Test plan of Elia

Summary	This document includes a proposal for a test plan developed by ELIA in accordance with the criteria specified in Regulation (EU) 2017/2196, the provisions of the Federal Technical Regulation and the Code of Conduct. On April 29, 2021, the Minister of Energy last approved the test plan by ministerial decree. The Ministerial Decree provides that Elia will submit to the Minister an amended version of the test plan within 6 months of the approval of the defense plan and the restoration plan. This document was subject to a public consultation from May 21 to June 21, 2024 and was then submitted to the Minister for approval on July 19, 2024. On 4 February 2025, the FPS Economy formally contacted Elia to inform it of its request for adaptation, following the comments made in the CREG's opinion on the proposed test plan of 19 July 2024. Elia responded with an amended proposal as submitted on 4 April 2025. The Minister approved the test plan as set out in the Ministerial Order of 18 June 2025.	
Version	2.1	
Date	04-04-2025	
Status	☐ Draft	☒ Final version approved by energy minister

Previous versions

Version	Date	Author	Summary of Changes
1.0	22-11-2019	ELIA	Comments from the Ministerial Decree of 15/04/2020, the CREG opinion of 11/03/2020 and the comments of various stakeholders.
1.1	30-10-2020	ELIA	Small adaptations following comments from AD Energie
2.0	19-07-2024	ELIA	Update of the test plan following the new version of the network defense plan and the restoration plan.

Related documents

System Defense Plan
Restoration Plan
General conditions to act as Provider of Restoration Services.

Content

1 Introduction

This document contains the Test Plan which defines the equipment and suitability to be tested relevant to the System Defense Plan and Restoration Plan.

The Test Plan has been prepared by ELIA taking into account the requirements of European Commission Regulation (EU) 2017/2196 of November 24, 2017 establishing a grid code for the emergency and restoration of the electricity grid (NC ER) and taking into account other relevant legislation:

- The Royal Decree of 29 November 2024 establishing a technical regulation for the operation of the electricity transmission system (hereinafter "the Federal Technical Regulation", referred to by the acronym FTR)
- Regulation (EU) 2016/631 establishing a network code on requirements for grid connection of electricity generation installations (NC RfG)
- Regulation (EU) 2016/1388 establishing a network code on the connection of distribution systems and demand installations (NC DCC)
- Regulation (EU) 2016/1447 establishing a network code on the requirements for grid connection of high-voltage direct current systems and non-synchronous direct current generator parks (NC HVDC)
- The Code of Conduct adopted by the CREG by Decision (B) 2409 of 20 October 2022, and as amended from time to time, laying down the conditions for connection to and access to the transmission system and the methods for calculating or determining the conditions for the provision of ancillary services and access to cross-border infrastructure, including the procedures for the allocation of capacity and the management of congestion.

In accordance with Article 74-77 of the Code of Conduct, ELIA has ensured, during the development of this test plan, that:

- the tests do not endanger the operational safety of the transmission system and the interconnected transmission system;
- the tests have minimal impact on system users

In accordance with Articles 4(2), 4(3) and 43(2) of the NC ER as well as Article 259 of the previous version of the Federal Technical Regulations, ELIA submitted a first version of the test plan to the Minister of Energy for approval on 22 November 2019.

The Minister approved the test plan by the Ministerial Order of 29 April 2021 in accordance with Article 259 of the RTF at the time. The Minister is asking ELIA to submit a new proposal for a test plan within six months of the approval of the system defense plan and the restoration plan. The latest versions of the system defense plan and the restoration plan were approved by the Minister on 25 January 2024. A new test plan must therefore be submitted to the Minister by July 25, 2024.

In accordance with Article 7 of the NC ER, Elia submitted the adapted proposal of its test plan for public consultation over a period of one month from 15 May 2024 to 15 June 2024.

In its adapted proposal, ELIA has taken into account CREG's opinion (A)2221 of 1 April 2021 on the proposal for an adapted test plan as well as the comments received during the public consultation. This proposal was submitted to the Minister of Energy for approval on July 19, 2024. On 4 February 2025, the FPS Economy formally contacted Elia to inform it of its request for adaptation, following the comments made in the CREG's opinion on the proposed test plan of 19 July 2024. Elia responded with an amended proposal as submitted on 4 April 2025.

The test plan refers to the system defense plan and the restoration plan drawn up by ELIA in accordance with the NC ER and the Federal Technical Regulation and approved by the Minister of Energy.

The Minister of Energy has approved the test plan as indicated in the Ministerial Decree of 18 June 2025 approving the proposal for the test plan in accordance with Article 29, §1 of the Royal Decree of 29 November 2024 establishing a technical regulation for the operation of the electricity transmission system. The Minister shall require the system operator to submit a revision of the test plan to the Minister for approval within six months of the approval of the system defense plan and the restoration plan.

2 Legal framework

The proposed test plan shall be drafted by Elia in accordance with Article 43 of the NC ER. This proposal is developed in consultation with the following stakeholders:

- Public Distribution System Operators (DSOs) during the dedicated working groups of the CE12, SOS Security of Supply, within Synergrid,
- Significant Grid Users (SGUs) identified in the System Defense Plan and in the Restoration Plan and Restoration Service Providers (RSPs) in specific consultations with Working Group members (WGSO & EMD[1]) as a subgroup of ELIA's user groups.

The current protection plan does not include any measures for defense service providers (DSPs) providing a response to demand. As a result, the test plan also does not provide for test conditions for equipment and capabilities under a defense services regime.

In accordance with Article 43(2) of the NC ER, the test plan shall identify the equipment and capabilities relevant to the network defense plan and the restoration plan to be tested.

In accordance with Article 43(3) of the NC ER, the test plan shall indicate the periodicity and conditions of the tests and shall follow the minimum requirements[2] set out in Articles 44 to 47 of the NC ER.

The test plan shall also take into account the requirements set out in the following provisions:

- Articles 48 and 49 of the NC ER;
- Articles 15(5)(a), 15(5)(c), 41(2), 45(5) et 45(6) du NC RfG ;
- Articles 37(2), 37(3), 69(1), 69(2), 70(1) et 71(11) du NC HVDC ;
- Articles 19(1), 19(2), 35(2), 37(4), 37(6), 39(5) et 41(1) du NC DCC.

The test plan follows the methodology set out in the NC RfG, the NC HVDC and the NC DCC for the corresponding capacity under test. However, for SGUs that are not yet required to comply with these codes under the applicable rules, in accordance with Article 36 of the RTF, the NC ER stipulates that the test plan must follow the provisions of national legislation. Without prejudice to the provisions relating to the definition of periodicity provided for in the Nc ER Article 43(3), the conditions for conformity testing of the capacities of electricity generating units (Article 44), of demand generation facilities providing a demand response service (Article 45), of the capacities of HVDC installations (Article 46) and of low-frequency load disconnection relays (Article 47), Elia defines the periodicity and conditions of the other relevant equipment and capabilities in the context of the defense and/or restoration plan that must be tested. In the absence of methodologies for testing equipment or capability defined in the NC RFG, NC HVDC, Nc DCC or national legislation, Elia shall define this methodology in the test plan in accordance with Articles 43(1) and 43(2) of the NC ER which stipulate that each TSO shall periodically assess the proper functioning of all equipment and capabilities considered in the framework of the system defense plan and/or the Restoration plan. In accordance with Articles 74-75 of the Code of Conduct, ELIA consulted the network users concerned in order to define the procedures, the schedule and the means to be used to carry out these tests with the network users concerned.

[1] WGSO & EMD : Working Group System Operation & European Market Design
[2] As the defence plan does not contain measures for defence service providers that provide demand response services, Article 45 of the CN RE is not applicable to that test plan.

For the equipment and capabilities included in the system defense plan and/or the restoration plan that are also used regularly in normal condition, Elia may assess their compliance on the basis of tests and simulations carried out as part of the process of connecting the installation to the transmission system as mentioned in Article 60§2 of the Code of Conduct on the basis of correct operation in normal condition, for properties that do not depend on the state of the system.

Neither the system defense plan nor the restoration plan provides for ELIA to impose measures that would exceed the capabilities of the SGUs identified in accordance with Articles 11(4) and 23(4) of the NC ER.

In accordance with Article 43(1) of the NC ER, Elia may re-check compliance at regular intervals, for example after a defect, modification or replacement of equipment that may affect the compliance of the installation with the requirements of the Federal Technical Regulation.

ELIA shall endeavor to strike a balance between, on the one hand, the certainty it wishes to obtain as to the proper functioning of the equipment or installations which are used in the context of the defense and/or restoration plan and the resources to be made available by the owner or operator of the installation and the system operator for preparation, the conduct and reporting of each test.

Therefore, no additional tests shall be specified for equipment and capabilities regularly used in the normal state, as the properties of such equipment or capability do not depend on the condition of the system.

Some equipment and capabilities relevant to the system defense plan and the restoration plan, which are necessary to support the grid in extreme states, are tested during the connection process. During these tests, the system cannot necessarily be placed in the same extreme states in which the equipment and functionalities concerned should be tested. In this case, reasonable efforts should be made to get as close as possible to the predicted extreme states of the grid.

In the case of installations offering black start services, the methodology defined in the NC RfG for new installations does not contain any additional aspects compared to the requirements that arise directly from Article III.4.1 of the standard contract for restoration services.

In the absence of a methodology in the national legislation for the conformity testing of low-frequency load disconnection relays, ELIA defines, in this test plan, the periodicity and test conditions of existing installations that are not subject to Article 37(6) and Article 39(5) of the NC DCC. In accordance with Article 75 of the Code of Conduct, ELIA has concluded an agreement with the users of the network concerned, after consultation on the procedure for carrying out the tests of disconnection relays for the interruption of consumers in the event of low frequency. This agreement has been formalized in the collaboration agreement established between ELIA and the public DSOs.

The terms and conditions for transmission-connected demand facilities and DSOs are defined in this test plan[3].

[3] This will be specified in Article 8.2.2 of the standard connection contract as publicly consulted from 20 December 2023 to 16 February 2024.

On the basis of a proposal made by ELIA and after consulting the CREG, the Minister of Energy approves or refuses the test plan, in accordance with Article 29 of the Federal Technical Regulations.

