

DS3 System Services Compliance and Testing Capability Management Guidance Document

6 July 2020

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1 SYSTEM SERVICE CAPABILITY MANAGEMENT

The compliance testing process builds on the learnings from the qualification trials process, implements the protocol requirements and ensures that unit evidence is gathered effectively in a safe, secure manner

For a unit to receive a contract to provide System Services they are required to demonstrate evidence of their capabilities in line with TSO requirements. This can be achieved through the compliance and testing processes in advance of contracting.

Existing service providers who wish to contract for enhanced capabilities must engage in changing operating characteristics and demonstrate enhanced capabilities.

System Service requirements are in addition to the standard Grid Code and are outlined through the System Service Documentation.

Further information on System Services testing and compliance requirements is available online¹.

2 DS3 SYSTEM SERVICES PROTOCOL

This DS3 System Services Protocol document is supplementary to the DS3 System Services Agreement. It provides information on Operational Requirements and Performance Monitoring requirements that need to be satisfied by Service Providers and their respective Providing Units as part of the DS3 System Services contractual arrangements. It is one of two supplementary documents referenced in the main Agreement. The most up to date version of the DS3 System Services Protocol document can be found on the EirGrid and SONI websites²

3 DS3 PERFORMANCE MEASUREMENT DEVICE STANDARDS FOR FAST ACTING SERVICES

The latest document setting out the minimum standards and compliance requirements for performance monitoring of DS3 System Services through the use of third party measurement devices i.e. devices not owned and operated by the TSOs, can be found on the EirGrid and SONI websites³. The minimum standards vary depending on both the nature and characteristics of each system service and additional requirements may apply to certain technology classes.

If the TSO has Monitoring Equipment that meets the minimum standards installed at the Service Provider's location then data from this may be used for the purpose of performance assessment of Fast Acting Services for a maximum period of 24 months from contract execution. After this

¹ <http://www.eirgridgroup.com/customer-and-industry/general-customer-information/grid-code-compliance-test/compliance-testing/system-services-testing/index.xml>

² <http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/ds3-consultations-and-pub/index.xml>

<http://www.soni.ltd.uk/media/documents/DS3-System-Services-Protocol-Regulated-Arrangements-v2.0.pdf>

³ <http://www.soni.ltd.uk/library/index.xml>; <http://www.eirgridgroup.com/library/>

time the Service Provider must have installed its own Monitoring Equipment, unless otherwise agreed by the TSO.

The DS3 System Services Protocol details the process to be followed in relation to submission of data by the Service Provider for the purposes of Performance Monitoring.

4 COMPLIANCE DOCUMENTATION

Different technology types will have to complete specific test procedures and test reports to show compliance for the relevant System Service. The most up-to-date DS3 System Services Compliance Procedures and Reports can be found on the EirGrid and SONI websites⁴

5 DS3 SYSTEM SERVICE PRODUCT OVERVIEW

Table 1 below contains a list of the DS3 System Services and a brief description.

Service Name	Abbreviation	Unit of Payment	Short Description
Synchronous Inertial Response	SIR	MWs ² h	(Stored kinetic energy)*(SIR Factor – 15)
Fast Frequency Response	FFR	MWh	MW delivered between 2 and 10 seconds
Primary Operating Reserve	POR	MWh	MW delivered between 5 and 15 seconds
Secondary Operating Reserve	SOR	MWh	MW delivered between 15 to 90 seconds
Tertiary Operating Reserve 1	TOR1	MWh	MW delivered between 90 seconds to 5 minutes
Tertiary Operating Reserve 2	TOR2	MWh	MW delivered between 5 minutes to 20 minutes
Replacement Reserve – Synchronised	RRS	MWh	MW delivered between 20 minutes to 1 hour
Replacement Reserve – Desynchronised	RRD	MWh	MW delivered between 20 minutes to 1 hour
Ramping Margin 1	RM1	MWh	The increased MW output that can be delivered with a good degree of certainty for the given time horizon.
Ramping Margin 3	RM3	MWh	
Ramping Margin 8	RM8	MWh	
Fast Post Fault Active Power Recovery	FPFAPR	MWh	Active power (MW) >90% within 250 ms of voltage >90%
Steady State Reactive Power	SSRP	Mvarh	(Mvar capability)*(% of capacity that Mvar capability is achievable)
Dynamic Reactive Response	DRR	MWh	MVAR capability during large (>30%) voltage dips

