Steady-State Reactive Power (SSRP)

System Services

 Test Report

Battery ESPS

Unit Name

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# Document Version History

Revision 3.0, published 30th July 2021

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  **Version** | **Date** | **Comment** | **Name** | **Company** |
| 0.1 | Insert date | Minor version (v0.1) - First submission for review and approval | Insert name | Insert company |
| 1.0 | Insert Date | Revised to version 1.0 following approval by EirGrid, SONI. | Insert Name | Unit Company Name |

# Introduction

The Unit shall submit the latest version of this test report template as published on the EirGrid or SONI websites[[1]](#footnote-2).

The report shall be developed for technical and non-technical readers and shall follow the agreed test programme. The report is submitted to generator\_testing@eirgrid.com or generator\_testing@soni.ltd.uk as appropriate.

Submission of this document is required if a Unit does not have and existing SSRP contract or is making changes or updates to any of the effected parameters.

To complete the report, the Unit shall have either:

1. Recorded active and reactive power data as per the test procedure agreed with EirGrid, SONI; or
2. Performance Data showing full reactive power capability.

Any issue with meeting any requirements or completing this report, please contact generator\_testing@eirgrid.com or  generator\_testing@soni.ltd.uk as appropriate.

# Abbreviations

AVR Automatic Voltage regulation

DMOL Defined Minimum Operating Level

ESPS Energy Storage Power Station

Hz Hertz – unit of frequency

kV kilovolt

MEC Maximum Export Capacity

MVAr Mega Volt Ampere – reactive

MW Mega Watt

PMax Maximum MW amount the unit can deliver while also providing reactive power at the connection point.

PMin Minimum MW amount the unit can deliver while also providing reactive power at the connection point.

Prange Maximum MW range that the unit can deliver while also being able to provide reactive power at the connection point.

QMax Maximum Lagging Mar that can be delivered over the full Prange.

QMin Minimum Leading MVAr that can be delivered over the full Prange.

Qrange Maximum MVAr range (from full lagging to full leading) that the unit can provide at the connection point.

RP Reactive Power

SSRP Steady-State Reactive Power

TSO Transmission System Operator

# Unit Data

|  |  |
| --- | --- |
| ESPS Name | ESPS to Specify(name per connection agreement) |
| ESPS Test Coordinator and contact number: | ESPS to Specify |
| Associated 110 kV Station | ESPS to Specify |
| ESPS connection point | ESPS to Specify(*i.e.* T121 in XXX Distribution or Transmission Station) |
| ESPS connection voltage | ESPS to Specify |
| ESPS Connection Type | ESPS to Specify(TSO, DSO Topology 1, DSO Topology 2 etc.) |
| Installed module type, MW size and quantity | ESPS to Specify |
| Contracted MEC | ESPS to Specify |
| Contracted MIC | ESPS to Specify |
| Registered Capacity | ESPS to Specify |
| Energy Storage Capacity | ESPS to Specify |
| % Charge maintained in normal operation | ESPS to Specify |
| Limiter applied to Exported MW | ESPS to Specify |
| Limiter applied to AAP | ESPS to Specify |
| DMOL | ESPS to Specify |
| RoCoF Capability | ESPS to Specify |
| Is the AVR functioning and fully tested?  | Yes/No |
| AVR Droop Setting | \_\_\_\_\_\_\_% |

# System Services

The definitions referenced in this document are for indicative purposes only. In the event of inconsistency between the definitions in this document and those in the DS3 System Services Agreement, the definitions in the DS3 System Services Agreement shall prevail.

## Steady-State Reactive Power

SSRP is defined as the dispatchable reactive power range (QRange) in MVAr that can be provided across the full range of active power output (PRange). For Battery, PRange may or may not be limited by DMOL.

## Reactive Power Factor calculation

$$RP Factor= \frac{Active Power Range across which reactive power can be provided \left(P\_{Range}\right)}{Registered Capacity}$$

$$SSRP Volume= Q\_{Range} x RP Factor$$

# Assessment

Qmin is the maximum leading MVAr that can be delivered over the full Prange. Qmax is the maximum lagging MVAr that can be delivered over the full Prange.

Prange is the MW range over which the Battery can deliver the Qrange.