In the event of any inconsistency between the test plan and the NC ER or any other regulations, the latter shall prevail.

3 Summary table of equipment and capabilities tested

In accordance with Article 43(2) of the NC ER, the following table identifies the complete list of existing and new equipment and capabilities relevant to the Network Defense Plan and the Restoration Plan, which are included in the Test Plan, with reference to the corresponding test frequency (which applies to the extent that the test is successful; indeed, In the event of a test failure, a new test must be performed in the short term, as specified in this test plan) as well as a reference to the test conditions.

Equipment and capabilities relevant to the Network Defense Plan and the Restoration Plan to be tested	As part of the Network Defense Plan or the Restoration Plan or general obligation of the NC ER	Who does the test	Who bears the costs of a successful test[4]	Periodicity of tests	Remarks
Black-Start Provider Group to which the RSP Contract Applies or Black-Start Restoration Site	Restoration Plan	Elia + RSP	Elia	3 years	The conditions of the tests are listed in section 4.2
SGUs identified in accordance with Article 11(4) of the NC ER that do not fall under the NC RfG, the NC HVDC or the NC DCC (existing installations)	Defense plan	SGU	Elia	Only once during the connection process	For installations which, at the request of ELIA, need to activate defense or restoration measures without a contractual basis, the capacities were tested during the connection process. ELIA will not impose any defensive or restoration measures exceeding the capacity of the installation(s) specified in the connection contract, as mentioned in paragraph 8.
SGUs identified in accordance with section 23(4) of the NC ER that do not fall under the NC RfG, the NC HVDC or the NC DCC (existing installations)	Restoration Plan	SGU	Elia		
The SGUs identified in accordance with Article 11(4) of the NC ER that fall under the NC RfG, the NC HVDC or the NC DCC (new installations)	Defense plan	SGU	Elia	Only once during the connection process	For installations which, at the request of ELIA, are required to activate defense or restoration measures without a contractual basis, the capacities have been tested during the connection process as described in the NC RfG, the NC HVDC or the NC DCC. ELIA will not impose any defensive or restoration measures exceeding the capacity of the installation(s) specified in the connection contract, as mentioned in paragraph 8.
SGUs identified in accordance with Article 23(4) of the NC ER that fall under the NC RfG, the NC HVDC or the NC DCC (new installations)	Restoration Plan	SGU	Elia		
Installations for the decoupling of demand implemented on installations of TSOs, public DSOs, transmission system-coupled demand facilities or CDSOs	Defense plan	Elia, DSO, CDSO and/or network user	Elia, DSO	Once when the installation is	The conditions of the tests are set out in paragraphs 7 and 8

[4] The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Conduct. The tests are therefore carried out at the expense of the transmission system user (referred to in the table as RSP, SGU, CDSO or system user) whose equipment and capabilities are to be tested, as described later in this test plan. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs of the transmission system user.
If tests are to be carried out by Elia, other TSOs, DSOs or Coreso, those entities will bear the costs of testing their equipment and capacities, as also specified in this test plan. For the costs incurred by Elia in connection with these tests, reference is also made to Article 77 of the Code of Good Conduct.

				commissioned for the disconnection of the consumption AND in accordance with §7.4.1 and §8.4.1.	
Communication systems, as defined in Article 41 of the NC ER, ELIA, RSPs, public DSOs, DSOs and SGUs identified in the Restoration Plan	General obligation under Article 48(1) of the NC ER	Elia, RSP, GRD, CDSO and SGU	Elia, DSO	1 year	The test conditions are listed in paragraph 10.1
Emergency power supply to the communication systems of ELIA, RSPs, public DSOs, DSOs and SGUs identified in the Restoration Plan	General obligation under Article 48(2) of the NC ER	Elia, RSP, GRD, CDSO and SGU	Elia, DSO	5 years	The test conditions are listed in paragraph 10.2
Inter-TSO communication systems	General obligation under Article 48(3) of the NC ER	Elia and other TSOs	Elia and other TSOs	1 year	The conditions of the test are listed in paragraph 10.4
Communication systems between ELIA and Coreso	General obligation under Article 49(2) of the NC ER	Elijah + Coreso	Elijah + Coreso	3 years	The test conditions are listed in paragraph 10.1
Système de notification Emergency ELIA, Blackout ELIA, Grid Restoration ELIA	Network defense plan and restoration plan	Elia, network users, stakeholders	Elia	1 year	The conditions of the tests are set out in paragraph 10.3
Main and backup power sources for ELIA's main and backup control centers, as stipulated in section 42(3) of the NC ER	General obligation under Article 49(2) of the NC ER	Elia	Elia	1 year	The test conditions are listed in paragraph 11.1
Provision of primary and emergency ELIA data with positions considered essential for the procedures of the Plan of Restoration	General obligation under Article 49(2) of the NC ER	Elia	Elia	3 years	The test conditions are listed in paragraph 10.1
ELIA's backup power sources that provide essential services to positions considered essential for the procedures of the Restoration Plan	General obligation under Article 49(3) of the NC ER	Elia	Elia	5 years	The conditions of the tests are set out in paragraph 11.2
ELIA transfer procedure to move the main control centre to the emergency centre	General obligation under Article 49(4) of the NC ER	Elia	Elia	1 year	The conditions of the tests are set out in paragraph 11.3
U-5% signal	Network defense plan	Elia + DSO	Elia + DSO	5 years	The conditions of the tests are set out in paragraph 12

Synchrocoupleur	Restoration Plan	Elia	Elia	Daily operation	The conditions of the tests are set out in paragraph 3
The restricted setting mode for under- and over-frequency of type C and D generation plants	Network defense plan	Elia + grid user	Elia	At least every 10 years or after significant changes	The conditions of the tests are listed in section 4.2
The restricted setting mode for sub- and over-frequency of HVDC systems that connect different synchronous areas.	Network defense plan	Elia + grid user	Elia	At least every 10 years or after significant changes	The conditions of the tests are listed in section 6.1

Table 1: Summaries of the equipment and capacities to be tested

At the request of the CREG, Elia communicates the results of the previous year's tests.

4 Compliance testing of power generating modules capabilities

4.1 Introduction

Each Restoration Service Provider (RSP) must test its Power Generating Units (PGM) to ensure that they can provide the specified restoration service(s). According to Article 44 of the NC ER, a Test Plan must be prepared for the following services provided by an RSP:

- Black-Start service
- Quick resynchronization service. This service is not included in the System Defense Plan or Restoration Plan (for now). Consequently, there is no corresponding test described in this document. If this service does need to be contracted in the future, a description of this test will be included in the test plan after consultation with the relevant (candidate) providers of this Restoration service and submitted to the Minister for approval after public consultation.

The following capabilities are also used in the System Defense Plan and/or in the Restoration Plan:

- LFSM-U (only for the production units covered by the NC RFG)
- LFSM-O (only for the production units covered by the NC RFG)
- Changing the target value of active power
- Providing additional voltage support by adjusting reactive power
- Frequency control in the case of Restoration

However, these capacities are not contracted by ELIA under the System Defense Plan and/or the Restoration Plan. The modalities of testing with respect to capacities provided by SGUs but not contracted by ELIA are set forth in Section 9.

Other requirements regarding the capacities of production units in the normal or alarm state are outside the scope of this Test Plan, as they fall outside the requirements determined by Art 43.2 of the NC ER

4.2 Service Black Start

4.2.1 Introduction

This section shall apply both to RSP contracts for delivery over the period 2024-2026 and for the period from 2027 onwards, unless explicitly stated otherwise and shall remain without prejudice to the obligations of RSP contracts. The RSP contracts for delivery from 2027 onwards include the concept of the "Black-start Supplier Group" which replaces the concept of the "Black-start Restoration Site" present in the RSP contracts for the period 2024-2026. Both concepts should be understood as such in this test plan.

Each Restoration Service Provider (RSP) that has a Black-Start Supplier Group and to which the RSP contract applies or that has a Black-Start Restoration Site shall perform a Black Start Capability Test at least every three years, taking into account the minimum requirements set out in Article 44(1) of the NC ER and Article 45(5) of the NC RfG.

As specified in section 45(5) of the NC RfG, the purpose of the Black Start capability test is to demonstrate the technical ability to start without an external power supply while the unit is stationary.

However, since the ultimate goal of a Black Start service is to re-energize a de-energized busbar, accept an active and reactive power load, and resynchronize the separate grid with the other part of the transmission grid to assist in grid restoration, ELIA requires Black-Start Supplier Groups or Black-Start Restoration Sites to demonstrate all of these aspects.

4.2.2 Periodicity of the test

In accordance with Article 44 of the NC ER, a Black Start capability test must take place at least every three years.

4.2.3 Description of the test

The test of Black-Start capabilities can take any of the following forms:

- **Test 0:** Black Start Inspection (the RSP contract refers to the Black-Start Inspection Test) which consists of:
    - A Black-Start Inspection test and submission to ELIA representatives of the "Black-out" and "Black Start" procedures that PGM operators must perform;
    - An explanation to ELIA by the RSP operators of these procedures;
    - A demonstration of the operation of the "Black Start" auxiliary installations (auxiliary diesel generators, compressors, auxiliary boilers, etc.).
- **Test 1**: Starting and reconnecting:
    - The PGM is shut down and then restarted according to the period defined in the paragraph "Provision of the Black-Start Service" of the RSP Contract (in the RSP contract for the delivery period from 01/01/2027: "Conditions for black-start supplier groups").
    - The PGM's auxiliary systems are powered by an independent power source, such as a diesel generator, in accordance with the PGM's "Black Start" procedure.
    - The PGM is then connected to the transmission grid that is already energized.
- **Test 2**:
    - The PGM's supporting systems are powered by an independent energy source.
    - The PGM shall demonstrate the ability to restore voltage to a transmission system main busbar with zero voltage. The PGM shall be able to regulate the voltage on the main busbar at the reference values 0.9 p.u., 1 p.u. (voltage base p.u.: rated voltage of the main busbar of the transmission system).
- **Test 3**:
    - In addition to the performance required in Test 2, the PGM must demonstrate the exchange of reactive power with the transmission system when the TSO switches inductive or capacitive elements to the system in islanding mode. The TSO may request to demonstrate reactive power

exchanges up to the limits specified in the paragraph "Conditions for BS Restoration Sites" of the RSP Contract (in the RSP contract for the delivery period from 01/01/2027: "Conditions for black-start supplier groups").

