Synchronous Inertial Response (SIR) Report

Unit Name

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# Document Version History

Revision 3.0 published 12th November 2019

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| --- | --- | --- | --- | --- |
| **Version** | **Date** | **Comment** | **Name** | **Company** |
| 0.1 | Insert Date | Minor version (v0.1) submitted 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 template version as published on the EirGrid and SONI websites[[1]](#footnote-2).

Sections (highlighted in yellow) shall be completed in full and supported, as applicable, by an Original Equipment Manufacturer (OEM) data sheet. This supporting documentation, including diagrams and graphs, shall use legible formatting, highlighting the applicable values included within this document.

All queries in relation to this document shall be submitted to generator\_testing@eirgrid.com or  generator\_testing@soni.ltd.uk .10 Business Days shall be allowed for EirGrid and SONI review.

Submission of this document is required if a Unit does not have an existing SIR contract or is proposing to make changes or updates to any of the affected parameters.

# Abbreviations

SIR Synchronous Inertial Response

SIRF Synchronous Inertial Response Factor

MW Mega Watt

MEC Maximum Export Capacity

kV kilovolt

Hz Hertz

OEM Original Equipment Manufacturer

# Unit DATA

|  |  |
| --- | --- |
| Unit name | Name\_\_\_\_\_\_\_\_ |
| Unit connection point | HV bushings of T101 in XX 110kV station |
| Unit connection voltage | \_\_\_\_\_\_\_\_\_\_kV |
| Unit Fuel Type(s)  | Primary:\_\_\_\_\_\_Secondary:\_\_\_\_\_\_\_\_\_ |
| Registered Capacity | \_\_\_\_\_\_\_MW |
| Contracted MEC | \_\_\_\_\_\_\_MW |
| Installed Plant  | Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_MW\_\_\_\_\_\_\_MVA |
| Minimum Generation (exported MW) | \_\_\_\_\_\_\_ MW |
| House Load  | \_\_\_\_\_\_\_MW |

# Synchronous Inertial Response

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.

## Definition

Synchronous Inertial Response (SIR) is the Kinetic Energy of a Centrally Dispatched Synchronous unit multiplied by the SIR Factor (SIRF).



SIRF is the ratio of the kinetic energy (at nominal frequency) to the unit’s minimum generation level (in exported MW):

$$SIRF= \frac{Stored Kinetic Energy (MWs^{2})}{Minimum Generation (MW)}$$

Where:

Stored Kinetic energy = H (Inertial constant) x MVA rating of the machine.

For an SIR providing unit that can provide Reactive Power Control while operating as a Synchronous Compensator or Synchronous Motor, the SIRF is set at 45 seconds.

## Calculation of the H constant

A key component of these calculations is the inertial constant of the unit, H. This is calculated using the following:

$$H= \frac{j x (2 x π x f)^{2}}{(2 x S\_{n} x 10^{6})}$$

Where:

j = Moment of inertia of the full train

f = Nominal system frequency (50Hz)

Sn = MVA rating of the machine

# SIR Variables and Characteristics

Mode: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (e.g. open cycle etc.)

OEM documentation supporting the following values shall be included within this report. The unit shall include a dynamic model and a generator data sheet along with this report.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Description** | **Unit** | **Value** |
| **H constant calculation** |
| **j** | Moment of inertia of the full train of the unit. | Kgm2 | Unit to specify |
| **Sn**  | MVA Rating of the unit | MVA | Unit to specify |
| **H constant** | Used to calculate the stored kinetic energy of the unit | N/A | Unit to specify |
| **SIRF Calculation** |
| **Stored Kinetic Energy** | The energy stored in the unit due to its motion | MWs2 | Unit to specify |
| **Minimum Generation** | The minimum MW Output which a Generating Unit can generate continuously, registered with the TSO under SDC1 as a Technical Parameter.  | MW | Unit to specify |
| **SIRF** | Ratio of the kinetic energy (at nominal frequency) to the lowest sustainable MW output the unit can operate at while providing reactive power control | Seconds | Unit to specify |

The unit shall add or delete additional tables, as required, for each additional mode.

Mode: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (e.g. combined cycle etc.)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Description** | **Unit** | **Value** |
| **H constant calculation** |
| **j** | Moment of inertia of the full train of the unit. | Kgm2 | Unit to specify |
| **Sn**  | MVA Rating of the unit | MVA | Unit to specify |
| **H constant** | Used to calculate the stored kinetic energy of the unit | N/A | Unit to specify |
| **SIRF Calculation** |
| **Stored Kinetic Energy** | The energy stored in the unit due to its motion | MWs2 | Unit to specify |
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| **SIRF** | Ratio of the kinetic energy (at nominal frequency) to the lowest sustainable MW output the unit can operate at while providing reactive power control | Seconds | Unit to specify |

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