Qmin and Qmax are based on reactive power measured at the connection point.



Figure 1: Example graph showing a unit with reactive capability down to 0 MW.



Figure 2: Example graph of a with no reactive power capability at 0 MW

# Results

## Summary

Testing was completed on [DATE].

*[Comment on the results, highlighting any issues encountered in performing the test or in analysing the results.]*

*[Insert Report summary]*

*[Include any relevant test notes here, relating to how the test was carried out or to any specific conditions encountered during the test.]*

*[Abnormal behaviour in the data (spikes, dips, unusual vibrations, etc.) shall be noted and documented. The reasons behind these shall be detailed along with any corrective actions taken and what its effects are on the unit and/or the result. If possible a clear graph of the issue should also be presented].*

*[Data shall be presented as a full PQ chart with significant points highlighted and clearly labelled. A table of values and/or results shall accompany the graph.]*

## Table of Results

The table will be list of the MVAr values at the MW intervals applied during testing.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reading** | **Importing/ Leading – Measured** | **Exporting/****Lagging - Measured** | **Importing/****Leading - Modelled** | **Exporting/****Lagging - Modelled** |
| MVAr at 100% of Registered Capacity | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| [ESPS shall extend this table to include MW intervals applied in testing from Registered capacity] | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at 0 MW | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| [ESPS shall extend this table to include MW intervals applied in testing to MIC] | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at MIC | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |

## System Services Parameters – Table of results

|  |  |
| --- | --- |
| **Point** | **Value** |
| Registered capacity (Pmax), full lagging | \_\_\_\_\_\_\_\_\_MW, \_\_\_\_\_\_\_MVAr |
| Registered capacity (Pmax), full leading | \_\_\_\_\_\_\_\_\_MW, \_\_\_\_\_\_\_MVAr |
| Minimum Load/ Minimum Generation (Pmin), full lagging | \_\_\_\_\_\_\_\_\_MW, \_\_\_\_\_\_\_MVAr |
| Minimum Load/ Minimum Generation (Pmin), full leading | \_\_\_\_\_\_\_\_\_MW, \_\_\_\_\_\_\_MVAr |
| Maximum leading MVAr that can be delivered over the full Prange. (Qmin ) | \_\_\_\_\_\_\_MVAr |
| Maximum lagging MVAr that can be delivered over the full Prange (Qmax ) | \_\_\_\_\_\_\_MVAr |

## System Services Values

|  |  |  |
| --- | --- | --- |
| **Reading** | **Value** | **Comment** |
| Registered Capacity | \_\_\_\_\_\_MW |  |
| P range | \_\_\_\_\_\_\_MW to \_\_\_\_\_MW |  |
| Q range  | \_\_\_\_\_\_MVAr to \_\_\_\_\_\_\_MVAr | (Qmin to Qmax as identified above in Table 7.3) |
| RP factor |  | Insert Calculation and value per Section 5.2Currently the maximum RP factor that can be contracted for is 1 (as of July 2021). If Section 5.2 calculation results in a RP factor greater than 1, please include two values here, one reflecting a max RP factor of 1, and one reflecting RP factor as per calculation in Section 5.2. |
| SSRP volume |  | Insert Calculation and value as per Section 5.1If Section 5.2 calculation results in a RP factor greater than 1, please include two values here, one reflecting the SSRP volume using the max RP factor of 1, and one reflecting the SSRP volume using the RP factor as per calculation in Section 5.2. |
| Q range at 0 MW | \_\_\_\_\_\_MVAr to \_\_\_\_\_\_\_MVAr |  |
| Cable Network Charging Capacitance including filters, *etc.* | 0 MW, \_\_\_\_\_\_\_MVAr | With Battery Modules disconnected |

## Graph of results

[*Insert a full graph of the results showing the full reactive power capability of the unit*, *all relevant values shall be displayed, such as the full Q range (x-axis) and the full P range (y-axis). Each corner point must also have its value clearly labelled; the chart shall also have the theoretical values shown.]*

[*Include any relevant test notes here, relating to how the test was carried out or any specific conditions encountered during this test.*]

1. <http://www.eirgridgroup.com/> or <http://www.soni.ltd.uk/> [↑](#footnote-ref-2)