- **Test 4**:
    - In addition to the performance required in Test 3, the PGM will demonstrate its ability to inject active power into the separate grid, when the TSO reconnects active load (MW) blocks. The TSO may request to demonstrate active power exchanges up to the limits specified in the paragraph:
        - III.3.3 (5) in the RSP contract for the 2024-2026 delivery period
        - III.3.5 Tab 3 in the RSP contract for the 2027-2029/2038 delivery period.

By default, ELIA will require the completion of a Black Start 4 capability test. However, if due to special circumstances (e.g. unavailable test load, possible negative impact on the transmission system), test 4 cannot be carried out, ELIA may, in consultation with the RSP, decide to carry out another test among those described in this article.

Apart from the triennial periodic test, ELIA reserves the right to require the RSP to perform the above-mentioned tests on an interim basis, if ELIA deems it necessary.

ELIA will justify and communicate to the RSP the reason for an interim test.

4.2.4 Passing Criteria

The test of Black-Start capabilities is considered successful when it meets the conditions determined by ELIA according to Article 43(5) of the NC ER.

4.2.5 Organization and preparation of the test

ELIA and the RSP shall prepare the test according to the minimum requirements set forth in Article 44.1 of the NC ER, except for the unscheduled tests set forth in Section 0 of this Test Plan.

The RSP and ELIA shall take all measures to minimize the commercial impact of implementing a planned test of Black-Start capabilities for both parties.

The date of testing of the Black-Start Capabilities (Test Date) shall be decided jointly by ELIA and the RSP. The Test Date must be chosen in a period beginning three months before the Reference Date and ending three months after the Reference Date. The Reference Date is the date furthest in the future between:

- the date of the previous Black Start capacity test on the same Black-Start Supplier Group or Black-Start Restoration Site plus thirty-three months.
- the date of the most recent pre-qualification test (as provided for in the relevant RSP contract) plus thirty-three months (*de facto* applicable only to RSP contracts for the delivery period from 1/1/2027).

If ELIA and the RSP fail to reach an agreement on the test date within 30 calendar days of the start of the consultations, ELIA will unilaterally impose the test date unless the RSP can demonstrate that this would seriously damage its assets and that other equally effective test periods are possible.

Article 4(8) of the NC ER applies to complaints and dispute resolution.

The Black Start capability test shall be conducted in accordance with-the RSP "Black Out" and "Black Start" procedures and the relevant ELIA procedures.

The RSP will provide ELIA with the following documents prior to the conduct of each Black Start capability test or at the request of ELIA:

- The "Black-out" procedure;
- The "Black Start" procedure;
- The complete single-line diagram of the installations.

ELIA has the right to attend the Black Start Ability Test. To this end, the RSP will ensure that ELIA has access to the buildings of the Black-Start Supplier Group or the Black-Start Restoration Site.

If the test of the Black-Start capabilities fails, ELIA undertakes to cooperate, where possible, in organizing a new test of the Black-Start capabilities, within two months of receiving the RSP's request.

4.2.6 Unscheduled test

Without prejudice to the preceding paragraphs, and in order to verify that the Black-Start Supplier Group or the Black-Start Restoration Site is actually capable of providing the Black Start service, ELIA shall be authorized to conduct a Black Start Capability Test as described in paragraph 4.2.3 of this test plan without prior warning or consultation with the RSP.

ELIA may only perform this type of unscheduled test if the Black-Start Supplier Group or the Black-Start Restoration Site is available (based on the definition of unavailability in Article II.4.6 of the RSP Agreement), if its production schedule is at zero (based on the nominations sent by the Service Provider) and if it does not participate in the provision of other reserves at that time. ELIA will be authorized to perform such tests at least once per Black-Start Supplier Group or Black-start Restoration Site during the term of the RSP contract.

4.2.7 Test Reports

ELIA, assisted by the RSP, shall prepare a report of each completed test.

The RSP will make available to ELIA all test reports and important information related to ongoing or past internal tests carried out on the Black-Start Supplier Group or Black-Start Restoration Site.

4.2.8 Initial Test for a New Black-Start Supplier Group or Black-Start Restoration Site

For any Black-Start Supplier Group or Black-Start Restoration Site not covered by a Black Start Service Agreement in the year prior to the year in which the RSP Agreement was entered into, or which has not passed a test in the preceding three years, a Black Start Capability Test shall be passed as soon as possible before the end of the first year of the RSP Agreement.

4.2.9 Costs of conducting the test

The costs of the tests will be borne in accordance with the provisions of Article 76 of the Code of Good Conduct and the relevant provisions and annexes of the RSP contract. Testing is therefore carried out at the expense of the RSP, whose equipment and capabilities must be tested. If the result of these tests shows that the operation is compliant, Elia will

reimburse the costs of the RSP, with the exception of the Black-Start inspection tests. This is because no specific compensation is provided for Black-Start inspection tests.

4.3 Limited frequency sensitive mode for over and under frequency

4.3.1 Introduction

Type A, B, C and D generating facilities that must comply with the NC RFG must have the limited frequency sensitive mode for over-frequency.

This is an operating mode that allows a reduction in active power injection in reaction to a variation in the system's frequency beyond a certain value.

Type C and D manufacturing facilities that must comply with the NC RFG must have the limited frequency sensitive mode for under-frequency.

This is an operating mode that allows an increase in active power injection in reaction to a change in the system frequency below a certain value.

ELIA's System Defense Plan includes measures that invoke the limited frequency sensitive mode for over- and under-frequency of Type C and D generation facilities that must comply with the NC RFG. However, Type A and B production facilities are not included in the test plan due to their limited impact on the system, as outlined in section 4.1 of the System Defense Plan.

Since the proper operation of this mode is an important measure to prevent further frequency disruption in an emergency state, and since this mode is not used in normal operation, a test of this mode of operation will be carried out not only during the connection process but also periodically throughout the life of the generating installation.

4.3.2 Periodicity of the test

A test shall be carried out at least every 10 years, or when the installation undergoes a significant modification, or if ELIA can prove, on the basis of measurements, that the LFSM O/U does not operate in accordance with the parameters provided for in the connection contract.

4.3.3 Description of the test

The production unit is connected to the transmission grid, distribution grid, closed distribution grid or relevant grid during the test.

A dead band of 200 mHz around the normal mains frequency is set on the power-frequency control of the production plant.

An artificially composed alternative frequency signal is injected at the input of the power-frequency controller of the generation plant (further referred to as "the injected frequency"), where normally the actual grid frequency is made available to the controller.

LFSM-O test:

The injected active power of the generation unit is set at 100% of the maximum value or the maximum available active power for generation units operating on renewable energy (such as wind farms, for example), at the normal grid frequency.

An alternate frequency signal is then injected according to the profile shown in Figure 1:

Starting from a frequency of 50.0 Hz, a frequency step of +500 mHz is injected, maintained for 40 seconds, followed by a progressive decrease in frequency to 50.0 Hz over a period of 30 seconds.

Half a minute later, a frequency step of +1500 mHz is injected, maintained for 40 seconds, followed by a progressive decrease in frequency to 50.0 Hz over a period of 30 seconds.

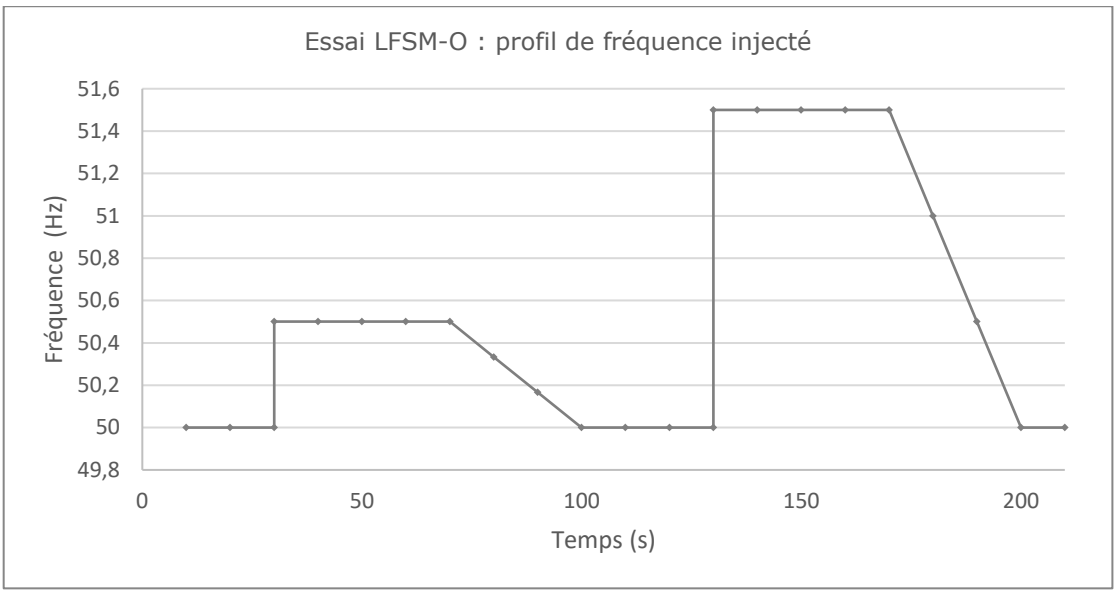

Figure 1: Profile of the injected frequency during an LFSM-O test

The measurement results will be listed (as illustrated in Table 2) and along with the measured values, presented in the form curves as a function of time will be included in the test report.

Scenario	Td [s]	Tsr [s]	Ts [s]	P max [MW]	P av [MW]	ΔP meas [MW]	ΔP exp [MW]
Jump to 50.5 Hz							
Jump to 51.5 Hz							

Table 2: Measurement results of an LFSM-O test

The parameters mentioned in the Table 2 are defined as follows:

- Dead time (**Td**): the time between sudden change in injected frequency until the active power of the production unit begins to change;
- Step response time (**Tsr**): the time between sudden change in injected frequency until the active power first reaches the tolerance limit, equal to 5% of the initial value of the active power;
- Setup time (**Ts**): the time between sudden change in injected frequency until the active power remains further within the tolerance limit, equal to 5% of the initial value of the active power.
- **P max**: the maximum active power the production unit can produce.

