Fast Frequency Response (FFR), Primary, Secondary and Tertiary Reserve (POR, SOR, TOR1, TOR2)

System Services

Test Report for Performance Scalar Reset

Synchronous Machine

Unit Name

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# Document Version History

Revision 1.0 published 16th September 2022

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Version** | **Date** | **Comment** | **Name** | **Company** |
| 0.1 | Insert Date | Minor version (v0.1) - First submission for review and approval | Insert Name | Unit Company Name |
| 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, 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](mailto:generator_testing@eirgrid.com) or  [generator\_testing@soni.ltd.uk](mailto:%20generator_testing@soni.ltd.uk) as appropriate.

To complete the report, the Unit shall have either:

1. Recorded frequency response data as per the test procedure agreed with EirGrid, SONI; or
2. Performance Data showing frequency response capability.

Any issue with meeting any requirements or completing this report, please contact [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com) or  [generator\_testing@soni.ltd.uk](mailto:%20generator_testing@soni.ltd.uk) as appropriate.

# Abbreviations

HV High Voltage

MW Mega Watt

MEC Maximum Export Capacity

kV kilovolt

Hz Hertz – unit of frequency

POR Primary Operating Reserve

SOR Secondary Operating Reserve

TOR Tertiary Operating Reserve

FFR Fast Frequency Response

# Unit Data

## Unit Data

|  |  |
| --- | --- |
| Unit name | Name:\_\_\_\_\_\_\_\_\_ |
| Unit connection point | HV Bushings of T101 in XX 110kV station |
| Contracted MEC | \_\_\_\_\_\_\_\_\_\_\_MW |
| Unit connection voltage | \_\_\_\_\_\_\_\_kV |
| Unit fuel type | Name:\_\_\_\_\_\_\_\_\_ |
| Operating modes | *e.g.* OCGT, CCGT, Sync Comp *etc*. |
| Registered capacity / maximum continuous rating | \_\_\_\_\_\_\_\_\_\_\_MW |
| Minimum load  Minimum generation | \_\_\_\_\_\_\_\_\_\_\_MW  \_\_\_\_\_\_\_\_\_\_\_MW |
| Installed plant | Name: \_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_MVA  Name: \_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_MW |
| House load | \_\_\_\_\_\_\_\_\_\_\_MW |
| Governor droop setting | \_\_\_\_\_\_\_% |
| Power system stabiliser | On / Off |

# System Services definitions

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.

## Fast frequency response (FFR)

FFR is defined as the additional increase in MW output from a unit or a reduction in demand following a frequency event that is available within two seconds of the start of the event and sustainable over the period from FFR Response Time to 10 seconds.

The extra energy provided, in the two-to-ten second timeframe, by the MW increase **shall be greater** than any loss of energy in the ten-to-twenty second timeframe afterwards due to a reduction in MW output.



Figure : Example graph showing the additional power provided to, and drawn from, the grid

As shown in the diagram above, in order to be eligible for FFR the amount indicated by the blue hatched area (Power provided) shall be greater than the green hatched area (Power drawn).

## FFR Response Time

A Providing Unit’s contracted FFR Response Time is the time from when the frequency falls through its contracted Reserve Trigger (T=0) to the time at which the Providing Unit must have achieved its contracted FFR volume, as dictated by its contracted FFR response curve.

The FFR response time provided in Section 7.4 shall be based on test data.

Please note that the FFR Response Time, as recorded on the Providing Unit’s installed performance measurement equipment, will be evaluated as part of the FFR performance monitoring process.

The product scalar for faster response of FFR will be based on the FFR response time of the Providing Unit.

## Operating Reserve (POR, SOR, TOR1 and TOR2)

### Operating Reserve

Operating Reserve is defined as the additional MW output provided from Generation plant, reduction of Active power transfer to an external system or increase of Active power transfer to the Transmission system by interconnectors, or reduction in Customer demand, which shall be realisable in real time operation to contain and correct any potential Transmission system deviation to an acceptable level.

### Primary Operating Reserve (POR)

Primary Operating Reserve (POR) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) where the nadir occurs between 5 and 15 seconds after an Event.

### Secondary Operating Reserve (SOR)

Secondary Operating Reserve (SOR) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 15 to 90 seconds following an event.

### Tertiary Operating Reserve band 1 (TOR1)

Tertiary Operating Reserve (TOR1) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 90 seconds to 5 minutes following an event.

### Tertiary Operating Reserve band 1 (TOR2)

Tertiary Operating Reserve (TOR2) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 5 minutes to 20 minutes following an event.

# Assessment

The assessment methodology is in line with that used for Performance Monitoring, as set out in the latest version of the DS3 System Services Protocol, and the supplementary ‘Note to customers who are contracted to provide FFR (DS3 System Service Contract)’, which gave further detail on the FFR assessment methodology.

# Results

## Summary

Testing was completed on [DATE].

*[Insert 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.]*

*[Any abnormal behaviour during the test (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 shall also be presented.]*

*[The unit shall show how their base load on the day of testing correlates to their registered capacity using their ambient correction curves.]*

## FFR, POR, SOR, TOR1 Results

The following table shows the test results, using assessment methodology and pass criteria in line with the latest DS3 System Services Protocol.

These tables will be repeated for each test condition – *i.e.* if the test was carried out at different load points. All tests carried out for the purpose of data poor scalar reset shall be presented and assessed. *i.e.* any failed tests shall not be omitted.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test Condition: *e.g.* 75% of Registered Capacity | | | | |
|  | **Achieved Volume** | **Available Volume** | **Contracted Volume** | **Result (pass/fail)** |
| **FFR** | See table below | See table below |  |  |
| **POR** |  |  |  |  |
| **SOR** |  |  |  |  |
| **TOR1** |  |  |  |  |
| **TOR2** |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Unit Parameters (FFR)** | | |
| Pre-Event Output |  | MW |
| Contracted FFR |  | MW |
| Available Headroom |  | MW |
| FFR Response Time |  | Sec |
| Frequency Trigger |  | Hz |
| Trajectory |  | Hz |

|  |  |
| --- | --- |
| **Unit Performance (FFR)** | |
| Initial FFR Expected within Response Time |  |
| Max FFR Achieved within Response Time |  |
| % Initial FFR Achieved within Response Time |  |
| % Time FFR Achieved & Sustained to 10 sec |  |
| Energy Provided > Recovered | **Yes / No** |
| FFR Performance Assessment | **Pass / Partial Pass / Fail** |

## Graphs of results

[*Insert full plots of the results demonstrating the frequency response of the unit for each load setpoint. Graphs shall be clear and highlight all relevant values and time periods, including levels. All Graphs shall be clearly labelled and easy to read.*]

*[Graph shall be a time series plot with Power and Frequency on the y axis and time on the x axis.]*

*[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/>

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