Table 1: List of DS3 System Services

⁴ <http://www.eirgridgroup.com/customer-and-industry/general-customer-information/grid-code-compliance-test/compliance-testing/system-services-testing/index.xml>

6 LIST OF PROVEN TECHNOLOGIES

Table 2 below provides a snapshot of the current proven technologies. This may be expanded upon in time based on the outcome of the Qualification Trial Process and will be updated accordingly on the EirGrid and SONI websites in the DS3 library⁵.

For each DS3 System Service, the "Proven List" sets out the technologies which the TSOs consider to be proven at this time for procurement purposes. The designation of a technology as "proven" does not entitle any individual service provider to a DS3 System Services contract. Each individual service provider must pass the compliance assessment and meet all service provision standards in terms of performance. Also, while a technology may be considered proven for multiple services, this does not mean that it can provide all of these services at the same time. Some services can only be provided in certain operational modes. Finally, for some types of service provider (e.g. windfarms, pumped hydro), the ability of the service provider is dependent on the underlying technology used.

Proven Technology List															
Type of Service Provider	Sub-technology (fuel / operational specific)	FFR	POR	SOR	TOR1	TOR2	RR (S)	RRD	RM1	RM3	RM8	SSRP	DRR	SIR	FPFAPR
Thermal/Hydro - Centrally Dispatched Generating Unit - CDGU	Coal	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Combined Cycle Gas Turbine - CCGT	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Open Cycle Gas Turbine - OCGT	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Distillate Oil	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Peat	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Anaerobic Digester / Waste to Energy	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Combined Heat and Power	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Biomass	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Hydro		x	x	x	x	x	x	x	x	x	x	x	x	x
Wind Power - WFPS	Wind Farm	x	x	x	x								x	x	x
Storage	Solid State Batteries e.g. Lithium Ion	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Flywheels (Non-Synchronous)	x	x	x	x										
	Pumped Hydro	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Compressed Air Energy Storage	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Synchronous Compensator	Synchronous Compensator	x	x	x	x	x	x	x	x	x	x	x	x	x	
HVDC Interconnector	Direct Current – Voltage Source Converters - VSC	x	x	x	x	x							x	x	x
	Direct Current – Line Commutated Converter LCC	x	x	x	x	x									
Aggregated Service Providers	Aggregated Generation Units (fossil-fuel based) - AGU	x	x	x	x	x	x	x	x	x	x				
	Industrial Demand Side Units (demand response) - DSU	x	x	x	x	x	x	x	x	x	x				
	Residential Demand Side Mangement (demand response) - RDSM														
Solar Power	Solar Photovoltaic														
	Solar Thermal														
	Concentrated Solar														
Ocean Energy	Tidal														
	Wave														
															Legend
															x Proven
															Not Proven

Table 2: Current Proven Technologies

⁵ <http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/ds3-consultations-and-pub/index.xml>

7 COMPLIANCE EVIDENCE

7.1 New Units

The Unit shall complete the compliance testing process for the applicable technology and DS3 System Service product. The Unit shall use the appropriate contact details in Section 12 to initiate the process.

7.2 Existing Units

Compliance and Performance Data already compiled from Grid Code and Distribution Code Operation and testing may be used for the development of the appropriate system service test report. In cases where existing compliance and performance data is used, the technical requirements set out in the test report will still need to be met.

7.3 Performance Scalars

The process for completing a performance test to address a poor performance scalar is set out in the DS3 System Services Protocol Document, which can be found on the EirGrid and SONI websites⁶.

Upon completion of a performance test process a Providing Unit's Performance Scalar may be reset to 1. This award will only be allocated once all the necessary work has been completed and any subsequent reports are provided to and approved by the testing teams within EirGrid and SONI.

8 CHARACTERISTIC CHANGES

All Users are obliged to inform the TSO of any changes to the technical capabilities, flexibilities or limitations of their Unit due to ageing of plant or apparatus.