- **P av**: the available active power is the maximum active power made available by the driving energy source at the relevant time.
- **ΔP meas**: the difference between the measured final and initial values of active power at steady state.
- **ΔP exp**: the difference between the pre-calculated final and initial steady-state active power value.

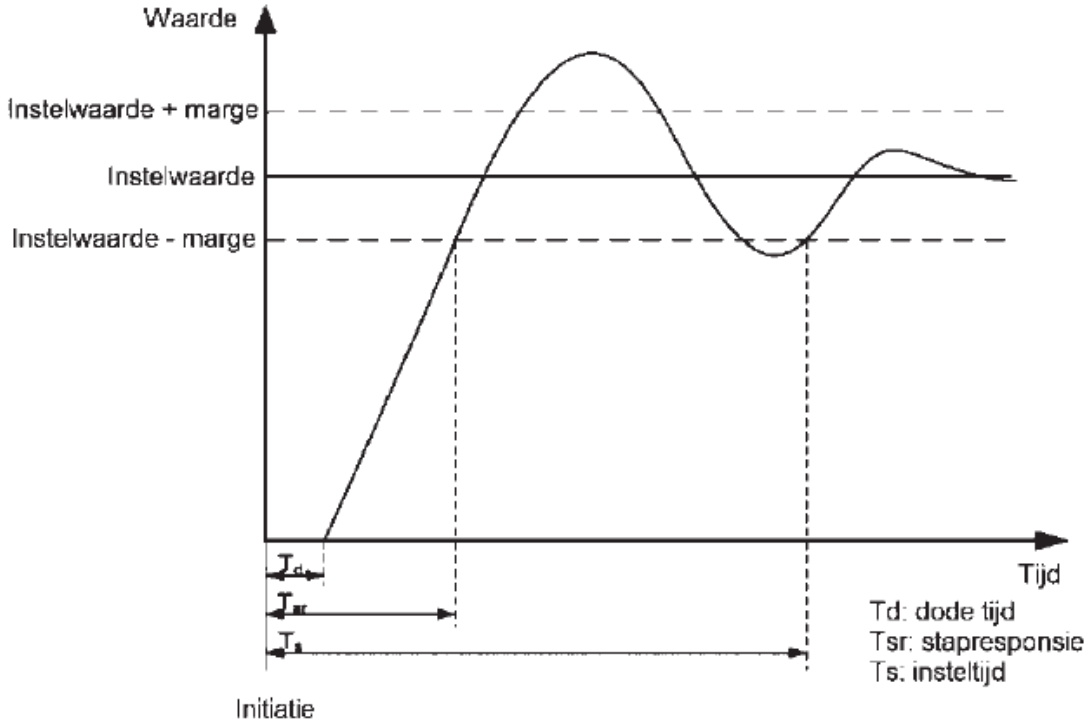

Figure 2: Example of an answer with an illustration of the parameters to be observed

LFSM-U test:

The injected active power of the production unit is set to an initial value that depends on the injected frequency profile as shown in the following formula:

$$P_{begin} = P_{max} - 100.\frac{|\Delta f| - |\Delta f1|}{fn}.\frac{Pref}{s[\%]}$$

Pmax: the maximum active power the production unit can produce.

Δf : the frequency step being injected

Δf1: 200 mHz, the insensitivity zone within which the LFSM-U operating mode is not active.

fn: 50 Hz, the normal mains frequency

s[%]: the set statiek: 5% or if otherwise specified in the connection contract, a value chosen between 2% and 12%

Pref: the maximum active power Pmax, which the generation unit can produce or the maximum available active power for generation units operating on renewable energy (such as wind farms, for example)

Example:

Suppose one wants to test a frequency step of -1500 mHz on a 400 MW production unit, one should set the injected active power of the production unit at the beginning of the test as follows:

$$P_{begin} = 400\ MW - 100.\frac{1500\ mHz - \ 200\ mHz}{50000\ mHz}.\frac{400\ MW}{5} = 400MW - 208MW = 192\ MW$$

An alternate frequency signal is then injected according to the profile shown in Figure 3:

Starting from a frequency of 50.0 Hz, a frequency step of -500 mHz is injected, maintained for 40 seconds, followed by a progressive increase in frequency to 50.0 Hz over a period of 30 seconds.

Half a minute later, a frequency step of -1500 mHz is injected, maintained for 40 seconds, followed by a progressive increase in frequency to 50.0 Hz over a period of 30 seconds:

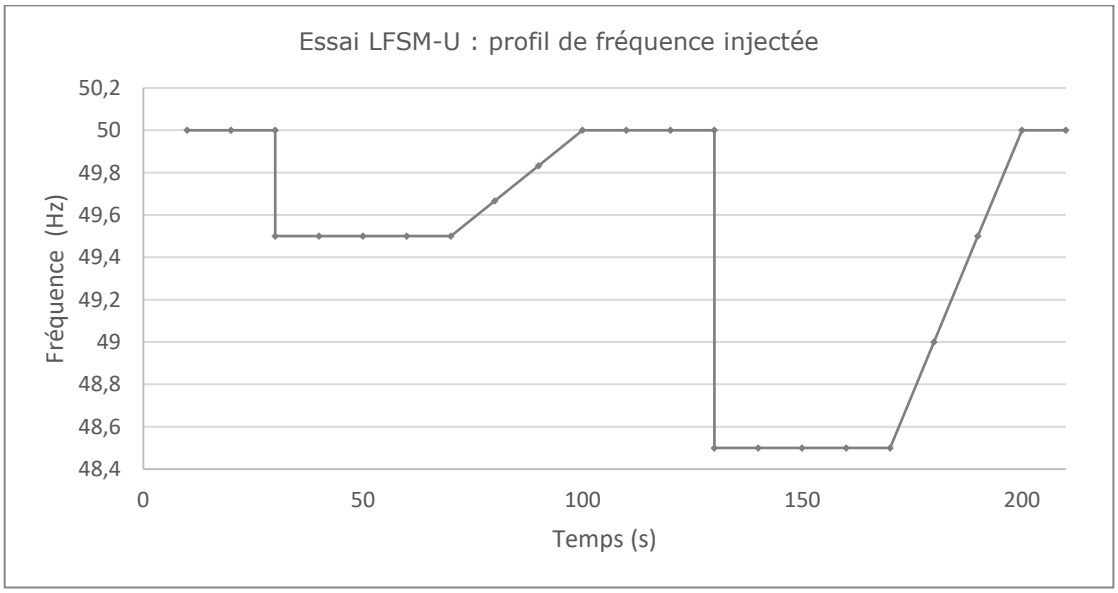

Figure 3: Frequency profile injected during an LFSM-U test

The measurement results will be listed (as illustrated in Table 2) and along with the measured values presented in the form curves as a function of time will be included in the test report.

4.3.4 Passing Criteria LFSM-O Test.

Without prejudice to the criteria mentioned in Article 88 §1 of the Federal Technical Regulations, the LFSM-O test is successful if it meets the following criteria:

- The injected power of the production unit at the connection point remains constant as long as the injected frequency is between 50.00 Hz and 50.20 Hz.
- As soon as the injected frequency rises above 50.20 Hz, the LFSM-O mode is automatically activated.
- As soon as the injected frequency increases further from 50.20 Hz to 51.00 Hz, the injected power of the production unit at the connection point decreases according to the statism specified in the connection contract (between 2% and 12%) or until the minimum control level of the production unit is reached.

- Once the minimum control level of the production unit is reached, the operating mode will be maintained at the same level (no further decrease in power with further frequency increase)
- The production unit is capable of stable operation in the LFSM-O operating mode.

4.3.5 Passing Criteria LFSM-U Test.

Without prejudice to the criteria mentioned in Article 88 §2 of the Federal Technical Regulations, the LFSM-U test is successful if it meets the following criteria:

- The injected power of the production unit at the connection point remains constant as long as the injected frequency is between 50.00 Hz and 49.80 Hz.
- As soon as the injected frequency falls below 49.80 Hz, the LFSM-U mode is automatically activated.
- As soon as the injected frequency decreases further from 49.80 Hz to 49.00 Hz, the injected power of the production unit at the connection point increases according to the statism specified in the connection contract (between 2% and 12%) or until the maximum control level of the production unit is reached.
- The production unit is capable of stable operation in LFSM-U operating mode.
- When LFSM-U is active, the LFSM-U reference value takes precedence over all other working power reference values.

4.3.6 Organization and preparation of the test

ELIA will inform the relevant system operator and the operator or owner of the generation unit sufficiently in advance to prepare the LFSM-O and LFSM-U tests according to the provisions of Article 4.3.3 of this Test Plan. These parties will take all measures to ensure safety during the execution of the planned tests and minimize the commercial impact for all parties.

The test date (Test Date) shall be decided jointly by ELIA, the relevant grid operator and the operator of the generating unit. If all parties do not agree on the Test Date within 30 calendar days from the start of consultation, ELIA unilaterally imposes a Test Date, unless the relevant grid operator or the operator of the generation unit can prove that this would seriously damage its assets and that other and equally effective test periods are possible.

Article 4, paragraph 8 of the NC ER applies in case of complaints and dispute resolution.

ELIA has the right to attend the LFSM-O/U test. To this end, the operator of the generation unit and, if necessary, the relevant system operator shall guarantee that ELIA has access to the generation unit.

If the LFSM-O/U test fails, ELIA, the operator of the generation unit and the relevant system operator undertake to cooperate, where possible, in the organization of a new LFSM-O/U test, within two months of the failed test.

4.3.7 Test Report

The operator of the generation unit, assisted by ELIA and the relevant system operator, shall prepare a report of each completed test.

The test report contains the measurements of the injected fr equence, the active power at the output of the generation unit and the active power injected by the generation unit at the connection point (provided by ELIA), with a sufficiently high resolution.

4.3.8 Costs of conducting the test

The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Good Conduct. The tests are therefore carried out at the expense of the operator of the production unit, whose equipment and capacities are to be tested. If the result of these tests shows that the operation is compliant, Elia reimburses the costs to the operator of the production unit.

