking currents in normal circuit conditions and, when specified, in given operating overload conditions. In addition, it is able to carry, for a specified time, currents under specified abnormal circuit conditions, such as short-circuit conditions.

Testing – implementation of measures in an electrical installation by means of which its effectiveness is proved (Note: It includes ascertaining values by means of appropriate measuring instruments, said values not being detectable by inspection).

Verification – all measures by means of which compliance of the electrical installation to the relevant standards are checked.

4 SUBMISSION OF REG INSPECTION APPLICATION

At this stage, the contractor belonging to the eligible consumer shall upload the REG inspection application request, in which he states that the REG system has been constructed and is ready for SEC inspection. The contractor shall upload the following documents reported in the below checklist.

Table 1: REG Inspection Application Checklist

Data name	Data type	Author	Notes
Selection of Contractor			
Insert Contractor name	Alphabetic	Consultant	
Contractor CR code	Numeric	Consultant	
Data name	Data type	Author	Notes
Site Test Upload and Request of Inspection			
1. Declaration of Conformity (letter of undertaking from Contractor) * This letter shall include: - Safety rules and instructions to follow on site, according to KSA safety laws and regulations, building code and distribution code. - Declare that site is safe for inspection and access. - Declare that the REG system is ready for energization	File	Consultant/ Contractor	
2. Details of the protection arrangement and settings, including: * - Overcurrent setting - short-circuit ratings of the installed equipment - Interface Protection settings	File	Consultant/ Contractor	Interface protection settings to include: - Under voltage [27] - Over voltage [59] - Over frequency [81>] - Under frequency [81<] - Loss Of Mains (Anti-Islanding)
3. Electrical Diagram, data sheets and SLDs of the Consumer's Equipment at the POC*	File	Consultant/ Contractor	Including approved SASO standards and Installed equipment certifications
4. Declaration that no changes to the initial design took place *	File	Consultant/ Contractor	Form to be developed
5. Proposed operation and maintenance manual*	File	Consultant/ Contractor	

6. Site test report including the relevant tests performed with a successful results declaration * The report shall include: • String test • Operational current test • Cable Insulation test • Attach FAT Factory Acceptance test	File	Consultant/ Contractor	
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*are mandatory field

After the submission of the above documents and certificates reported in Table 1, SEC shall revise all these documents and check if they are all uploaded correctly and include all declarations and technical information. If SEC is satisfied with the uploaded documents, they can coordinate with the eligible consumer, consultant and contractor to fix a date and time for the site visit to conduct the on-site inspection.

5 ON-SITE INSPECTION CHECKLIST

The purpose of the site visit is to check that the REG system is constructed as per the design documents provided previously to SEC and revised in the design documentation review phase. SEC will not be interested in inspecting the entire REG system, but it will focus mainly on inspecting the protection and components that are impacting the distribution network e.g., interface protection, the point of connection, etc. The inspection of SEC will follow the below checklist, hence, it's important that the contractor knows beforehand what SEC engineer will inspect before the site visit, to ensure that everything in the REG system is well constructed to meet SEC technical requirements and expectations.

Table 2: Onsite Inspection Checklist

Data name	Data type	Author	Notes
AC System - General			
<i>The Main Switch is present*</i>	Selection	SEC	☐ Yes ☐ No Notes:
<i>The Interface Switch is present*</i>	Selection	SEC	☐ Yes ☐ No Notes:
<i>Interface protection (IP) is present*</i>	Selection	SEC	☐ Yes ☐ No Notes:
<i>The Backup interface device is present*</i>	Selection	SEC	☐ Yes ☐ No ☐ Not Applicable Notes:
<i>An UPS to support the Interface protection system is present*</i>	Selection	SEC	☐ Yes ☐ No Notes:
<i>BESS size to check the installed capacity is correct*</i>	Selection	SEC	☐ Yes ☐ No Notes:

Monitoring system is present*	Selection	SEC	☐ Yes ☐ No ☐ Not Applicable Notes:
Labelling and identification			
Means of isolation on the AC side is clearly labelled	Selection	SEC	☐ Yes ☐ No Notes:
Dual supply warning labels are fitted at point of interconnection*	Selection	SEC	☐ Yes ☐ No Notes:
A single line wiring diagram is displayed in the electrical room*	Selection	SEC	☐ Yes ☐ No Notes:
Contractors, O&M team, fire fighters and concerned persons details are displayed in the electrical room including their phone numbers and hotline numbers*	Selection	SEC	☐ Yes ☐ No Notes:
Shutdown procedures are displayed in the electrical room	Selection	SEC	☐ Yes ☐ No Notes:
All signs and labels in the electrical room are suitably affixed and durable*	Selection	SEC	☐ Yes ☐ No Notes:
All signs and labels in the electrical room are in both Arabic and English*	Selection	SEC	☐ Yes ☐ No Notes:
Fire Protection			
Data name	Data type	Author	Notes
A simplified site plan with the position of BESS, cables and disconnectors is exposed close to the main energy meter. If a manual call point is present in the building a further copy of the simplified site plan is exposed on the side	Selection	SEC	☐ Yes ☐ No ☐ Not Applicable Notes:
Final Approval			
Is the Inspection approved? *	Selection	SEC	☐ Yes ☐ No Notes:
Has the result been notified to the Consumer?	Selection	SEC	☐ Yes ☐ No Notes:
Does the BESS plant grant a "Limited Operational Notification"? *	Selection	SEC	☐ Yes ☐ No Notes:
"Limited Operational Notification" duration based on agreement with contractor/consultant*	Selection	SEC	☐ 2 days ☐ 3 days ☐ other Notes:
Does SEC need to witness the commissioning test? *	Selection	SEC	☐ Yes ☐ No Notes:
Name of the SEC Inspector	Alphabetic	SEC	

Notes from SEC Inspector	Alphabetic	SEC	
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*are mandatory field

6 CONSUMER COMMISSIONING REPORT

After the compilation of the on-site inspection, and if SEC is satisfied with the test results and the way the REG system is constructed, SEC shall provide the eligible consumer with a “limited operational notification”. Some tests usually must be performed with a grid connection e.g., performance test and for this reason, SEC will provide the eligible consumer with a temporary connection in which the REG system will be allowed to be connected to the network for the purpose of running those tests.

The contractor performing these tests must provide a commissioning report, illustrating all test results. SEC will review the commissioning report following the checklist reported in Table 3, and accordingly, it's important for the contractor to ensure that he has included in his commissioning report all the items that will be checked and revised by SEC. Finally, it's important to mention that SEC may also witness the commissioning test on-site, but this is subject to SEC evaluation and needs, depending on the situation SEC has also the right to ask the contractor to perform additional tests if deemed necessary.

Table 3: Commissioning report evaluation

Data name	Data type	Author	Notes
REG System – General			
<i>Expected date of energization*</i>	Numeric	SEC	Automatically provided
Commissioning Test Report including: * - Test Report of the Interface Protection including: • 27< 90% Nominal Voltage test • 27<< 40% Nominal Voltage test • 59> 110% Nominal Voltage test • 59>> 120% Nominal Voltage test • 81>> over frequency test 62.5 Hz • 81< under frequency test 57.5Hz • 81<< under frequency test 57 Hz - Performance test - Power Quality test	File	SEC	☐ Yes ☐ No Notes:
Responsible of the Commissioning and Subjects involved			
<i>Name of the Responsible</i>	Alphabetic	Consultant/ Contractor	
<i>Other Subjects involved</i>	Alphabetic	Consultant/ Contractor	Names and Roles
Data name	Data type	Author	Notes
REG System – General			

Expected date of energization	Numeric	IFS	Automatically provided
Interface Protection			
The enabled functions of the Interface Protection are those required by SEC?*	Selection	SEC	☐ Yes ☐ No Notes:
The thresholds settings are those required by SEC* • 27< 90% Nominal Voltage • 27<< 40% Nominal Voltage • 59> 110% Nominal Voltage • 59>> 120% Nominal Voltage • 81>> over frequency 62.5 Hz • 81< under frequency 57.5 Hz • 81<< under frequency 57 Hz	Selection	SEC	☐ Yes ☐ No Notes:
The times of intervention of interface protection are those required by SEC * • 27< 90% Nominal Voltage 1.5 s • 27<< 40% Nominal Voltage 0.8 s • 59> 110% Nominal Voltage 3 s • 59>> 120% Nominal Voltage 0.2 s • 81>> 62.5 Hz 0.1 s • 81< 57.5 Hz 4 s • 81<< 57 Hz 0.1 s	Selection	SEC	☐ Yes ☐ No Notes:
Interface device switches off in case of power failure on command of the Interface Protection *	Selection	SEC	☐ Yes ☐ No Notes:
After a power recovery the Interface Protection recloses the Interface device *	Selection	SEC	☐ Yes ☐ No Notes:
Final Approval			
Is the Consumer Commissioning Report approved? *	Selection	SEC	☐ Yes ☐ No Notes:
Has the result been notified to the Consumer? *	Selection	SEC	☐ Yes ☐ No Notes:
Does the BESS plant grant "Final Operational Notification"? *	Selection	SEC	☐ Yes ☐ No Notes:
Name of the SEC Inspector	Alphabetic	SEC	
Notes from SEC Inspector	Alphabetic	SEC	If relevant

*are mandatory field