Steady-State Reactive Power (SSRP)

System Services

 Test Report

WFPS

Unit Name

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# Document Version History

Revision 3.0 published 12th November 2019

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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

SSRP Steady-State Reactive Power

MVAr Mega Volt Ampere – reactive

MW Mega Watt

TSO Transmission System Operator

MEC Maximum Export Capacity

RP Reactive Power

kV kilovolt

Hz Hertz – unit of frequency

AVR Automatic Voltage regulation

DMOL Defined Minimum Operating Level

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

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.

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

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

# Unit Data

|  |  |
| --- | --- |
| WFPS Name | WFPS to Specify  |
| WFPS Test Coordinator and contact number: | WFPS to Specify |
| WFPS Location | WFPS to Specify  |
| WFPS connection point | HV Bushings of T101 in XX 110kV station |
| WFPS connection voltage | WFPS to Specify  |
| Installed Turbine type, MW size and quantity | WFPS to Specify |
| Contracted MEC | WFPS to Specify  |
| Registered Capacity | WFPS to Specify |
| Limiter applied to Exported MW | WFPS to Specify |
| Limiter applied to AAP | WFPS to Specify |
| DMOL | WFPS to Specify  |
| Is the AVR fully commissioned and functional? | 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 WFPS, 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 WFPS 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.]*

If the unit was not tested over the full Prange, please ensure modelled data is included in the results and displayed on the graph. If the tested capability follows the model, modelled values may be used for the range that was not tested. If there is no test data or modelled data, the Qmin or Qmax value should be the minimum Grid Code requirement of the WFPS.

## 1MW resolution – Table of Results

The table will be list of the MVAr values at 1MW intervals both modelled and measured. If the unit did not complete testing over the full Prange, please put N/A in the measured columns. Provide modelled data for the entire Prange.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reading** | **Importing/ Leading – Measured** | **Exporting/****Lagging - Measured** | **Importing/****Leading - Modelled** | **Exporting/****Lagging - Modelled** |
| MVAr at 100% of Registered Capacity | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| [Unit shall amend this table and include 1MW intervals from Registered capacity] | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at 5MW | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at 4MW | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at 3MW | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at 2MW | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at 1MW | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr | \_\_\_\_ MVAr |
| MVAr at 0 MW | \_\_\_\_ 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 Section 7.3) |
| RP factor |  | Insert Calculation and value per Section 5.2  |
| SSRP volume |  | Insert Calculation and value as per Section 5.2 |
| Q range at 0 MW | \_\_\_\_\_\_MVAr to \_\_\_\_\_\_\_MVAr |  |
| Cable Network Charging Capacitance including filters, *etc.* | 0 MW, \_\_\_\_\_\_\_MVAr | With WTGs 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)