5 Compliance testing of demand facilities

As part of the System Defense Plan and the Restoration Plan, ELIA may require demand facilities to implement the instructions contained in the System Defense Plan or the Restoration Plan.

However, these instructions cover capacities not necessarily contracted by ELIA under the System Defense Plan or the Restoration Plan. The modalities of testing with respect to capacities provided by SGUs and not contracted by ELIA are set forth in Section 9.

Notwithstanding that Article 43(3) of the NCER provides that the test plan shall establish the test frequency and conditions in accordance with the compliance testing of demand facilities providing demand response services described in Article 45, they are not included in this test plan, as the System Defense Plan does not include measures implemented by defense service providers providing demand response services.

If these defense services would be contracted in the future, a prior description of this test will be included in the test plan after consultation with the relevant (prospective) providers of these defense services and submitted to the Minister for approval after public consultation.

6 Compliance testing of HVDC installations

Under the System Defense Plan and Restoration Plan, ELIA may require the HVDC facilities to carry out certain instructions contained in the System Defense Plan or Restoration Plan.

However, these instructions cover capacities not contracted by ELIA under the System Defense Plan or Restoration Plan.

The modalities of testing with respect to capacities provided by SGUs and not contracted by ELIA are set forth in Section 9.

6.1 Limited frequency sensitive mode for over and under frequency

6.1.1 Introduction

Since the correct operation of the frequency-sensitive over- and under-frequency mode is an important measure to prevent the grid frequency from further derailing in the emergency state, and since this mode is not used during normal operation, this mode of operation will be tested not only during the connection process, but also periodically during the lifetime of the HVDC installation.

For installations that connect two different synchronous zones[5], a test of the limited frequency sensitive mode for over and under frequency will be performed.

6.1.2 Periodicity of the test

At least every 10 years or when the installation is substantially changed or if ELIA can prove on the basis of measurements that the LFSM O/U is not functioning correctly in accordance with the settings indicated in the connection contract.

6.1.3 Description of the test

During the test, the HVDC plant is connected at both ends to the corresponding transmission grids belonging to two different synchronous zones.

A dead band of 200 mHz around the normal grid frequency is set on the power-frequency control of the HVDC plant on the Belgian side.

An artificially composed alternative frequency signal is injected at the input of the power-frequency control of the HVDC plant on the Belgian side (further referred to as "the injected frequency"), where normally the actual grid frequency is made available to the controller.

LFSM-O test in import mode (if applicable on the installation):

The active power injected by the HVDC plant on the Belgian side is set at 100% of the maximum value, at the normal grid frequency.

An alternative frequency signal is then injected according to the profile shown in Figure 1 in § 4.3.3.

The measurement results will be listed (as illustrated in Table 2) and along with the measured values presented in the form curves as a function of time will be included in the test report.

[5] For HVDC installations that belong to the same synchronous zone, the LFSM O/U is not applicable

LFSM-O test in export mode (if applicable on the installation):

The active power extracted by the HVDC plant on the Belgian side is set to an initial value that depends on the injected frequency profile as shown in the following formula, whose parameters are defined in §4.3.3:

$$P_{begin} = P_{max} - 100.\frac{|\Delta f| - |\Delta f1|}{fn}.\frac{Pref}{s[\%]}$$

Example: for an HVDC plant with a maximum power of 1000 MW, the initial value of active power should be set as follows, for a test using a frequency step of 1500 mHz:

$$P_{begin} = 1000\ MW - 100.\frac{1500\ mHz - 200\ mHz}{50000\ mHz}.\frac{1000\ MW}{5} = 1000MW - 520MW = 480\ MW$$

An alternative frequency signal is then injected according to the profile shown in Figure 1 in § 4.3.3.

The measurement results will be listed (as illustrated in Table 2) and along with the measured values presented in the form curves as a function of time will be included in the test report.

LFSM-U test in import mode (if applicable on the installation):

The active power injected by the HVDC plant on the Belgian side is set to an initial value that depends on the injected frequency profile as shown in the following formula, whose parameters are defined in §4.2.3:

$$P_{begin} = P_{max} - 100.\frac{|\Delta f| - |\Delta f1|}{fn}.\frac{Pref}{s[\%]}$$

An alternative frequency signal is then injected according to the profile shown in Figure 3 in § 4.3.3.

The measurement results will be listed (as illustrated in Table 2) and along with the measured values presented in the form curves as a function of time will be included in the test report.

LFSM-U test in export mode (if applicable on the installation):

The active power extracted by the HVDC plant on the Belgian side is set to 100% of the maximum value, at the normal grid frequency.

An alternative frequency signal is then injected according to the profile shown in Figure 3 in § 4.3.3.

The measurement results will be listed (as illustrated in Table 2) and along with the measured values presented in the form curves as a function of time will be included in the test report.

6.1.4 Passing criteria LFSM-O test in import mode

Without prejudice to the criteria mentioned in Article 102 § 5 of the Federal Technical Regulations, the LFSM-O test in import mode is successful if it satisfies the following criteria:

- The injected power of the HVDC system at the connection point remains constant as long as the injected frequency is between 50.00 Hz and 50.20 Hz.
- As soon as the injected frequency rises above 50.20 Hz, the LFSM-O mode is automatically activated. The initial delay of the power-frequency response does not exceed 2 seconds.
- As soon as the injected frequency increases further from 50.20 Hz to 51.00 Hz, the injected power of the HVDC plant at the connection point decreases according to the statism specified in the connection contract (between 2% and 12%) or until 0 MW is reached.
- The HVDC plant is capable of stable operation in the LFSM-O operating mode.
- When LFSM-O is active, the LFSM-O reference value takes precedence over all other working power reference values.

6.1.5 Passing criteria LFSM-O test in export mode.

Without prejudice to the criteria mentioned in Article 102 § 5 of the Federal Technical Regulations, the LFSM-O test in export mode is successful if it meets the following criteria:

- The active power extracted from the ELIA grid by the HVDC plant at the connection point remains constant as long as the injected frequency is between 50.00 Hz and 50.20 Hz.
- As soon as the injected frequency rises above 50.20 Hz, the LFSM-O mode is automatically activated. The initial delay of the power-frequency response does not exceed 2 seconds.
- As soon as the injected frequency increases further from 50.20 Hz to 51.00 Hz, active power withdrawn from the ELIA grid by the HVDC plant at the connection point increases according to the statism specified in the connection contract (between 2% and 12%) or until the maximum control level of the HVDC plant is reached.
- The HVDC plant is capable of stable operation in the LFSM-O operating mode.
- When LFSM-O is active, the LFSM-O reference value takes precedence over all other working power reference values.

6.1.6 Passing criteria LFSM-U test in import mode.

Without prejudice to the criteria mentioned in Article 102 § 5 of the Federal Technical Regulations, the LFSM-U test in import mode is successful if it satisfies the following criteria:

- The injected power of the HVDC system at the connection point remains constant as long as the injected frequency is between 50.00 Hz and 49.80 Hz.
- As soon as the injected frequency falls below 49.80 Hz, the LFSM-U mode is automatically activated. The initial delay of the power-frequency response does not exceed 2 seconds.

- As soon as the injected frequency drops further from 49.80 Hz to 49.00 Hz, the injected power of the HVDC plant at the connection point increases according to the statism specified in the connection contract (between 2% and 12%) or until the maximum control level of the HVDC plant is reached.
- The HVDC plant is capable of stable operation in the LFSM-U operating mode.
- When LFSM-U is active, the LFSM-U reference value takes precedence over all other working power reference values.

6.1.7 Passing criteria LFSM-U test in export mode.

Without prejudice to the criteria mentioned in Article 102 § 5 of the Federal Technical Regulations, the LFSM-U test in export mode is successful if it satisfies the following criteria:

- The active power extracted from the ELIA grid by the HVDC plant at the connection point remains constant as long as the injected frequency is between 50.00 Hz and 49.80 Hz.
- As soon as the injected frequency falls below 49.80 Hz, the LFSM-U mode is automatically activated. The initial delay of the power-frequency response does not exceed 2 seconds.
- As soon as the injected frequency drops further from 49.80 Hz to 49.00 Hz, active power withdrawn from the ELIA grid by the HVDC plant at the connection point decreases according to the statism specified in the connection contract (between 2% and 12%) or until 0 MW is reached.
- The HVDC plant is capable of stable operation in the LFSM-U operating mode.
- When LFSM-U is active, the LFSM-U reference value takes precedence over all other working power reference values.

6.1.8 Organization and preparation of the test

ELIA, the relevant system operator of the transmission system to which the other end of the HVDC facility is connected and the operator of the HVDC facility shall prepare the test according to the provisions of Article 6.1 of this Test Plan, taking all measures to minimize the commercial impact of conducting a planned test for all parties.

The date on which the test will take place (Test Date) will be decided jointly by the three aforementioned parties.

ELIA shall have the right to attend the LFSM-O/U test. To this end, the operator of the HVDC facility warrants that ELIA has access to the HVDC facility.

If the LFSM-O/U test fails, three aforementioned parties undertake to cooperate, where possible, in organizing a new LFSM-O/U test, within two months of the failed test.

6.1.9 Test Report

The operator of the HVDC plant, assisted by ELIA and the relevant system operator of the transmission system to which the other end of the HVDC plant is connected, shall prepare a report of each completed test.

The test report contains the measurements of the injected frequency, the active power exchanged between the HVDC installation and the connection point with the transmission grid on the Belgian side, with a sufficiently high resolution.

6.1.10 Costs of conducting the test

The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Good Conduct. The tests are therefore carried out at the expense of the HVDC plant operator, whose equipment and capabilities are to be tested. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs to the HVDC installation operator.

7 Compliance testing of low-frequency demand deconnection (LFDD) via relays at DSOs

7.1 Introduction

This chapter contains the procedure for carrying out low-frequency demand disconnection tests in public distribution installations connected to the transmission system.

These tests aim to verify the proper functioning of the entire demand disconnection installation, in particular the LFDD relays that determine the frequency drop and the actions necessary to effectively interrupt the demand within the allotted time.

Elia and the public DSOs connected to the transmission system shall carry out low-frequency demand disconnection tests via the LFDD relays present in the installations of the above-mentioned entities in accordance with the minimum requirements defined in Articles 43 and 47 of the NC ER and according to the methodology defined in Article 37 §6 of the NC DCC.