Before any modification to a Unit takes place the User must inform the TSO.

A Load profile request form shall be submitted for any testing or changes to Unit characteristics or software upgrades.

Modifications which are made without informing the TSO which alter the technical capabilities, flexibilities or limitations of the Unit either positively or negatively with respect to the requirements of the Grid Code may result in the withdrawal of a valid Operational Certificate or Operational Readiness Confirmation.

Changes to the operating characteristics shall be assessed with the compliance and testing matrix (Phase A,B,C,D) for that technology type and be categorised major or minor depending on the level of works required. A detailed scope of works for the changes applied to the unit is required to appropriately assess the level of compliance and testing required. Templates for the various technology types can be found on the EirGrid and SONI websites⁷

⁶ <http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/ds3-consultations-and-pub/index.xml>

⁷ <http://www.eirgridgroup.com/library/index.xml>

Compliance and testing changes will involve a subset of tests from some of the initial testing phases (A, B, C or D).

- Phase A testing covers the period of testing up until the initial energisation and the issuing of an energisation operational certificate.
- Phase B covers the testing the unit up until the declaration of fitness of the unit and its 1st synchronisation.
- Phase C covers the period of testing up until the issuing an operational certificate for the unit. This phase covers the bulk of the grid code testing and the units' reliability run.
- Phase D covers system service testing for a unit.

9 SYSTEM SERVICES SIGNALS AND CONTROLS

9.1 Signalling Requirements

Signal lists templates⁸ including new system service signals are available for the following unit types.

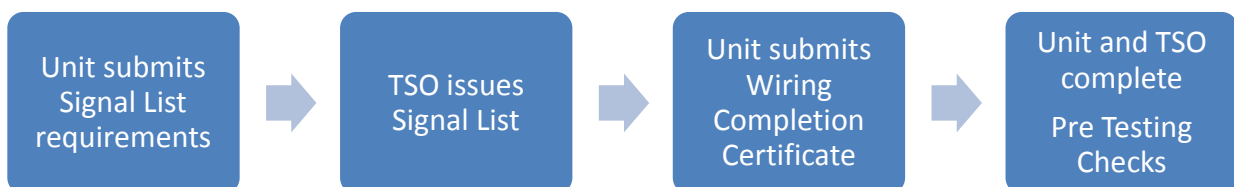
1. Generic System Service requirements.
2. WFPS Units.
3. DSUs.
4. Batteries.
5. Interconnectors.

9.2 Signal List Updates

Units intending to provide system services requiring new signals shall inform EirGrid or SONI as applicable, outlining the intention to upgrade the existing signal lists and existing communication infrastructures i.e. Remote Terminal Unit (RTU).

A minimum of 20BD shall be allowed to develop, review and issue the signal list requirements to units.

The process of the signalling commissioning process is outlined below.



A wiring completion certificate confirming signals are hardwired to the interface boundary is required in advance of provision of system services.

In the event that a wiring certificate has been received and Pre Testing checks cannot be completed for TSO reasons, the Unit shall agree an alternative process for submissions of real and performance monitoring information.

⁸ All signals lists are available here: <http://www.eirgridgroup.com/customer-and-industry/general-customer-information/grid-code-compliance-test/compliance-testing/system-services-testing/index.xml>

10 TEST SCHEDULING, EXECUTION AND PREQUALIFICATION

10.1 Test Scheduling

Depending on the technology categorisation e.g. Power Park Module, Conventional or DSU, there is a specific testing protocol and specific template forms that are required to be completed prior to testing. These can be found on the EirGrid and SONI websites⁹

Further details on the general testing process can be found in the Unit Testing Business Process on the SEMO website¹⁰.

10.2 Execution

On the day of testing the unit operator will ensure that there are suitably qualified personnel available on site to assist with the testing. They should be able to perform the following tasks:

1. Set up and disconnect the control system and instrumentation as required;
2. Ability to fully understand the Unit's function and its relationship to the System;
3. Liaise with NCC, CHCC as required;
4. Mitigate issues arising during the test and report on system incidents.