In accordance with those articles, the test concerning the low frequency demand disconnection via relays must demonstrate that the transmission system connected distribution facility is technically capable of decoupling demand at low-frequency by a percentage of the demand specified by Elia in consultation with the concerned neighboring TSOs, to the extent that it is equipped for this purpose in accordance with Article 19 of the NC DCC. In the absence of a test methodology for low-frequency demand disconnection relays of "existing" demand facilities in national legislation, ELIA defines, in this test plan, the periodicity and test conditions of existing demand facilities that are not subject to Article 37(6) and Article 38(5) of the NC DCC. ELIA is authorised to do so in accordance with Articles 43(1) and 43(2) of the NC ER, which state that each TSO periodically assesses the proper functioning of **all equipment and capabilities** considered in the context of the defense plan and/or the restoration plan.

In accordance with Article 75 of the Code of Conduct, ELIA has, after consultation with the network concerned users, concluded an agreement on the procedure for carrying out the tests of low-frequency demand disconnection relays. This agreement has been formalised in the collaboration agreement (SOK) between ELIA and the public DSOs.

The tests shall demonstrate that the concerned LFDD relays comply with the technical requirements applicable to LFDD relays.

On the other hand, the tests must demonstrate that the successive actions between the time when the network frequency reaches the predetermined limit and the time when consumption is interrupted are correct and take place within the predetermined time.

7.2 Tests to evaluate the proper functioning of demand decoupling systems

The owner of LFDD relays provides two types of tests to assess the compliance of demand disconnection facilities with the above requirements. The tests are carried out on the demand disconnection installations of the existing and new installations of Elia and the public DSOs. :

1. A **qualification test**, which takes place before the LFDD relay is installed;
2. A **commissioning test**, which takes place at least when a new demand disconnection installation is commissioned;

Each Party shall bear the costs of its personnel and any other costs associated with carrying out the test on its facilities.

7.2.1 Costs of conducting the test

For the above-mentioned tests (also discussed below) carried out by Elia and the public DSOs, these entities bear the costs of testing their equipment and capacities. Each party therefore bears its own personnel costs and all other costs for carrying out the tests on its facilities.

7.3 Qualification test

Before a new type of LFDD relay is installed by the owner, it will be subjected to a qualification test. This qualification test allows Elia to assess the compliance of the LFDD relays with the specifications as mentioned by the supplier. The test will take place prior to the installation of the LFDD relays.

The following properties are tested:

- Measuring the accuracy of the frequency threshold
- Measurement of relay action time in the event of a sudden drop in frequency
- Measurement of the relay action time in the event of a frequency drop accompanied by different rates of change (slopes)
- Blocking of the frequency function at minimum voltage
- Checking the behavior of the relay in case of harmonics and TCC
- Checking the behavior of the relay in the event of a sudden vector jump
- Checking the behavior of the relay in the event of unbalanced voltage
- Checking the Relay Anti-Aliasing Filter
- Controlling the behavior of the relays in the event of power fluctuations
- Single-phase fault relay behaviour control with circuit breaker opening
- Checking the behavior of the relay when opening the last circuit breaker on a rail which is then de-energized
- Checking the Relay Behavior When Re-energizing a De-energized Rail
- Verification of relay behavior when discharging a cable on voltage transformers used for frequency measurement
- Checking the operation of the LEDs
- Checking the initialization time. This is the time required between the relay powering up and the relay generating a power-off order under fault conditions
- Checking the bounce reaction of the relay trip contacts, specifically, this is to check that the relay contacts are not opened and closed repeatedly in a short period of time before it finally comes to rest in an open or closed position
- Verification of the response of the action time in the event of the disappearance of one or two phase-to-ground voltages

7.4 Commissioning test (Site acceptance test SAT)

7.4.1 Modalities of a commissioning test

Before a new demand disconnection system is put into operation in an existing or new installation of a public DSO connected to the transmission system, a commissioning test must be carried out.

The parties concerned: Elia and the DSO, will inform and coordinate duly on the commissioning test schedule after the implementation of the new demand disconnection installation.

The commissioning test verifies the compliance of newly installed LFDD relays using a frequency drop test. During the commissioning test, the proper functioning of the entire demand disconnection installation shall be assessed and it shall be checked whether the maximum total operating time specified in point 7.4.3 is compliant. External frequency signals are injected by the LFDD relay owner onto the LFDD relay to verify that the trip command is correctly sent and received by the relevant circuit breakers within an acceptable operating time.

In the case of a **non-selective trip control** where the trip signal is transmitted by the LFDD relay owner to the MV circuit breaker, the response time check is as follows:

1) The measured response time shall be less than the total operating time specified in section 7.4.3. Response time refers to the operating time of the LFDD relay taking into account the measurement and calculation time of the relay as well as the operating time of the circuit breaker.
2) No rebound phenomenon was observed (repeated establishment and breakage of contact within a short period of a few seconds to achieve a given position, closed or open).

In the case of a **selective cut-off control** where the cut-off signal is transmitted by Elia to the DSO via the interface cabinet, the response time is checked in two steps:

1) Elia measures the time between the time when the injected frequency signal drops below the frequency threshold and the time when the signal arrives at the interface cabinet.
2) Measurement by the public DSO of the time between the time the signal is activated in the interface cabinet and the time the signal arrives at each relevant circuit breaker.

The arrival of the load cut-off signal is measured by the DSO at the terminals closest to the circuit breaker.

For remote disconnection, the signal transfer time between the frequency relay, the interface cabinet, and the terminals closest to the circuit breaker must also be considered.

Elia has established a test program for the end-to-end testing of the entire installation, to be carried out in close cooperation with the DSO. The tests to be carried out on clean equipment, without coordination, will be prepared and carried out by the entity concerned before the end-to-end test.

For tests on existing consumption facilities, Elia and the public DSO will take precautions to avoid **unwanted interruptions in consumption** during the test. If the circuit breaker(s)

cannot be opened during the test, the total outage time will be conservatively estimated by adding to the measured time the maximum time for the circuit breaker(s) to be opened according to the manufacturer's data.

For the testing of the new demand facilities, Elia and the public DSO will jointly decide to carry out the complete end-to-end test, including the circuit breaker test, before the new demand facility is actually put into operation.

Both Elia and the DSO will sign a test certificate confirming that the installation has been tested and whether or not the results meet the predefined specifications. A model test certificate is annexed to the SOK between Elia and the DSOs.

In the event of a change in the technical concept of automatic demand disconnection, the entity concerned must inform the other entity. A new commissioning test may be necessary and should be carried out in close cooperation with the other entity.

In the event of a significant change to the demand installation that has a significant impact on the demand disconnection installation, the network user shall inform Elia. In this case, Elia and the public DSO will decide whether a new commissioning test is necessary.

7.4.2 Criteria for Successful Commissioning Testing

At public DSOs, the method of disconnecting the demand is evolving:

1. In some substations, which are not yet equipped by the DSO to allow the selective disconnection of individual medium-voltage cables, the disconnection of demand shall be carried out **in a non-selective** manner. In this case, the entire substation is de-energized when a frequency drop occurs by interrupting the circuit breaker on the secondary side of the distribution transformer.
2. In substations equipped by the DSO to allow the **selective disconnection** of individual medium-voltage cables, the demand disconnection shall take place at the DSO feeders, where the DSO may set the individual feeders to be de-energised or not in the event of a frequency drop. In this way, the DSO can ensure that priority feeders or feed-only feeders are not cut off.
3. A limited number of substations are equipped with a system that allows consumption to be selectively disconnected **depending on the direction** in which the active power flows over an individual outlet, the so-called directionality. Therefore, it is only when the departure behaves like a consumer during a frequency drop that it is disconnected.

The commissioning test is considered successful if the following criteria are met, as stated on the test certificate:

- The data and setting values of the frequency relay are consistent between Elia's databases and reality.
- The Factory Acceptance Test report is available and validated by Elia.
- The cabling plans are up-to-date and available from Elia.
- A visual check of the identification plates, external wiring and earthing took place and no abnormal condition was found by Elia.
- A check of the voltage readings on the relay screen when 20-40-60 V was injected into the TP circuit was carried out by Elia.

- A separate inspection of all the cut-off circuits was carried out by Elia.
- Elia checked that the "malfunction alarm" on the relay's DCS and EMS were working properly.
- Elia has verified the correct functioning of the F1 and F2 trip thresholds of the frequency relay and the notification of the shutdown to F1 and F2 in the DCS and EMS.
- A check of the correct start-up of the BEN disruptograph was carried out by Elia.

In the case of selective **disconnection**, the shutdown command is transmitted by Elia via the interface cabinet to the network user and the control is carried out as follows:

- Elia measures the time (time A) between the time when the injected frequency signal drops below the F1 threshold and the time when the cut-off signal is detected in the interface cabinet.
- Measurement by the network user of the time (time B) between the time the signal is tripped in the interface cabinet and the time the signal arrives at each relevant circuit breaker.
- If the circuit breaker(s) cannot be opened during the test, the maximum opening time of the circuit breaker(s) will be observed (time C) according to the manufacturer's data.

The total trigger time is obtained by adding times A, B and C. This total tripping time shall not exceed the limit value specified in section 7.4.3.

In the case of a **non-selective disconnection**, the check is done as follows:

- Elia measures the time (time A) between the moment when the injected frequency signal falls below the F1 threshold and the moment when the signal arrives at each circuit breaker concerned.
- If the circuit breaker(s) cannot be opened during the test, the maximum opening time of the circuit breaker(s) will be observed (time C) according to the manufacturer's data.

The total trigger time is obtained by adding times A and B. This total tripping time shall not exceed the limit value specified in section 7.4.3.

A similar test is performed for the F2 frequency threshold.

It shall also be verified that the alarm signals associated with the operation of the LFDD can be correctly transmitted between Elia and the DSO.

7.4.3 Maximum operating times

Depending on the version of the applicable Nc DCC, different maximum deadlines must be met. Articles 3 and 4 of the NC DCC define the conditions for the applicability of the NC DCC to new and existing public distribution systems connected to the transmission system. The maximum operating times to be respected are as follows:

- For NC DCC v1.0, the maximum target total operating time, consisting of frequency relay response time, switch open time, and communication time, is 300 ms.

- For NC DCC v2.0, the maximum target total operating time, consisting of frequency relay response time, switch open time, and communication time, is 200 ms (to be confirmed).

7.4.4 Actions to be taken if the maximum allowable operating times are exceeded during the commissioning test

If it is found during the tests that the maximum permissible operating times are exceeded, the following measures should be taken:

If the total operating time determined exceeds one and a half times the permitted operating time, the load disconnection installation shall be rejected and shall not be put into operation. The entities concerned shall establish an action plan to comply within a reasonable period of time. In accordance with Article 43 (5) of the NC ER, the test shall be carried out again after making the necessary adjustments to comply with the limits.

If the total operating time determined is less than one and a half times the permitted operating time, the load disconnection installation will be put into operation. The entities concerned shall establish an action plan to comply within a reasonable period of time.

8 Compliance testing of low-frequency demand disconnection (LFDD) via relays in transmission-connected demand facilities and transmission-connected CDS

8.1 Introduction

This chapter contains the procedure for carrying out low-frequency demand disconnection tests in transmission-connected demand facilities and transmission-connected CDS. These tests are only applicable to demand installations connected to the transmission system and CDS connected to the transmission network where an LFDD relay is installed. These tests are not applicable to transmission-connected demand facilities and transmission-connected CDS that have chosen to be part of an LFDD group and do not have an LFDD relay connected to their facility.

These tests aim to verify the proper functioning of the entire demand disconnection installation, in particular the LFDD relays that determine the frequency drop and the actions necessary to effectively interrupt the demand within the allotted time.

Elia, the CDS connected to the transmission system and the demand facilities connected to the transmission system shall carry out low-frequency demand disconnection tests via the LFDD relays present in the installations of the above-mentioned entities in accordance with the minimum requirements defined in Articles 43 and 47 of the NC ER and according to the methodology defined in Article 37 §6 of the NC DCC.

In accordance with these articles, the test concerning the disconnection of demand at low frequency via relays must demonstrate that the transmission-connected demand facility and the transmission-connected CDS are technically capable of decoupling demand at low frequency by a percentage of the demand specified by Elia in consultation with the relevant neighbouring TSOs, insofar as it is equipped for this purpose in accordance with Article 19 of the NC DCC.

In the absence of a test methodology for low-frequency demand disconnection relays of "existing" demand facilities in national legislation, ELIA defines, in this test plan, the periodicity and test conditions of existing demand facilities that are not subject to Article 37(6) and Article 39(5) of the NC DCC.

ELIA is authorised to do so in accordance with Articles 43(1) and 43(2) of the NC ER, which state that each TSO periodically assesses the proper functioning of **all equipment and capabilities** considered in the context of the defense plan and/or the restoration plan.

In accordance with Article 75 of the Code of Conduct, ELIA has, after consultation with the network users concerned, concluded an agreement on the procedure for carrying out the tests of low-frequency load disconnection relays. The terms and conditions for transmission-connected demand facilities and CDS are defined in this test plan[6].

The tests shall demonstrate that the concerned LFDD relays comply with the technical requirements applicable to LFDD relays.

On the other hand, the tests must demonstrate that the successive actions between the time when the network frequency reaches the predetermined limit and the time when consumption is interrupted are correct and take place within the predetermined time.

8.2 Tests to evaluate the proper functioning of load decoupling systems

The owner of LFDD relays provides two types of tests to assess the compliance of load decoupling facilities with the above requirements. The tests are carried out on the demand disconnection facilities of Elia's existing and new installations and the consumption facilities connected to the transmission system and CDS connected to the transmission system:

1. A **qualification test**, which takes place before the LFDD relay is installed;
2. A **commissioning test**, which takes place at least when a new demand disconnection installation is commissioned;

Each Party shall bear the costs of its personnel and any other costs associated with carrying out the test on its facilities.

8.2.1 Costs of conducting the test

The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Good Conduct. The tests are therefore carried out at the expense of the transmission system user (transmission consumption facilities or transmission network connected RFDs) whose equipment and capacities must be tested. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs of the transmission system user.

For the tests carried out by Elia on its own facilities, Elia covers the costs of these tests during which its equipment and capacities are tested.

8.3 Qualification test

Before a new type of LFDD relay is installed by the owner, it will be subjected to a qualification test. This qualification test allows Elia to assess the compliance of the LFDD

[6] This will be specified in Article 8.2.2 of the standard connection contract as publicly consulted from 20 December 2023 to 16 February 2024.

relays with the specifications as mentioned by the supplier. The test will take place prior to the installation of the LFDD relays.

The following properties are tested:

- Measuring the accuracy of the frequency threshold
- Measurement of relay action time in the event of a sudden drop in frequency
- Measurement of the relay action time in the event of a frequency drop accompanied by different rates of change (slopes)
- Blocking of the frequency function at minimum voltage
- Checking the behavior of the relay in case of harmonics and TCC
- Checking the behavior of the relay in the event of a sudden vector jump
- Checking the behavior of the relay in the event of unbalanced voltage
- Checking the Relay Anti-Aliasing Filter
- Controlling the behavior of the relays in the event of power fluctuations
- Single-phase fault relay behaviour control with circuit breaker opening
- Checking the behavior of the relay when opening the last circuit breaker on a rail which is then de-energized
- Checking the Relay Behavior When Re-energizing a De-energized Rail
- Verification of relay behavior when discharging a cable on voltage transformers used for frequency measurement
- Checking the operation of the LEDs
- Checking the initialization time. This is the time required between the relay powering up and the relay generating a power-off order under fault conditions
- Checking the bounce reaction of the relay trip contacts, specifically, this is to check that the relay contacts are not opened and closed repeatedly in a short period of time before it finally comes to rest in an open or closed position
- Verification of the response of the action time in the event of the disappearance of one or two phase-to-ground voltages

8.4 Commissioning test (Site acceptance test SAT)

8.4.1 Modalities of a commissioning test

Before a new demand disconnection system is commissioned, a commissioning test must be carried out in:

- an existing or new installation of a transmission network-connected demand facility

  or

- CDS connected to the transmission network,

The parties involved: Elia and the network user, will inform and coordinate each other duly on the commissioning test schedule after the implementation of the new demand disconnection installation.

The commissioning test verifies the compliance of newly installed LFDD relays using a frequency drop test. During the commissioning test, the proper functioning of the entire demand disconnection installation shall be assessed and whether the maximum total operating time specified in point 8.4.3 can be met.

External frequency signals are injected by the LFDD relay owner onto the LFDD relay to verify that the trip command is correctly sent and received by the relevant circuit breakers within an acceptable operating time.

The cut-off signal is transmitted by Elia to the network user via the interface cabinet, the response time is controlled in two steps:

1) Elia measures the time between the time when the injected frequency signal drops below the frequency threshold and the time when the signal arrives at the interface cabinet.

2) Measurement by the network user of the time between the time the signal is activated in the interface cabinet and the time the signal arrives at each relevant circuit breaker.

The arrival of the demand cut-off signal is measured by the network user at the terminals closest to the circuit breaker.

For remote disconnection, the signal transfer time between the frequency relay, the interface cabinet, and the terminals closest to the circuit breaker must also be considered.

Elia has established a test program for the end-to-end testing of the entire installation, to be carried out in close collaboration with the network users. The tests to be carried out on clean equipment, without coordination, will be prepared and carried out by the entity concerned before the end-to-end test.

For tests on existing consumption facilities, Elia and network users will take precautions to avoid **unwanted interruptions in consumption** during the test. If the circuit breaker(s) cannot be opened during the test, the total outage time will be conservatively estimated by adding to the measured time the maximum time for the circuit breaker(s) to be opened according to the manufacturer's data.

For the testing of the new demand facilities, Elia and the network users will jointly decide to carry out the full end-to-end test, including the test of the circuit breakers, before the actual commissioning of the new demand facility.

Elia and the network users will both sign a test certificate confirming that the installation has been tested and whether or not the results meet the predefined specifications. A model test certificate is added to Annex 1 to the document "Technical concept for selective automatic load shedding related to transmission, connected demand facilities and CDS" added to Annex 1 to this document.

In the event of a change in the technical concept of automatic demand disconnection, the entity concerned must inform the other entity. A new commissioning test may be necessary and should be carried out in close cooperation with the other entity.

In the event of a significant change to the demand installation that has a significant impact on the demand disconnection installation, the network user shall inform Elia. In this case, Elia and the network user will decide whether a new commissioning test is necessary.

8.4.2 Criteria for Successful Commissioning Testing

The commissioning test is considered successful if the following criteria are met, as stated on the test certificate:

- The data and setting values of the frequency relay are consistent between Elia's databases and reality.
- The Factory Acceptance Test report is available and validated by Elia.
- The cabling plans are up-to-date and available from Elia.
- A visual check of the identification plates, external wiring and earthing took place and no abnormal condition was found by Elia.
- A check of the voltage readings on the relay screen when 20-40-60 V was injected into the TP circuit was carried out by Elia.
- A separate inspection of all the cut-off circuits was carried out by Elia.
- Elia checked that the "malfunction alarm" on the relay's DCS and EMS were working properly.
- Elia has verified the correct functioning of the F1 and F2 trip thresholds of the frequency relay and the notification of the shutdown to F1 and F2 in the DCS and EMS.
- A check of the correct start-up of the BEN disruptograph was carried out by Elia.

As soon as the disconnection command is transmitted by Elia via the interface cabinet to the network user, the control is carried out as follows:

- Elia measures the time (time A) between the time when the injected frequency signal drops below the F1 threshold and the time when the cut-off signal is detected in the interface cabinet.
- Measurement by the network user of the time (time B) between the time the signal is tripped in the interface cabinet and the time the signal arrives at each relevant circuit breaker.
- If the circuit breaker(s) cannot be opened during the test, the maximum opening time of the circuit breaker(s) will be observed (time C) according to the manufacturer's data.

The total trigger time is obtained by adding times A, B and C. This total tripping time shall not exceed the limit value specified in section 8.4.3.

A similar test is performed for the F2 frequency threshold.

It is also verified that the alarm signals associated with the operation of the LFDD can be correctly transmitted between Elia and the network user.