It will be up to the NCC, CHCC personnel if the testing conditions are appropriate for testing on the day, if testing should go ahead and what tests are to be performed on the day. Directly after testing has been completed, EirGrid, SONI and the customer will review the test procedure filled out during the test, make any additions and comments needed and then both parties shall sign-off on the test procedure. Copies of this will be sent to the compliance and testing team.

10.3 Prequalification

The following process and timelines have been updated and clarified in order to comply with articles 155, 159 and 162 of the EU regulation 2017/1485 establishing a guideline on electricity transmission system operation (SOGL)¹¹. This aligns the prequalification process for the relevant DS3 system services with those specified in the aforementioned articles.

These services are mapped in Table 3.

⁹ <http://www.eirgridgroup.com/customer-and-industry/general-customer-information/grid-code-compliance-test/compliance-testing/index.xml>

¹⁰ <https://www.sem-o.com/publications/tso-responsibilities/>

¹¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R1485&from=EN>

Existing DS3 System Service	EU Regulation Transmission System Operator Guideline Equivalent
POR (5-15sec) SOR (15-90sec)	Frequency Containment Reserve (FCR)
TOR1 (90sec-5min) TOR2 (5-20min)	Frequency Restoration Reserve (FRR)
RRS (20min-1hr) RRS (standard Grid Code Test is 20min-4hrs) RRD (20min-1hr) RRD (standard Grid Code Test is 20min-4hrs)	Replacement Reserve (RR)

Table 3: Mapping table of existing DS3 System Services and their naming convention under EU regulation 2017/1485

As part of the pre-qualification process for any of the services referred to in Table 3, the following steps and timelines shall apply:

1. A test report shall be written by the unit operator and submitted to the compliance and testing team 10 Business Days (BD) following completion of the test.
2. Within 10 BD from receipt of the test report, the reserve connecting TSO shall confirm whether the test report is complete.
3. If the test report is incomplete the TSO will request the required information from the unit operator.
4. The unit operator should submit the required information to the TSO within 10 BD. No more than 4 weeks will be allowed for the test report to be completed if a number of iterative submissions of information are required. Please note the TSOs conduct periodic procurement gates to allow for new units to contract for the provision of services and for existing units to amend their contracted service provision. Specific milestones apply to each gate, including milestones relating to testing. Units whose prequalification for services does not meet a particular gate's milestones may tender for services at a subsequent gate.
5. The TSO will evaluate the test report and respond to the unit operator within 10 BD with confirmation of whether the test report has been approved or not.

11 PRODUCT COMPLIANCE INFORMATION

11.1 Synchronous Inertial Response (SIR)

11.1.1 Minimum Generation Testing

Generator units seeking to increase their SIR payments may wish to alter their minimum generation levels. The following testing schedule may be required for any unit changing their minimum generation levels. The testing schedule is subject to agreement with the TSO.

1. Provision of Studies and updated Model
 - a. Rate of Change of Frequency Study
 - b. Fault Ride Through Study
2. Declarations of Fitness
3. Ramp Rates tests
4. Updates to Registered Data and TOD

11.1.2 Minimum Load Testing

Generator units seeking greater SIR payments may also wish to alter minimum load levels. As a result the following Grid Code compliance testing schedule is applied for minimum load changes. The testing schedule is subject to agreement with the TSO.

1. Provision of Studies and updated Model
 - a. Rate of Change of Frequency study for new min load.
 - b. Fault Ride Through study (updated report required if the new minimum load)
2. Declarations of Fitness
3. Operating Reserve
4. Min Load
5. Ramp Rates
6. Time from synch to Min Load
7. Unit stability at max leading/lagging at min load. The leading Mvar requirement reduces for a lower min load, while the capability of the unit increases.
8. Update Registered Data and TOD

Load Level	Frequency Injection (for 5min)	POR (5-15sec) Requirement	SOR (15-90sec) Requirement	TOR1 (90-300sec) Requirement	Estimated response with a 4 % droop
Min load	-0.2Hz (Step)	5%	5%	8%	+10%
Min load	+0.2Hz (Step)	N/A	N/A	5min stable and stop test	-10%
Min load	-0.5Hz (1Hz/sec)	N/A	N/A	5min stable and stop test	+25%

Table 4: SIR compliance and testing parameters

Note: Positive frequency injection testing shall be completed at minimum load. While there is no specification of required response below min load, ability to govern around min load is strongly preferable for system operation.

11.2 FFR, POR, SOR & TOR1

11.2.1 Synchronous Machines, Interconnectors and WFPS

Testing is carried out using frequency injections to the appropriate control system. For conventional units, FFR can run in conjunction with SIR so providers that can maintain or increase their outputs within the timeframes are eligible for both services.

Unit Characteristic changes may involve additional assessment in the following areas:

1. Operating reserves
2. Demonstration of ramp rates
3. Droop
4. Deadband
5. Registered characteristics
6. WFPS Frequency response test procedure

11.2.2 DSU Aggregators

For DSU Aggregators providing reserve services, an application form shall be submitted. The DSU shall be registered within SEM and have completed compliance testing. The DSU application form has been updated with additional information for System Services and is available on the EirGrid and SONI websites¹².

The DSO shall assess if system services can be provided for the individual demand sites.

Individual Demand Sites providing services, shall be registered with a capacity and service to the same DSU and may, where the IDS is providing services only, have a capacity registered as 0MW. IDSs shall not provide services to multiple DSUs.

11.2.3 Energy Storage Units

The applicable test procedures and reports for this technology type including Batteries can be found on the System Services Compliance page on the EirGrid and SONI websites¹².

11.3 TOR2, RM1, RM3, RM8

Ramping margin and replacement reserve values are evaluated using existing (and verified) TOD and Registered Characteristics data submitted to EirGrid, SONI.

If the customer wishes to contract for a different value than this, additional testing and verification is required as normal for validation of proposed new TOD values.

For DSUs the registered characteristics are listed within the operational certificates.

Note: In the case of prequalification, TOR1, TOR2 (referred to as FRR in EU regulations) and RR, the TSOs shall have the right to exclude groups providing these services based on technical arguments such as the geographical distribution of the power generating modules or demand units belonging to such a service providing group to ensure operational security, as per articles 159 and 162 of EU regulation 2017/1485¹³.

¹² <http://www.eirgridgroup.com/customer-and-industry/general-customer-information/grid-code-compliance-test/compliance-testing/system-services-testing/index.xml>

¹³ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R1485&from=EN>

11.4 Steady State Reactive Power

Characteristic changes to increase SSRP may result in the following tests

1. Reactive power capability
2. Demonstration of Over Excitation and Under Excitation limiters
3. Registered Characteristics
4. WFPS Reactive power capability test procedure
5. WFPS Reactive power control test procedure

11.5 Nodal Controller

For the most up to date detail on Nodal Controller projects being developed by both ESB Networks and NIE Networks, along with any associated compliance and testing documentation, please refer to the respective websites www.esbnetworks.ie/ and www.nienetworks.co.uk.

12 PROCUREMENT GATES AND CONTACT DETAILS

Periodic procurement gates allow for new Units to contract for the provision of services and for existing Units to amend their contracted service provision. Tenders are published in the Official Journal of the European Union (OJEU¹⁴). Information relating to tenders is also made available on the EirGrid and SONI websites¹⁵.

Units seeking to make changes to their characteristics and contract values shall contact the TSO using the relevant contact details:

12.1 Compliance and Testing Contact Details

The role of the compliance and testing team is to ensure that all the contracted values for a unit are verified through approved testing and performance data. The team coordinates testing with the NCC and CHCC. They also review and approve test procedures, data and reports, schedule 9 contract parameters and recommend derogations or operational certificates as appropriate.

The compliance and testing team can be contacted using the following details as appropriate:

- Generator_testing@eirgrid.com
- Generator_testing@soni.ltd.uk
- DSU@Eirgrid.com

12.2 Contracts and Settlement Contact Details

Units seeking information on existing contracted capability may contact the Contracts and Settlement team at CAS@eirgrid.com or CAS@SONI.ltd.uk.

¹⁴ <https://www.ojeu.eu/>

¹⁵ <http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/ds3-consultations-and-pub/index.xml>