8.4.3 Maximum operating times

The maximum operating times targeted depend on the reference time at which Elia notified the network user of the availability of the installation for the disconnection of the demand, more specifically:

- For NC DCC v1.0, the maximum target total operating time, consisting of frequency relay response time, switch open time, and communication time, is 300 ms.

- For NC DCC v2.0, the maximum target total operating time, consisting of frequency relay response time, switch open time, and communication time, is 200 ms (to be confirmed).

8.4.4 Actions to be taken if the maximum allowable operating times are exceeded during the commissioning test

If it is found during the tests that the maximum permissible operating times are exceeded, the following measures should be taken:

If the total operating time determined exceeds one and a half times the permitted operating time, the demand disconnection installation shall be rejected and shall not be put into operation. The entities concerned shall establish an action plan to comply within a reasonable period of time. In accordance with Article 43 (5) of the NC ER, the test shall be carried out again after making the necessary adjustments to comply with the limits.

If the total operating time determined is less than one and a half times the permitted operating time, the demand disconnection installation will be put into operation. The entities concerned shall establish an action plan to comply within a reasonable period of time.

9 Compliance testing for SGUs without a contract for defense or Restoration services

Chapter 4 of the Network Defense Plan and the Restoration Plan contains a list of SGUs identified in accordance with Articles 11(4) and 23(4) of the NC ER whose capabilities can be used by ELIA to put in place defense and/or restoration measures, without the need for a contract for the provision of these services between ELIA and the person in charge of these facilities.

For identified SGUs that do not fall under the NC RfG, the NC HVDC or the NC DCC (existing installations) and that need to activate defense or restoration measures at the request of ELIA without a contractual basis, the capacities have been tested in the past during the compliance verification and periodic compliance check described in the connection contract.

The test modalities are defined in the connection contract and its annexes as mentioned in Article 60(2) of the Code of Conduct. Requests issued by ELIA when the grid is in a state of emergency, blackout or restoration will not run counter to the capacities tested during the connection process and will take into account the technical limits indicated in the connection contract.

For identified SGUs that are indeed covered by NC RfG, NC HVDC or NC DCC and that need to activate defense or restoration measures at the request of ELIA without a contractual basis, the capabilities specified in the above-mentioned network codes will be tested during the connection process.

ELIA will not impose any defensive or restoration measures beyond the capacity of the installation(s) specified in the connection contract.

The capabilities of a facility that will be used for defense and Restoration services include:

- Injection or withdrawal of active and reactive power over the entire operating area of the installation;
- Maintaining the connection to the grid as long as the grid frequency and the voltage at the connection point remain within the limits specified by the regulations in force;
- Disconnection of the network installation as soon as the disconnection criteria are met.

Since the compliance of a facility's capabilities has been verified during the connection process for the entire life of the facility, no other tests to verify these capabilities are specified in this test plan, with the exception of the LFSM-O/U mode of operation, as specified in sections 4.3 and 0.

If the facilities are substantially upgraded in accordance with the provisions of section 4.1. of the RFG, DCC and HVDC network codes and articles 47-48 of the code of conduct, the network user must inform ELIA who will determine whether further tests need to be carried out. In accordance with Article 74 of the Code of Conduct, for reasons related to the safety, reliability or efficiency of the transmission system, the transmission system operator may at any time verify the conformity of the connection and installations of a transmission system user. To that end, in the event of a presumption of non-compliance by the transmission system user's installations, the transmission system operator may carry out tests on those installations itself or have them carried out by the transmission system user.

The costs of such testing shall be apportioned in accordance with Article 77 of the Code of Conduct.

9.1.1 Costs of conducting the test

The allocation of the costs of these tests shall be established in accordance with the connection contract concluded between Elia and the transmission system user.

For the cost of testing the LFSM-O/U operating mode, see sections 4.3 and 6.1 above.

10 Testing of communication systems (NC ER Art. 48)

10.1 Testing of voice communication devices

The SGUs designated under Article 23(4) of the NC ER, which are included in the Restoration Plan as well as each public DSO, each Restoration service provider, Coreso[7] and ELIA test the communication systems defined in Article 41 of the NC ER at least every year.

These are voice communication systems with sufficient backup equipment and backup power sources so that at least 24 hours of Restoration Plan information can be exchanged if the external power supply fails completely or the individual equipment of the voice communication system fails.

ELIA uses voice-over-IP telephone connections connected to ELIA's internal data communication network for voice communication applications between ELIA's various sites such as posts (including posts considered essential to the Restoration Plan), control centers, service centers, administrative sites, etc. All public DSOs, Coreso, all Restoration service providers and some SGUs also have one or more voice-over-IP telephone connections connected to ELIA's internal data communications network. In the coming years, the remaining SGUs will be invited by ELIA to establish such voice communication links.

ELIA will a priori use its internal Datacom network for voice communications between its own sites, so this system will be tested on an ongoing basis.

At least once a year, at pre-arranged times, a voice communications test will be organized between ELIA operators in the control centers, on the one hand, and the operations manager of each public DSO, Coreso, each Restoration service provider and designated SGUs that has a voice-over-IP telephone connection connected to ELIA's internal data communications network, on the other hand.

ELIA records the time of such test, indicating whether the test was passed or failed.

VOIP telephone connections in ELIA stations are regularly tested in real situation to communicate with ELIA dispatching. In case of communication failures, an analysis will be made to determine the causes of the failure and appropriate measures will be taken to restore communication.

Each party shall bear its own personnel costs and any other costs of conducting the test on its facilities.

10.1.1 Costs of conducting the test

The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Good Conduct. The tests are therefore carried out at the expense of the transmission system user (restoration service provider and designated SGUs) whose equipment and capacities are to be tested. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs of the transmission system user.

For the tests carried out by Elia, the public DSOs or Coreso, these entities bear the costs of testing their equipment and capacities. Each of these parties therefore bears its own personnel costs and any other costs for carrying out the test on its facilities.

[7] Coreso is the regional security coordinator (RSC)

10.2 Testing the backup power supply of voice communication systems

The SGUs designated pursuant to Article 23(4) of the NC ER, included in the Restoration Plan as well as each public DSO, each Restoration service provider and ELIA shall test the backup power supply of the communication systems defined in Article 41 of the NC ER at least every five years.

Each named entity performs a test in which the power supply of all active and passive components involved in the voice link is disconnected from the external mains supply and taken over by a backup power supply. The correct operation of the voice communication link is also tested in this process. Each named entity records the time of such test, indicating whether the test was successful or not.

Each party shall bear its own personnel costs and any other costs of conducting the test on its facilities.

10.2.1 Costs of conducting the test

The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Good Conduct. The tests are therefore carried out at the expense of the transmission system user (restoration service provider and designated SGUs) whose equipment and capacities are to be tested. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs of the transmission system user.

For the tests carried out by Elia, the public DSOs or Coreso, these entities bear the costs of testing their equipment and capacities. Each of these parties therefore bears its own personnel costs and any other costs for carrying out the test on its facilities.

10.3 Tests on notifications Emergency ELIA , Blackout ELIA, Grid Restoration ELIA

In accordance with Article 40.2 of the NC ER, ELIA must notify its stakeholders of the system state if it is in an emergency, blackout or Restoration state. In order to accomplish this, ELIA has provided a system that uses multiple communication channels to send subsequent notification signals:

- Emergency ELIA
- Blackout ELIA
- Grid Restoration ELIA

The test is designed to:

- Verifying that the system is working correctly
- Make the various parties using the service aware of its existence
- Keep the contact database current

10.3.1 Send notifications by SMS or e-mail

The sending of notifications via text or e-mail is tested every year. During a test, only one of the three notifications will be tested. The other notifications will be tested in subsequent test periods.

The tests are organized as follows:

- ELIA will send an SMS/e-mail to all parties using SMS or e-mail to notify the time period when the system will be tested.
- ELIA sends the notification. The message explicitly states that it is a test.

The test of the system is considered successful when:

- ELIA does not receive a "delivery failure."
- No party using the service contacts ELIA to report that they did not receive the text message or email.

If the test is not a complete success (only some of the actors did not receive notification), the parties using the service and ELIA will verify that the contact information was correctly entered into the database.

If the test fails (no party received the notification), ELIA will analyze its system in depth to identify the cause of the problem and will take the necessary measures to resolve the issue.

Each party shall bear its own personnel costs and any other costs of conducting the test on its facilities.

10.3.2 Costs of conducting the test

The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Good Conduct. The tests are therefore carried out at the expense of the transmission system user (transmission demand facilities connected to the transmission system and RFDs connected to the transmission network) whose equipment and capacities must be tested. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs of the transmission system user

10.3.3 Sending notifications via a SCADA signal

The transmission of notifications via a SCADA signal is tested every month. During a test, only one of the three notifications will be tested. The other notifications will be tested in subsequent test periods.

The tests are organized as follows:

- ELIA will alert SCADA users a month in advance via e-mail about the exact period of the test.
- ELIA sends the notification. During the test, the same SCADA signal as in a real situation is used.
- The SCADA stakeholder automatically sends a response upon receipt of the notification
- The SCADA stakeholder manually acknowledges receipt of the notification by sending the corresponding signal

The test is considered successful when all SCADA stakeholders have automatically and manually acknowledged receipt of the notification.

If the test is not a complete success (only some of the actors did not receive a notification), ELIA will call the SCADA stakeholders who did not acknowledge receipt of the notification within five minutes to clarify the problem and take necessary action.

If the test fails (no party received the notification), ELIA will analyze its system in depth to identify the cause of the problem and will take the necessary measures to resolve the issue.

Each party shall bear its own personnel costs and any other costs of conducting the test on its facilities.

10.3.4 Costs of conducting the test

The costs of the tests are covered in accordance with the provisions of Article 76 of the Code of Good Conduct. The tests are therefore carried out at the expense of the transmission system user (transmission demand facilities connected to the transmission system and RFDs connected to the transmission network) whose equipment and capacities must be tested. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs of the transmission system user.

10.4 Testing of communication systems between TSOs

10.4.1 Voice Communications Test

In accordance with Article 48.3 of the NC ER, Elia, in consultation with the other TSOs within Entso-e, has established a test plan for the Emergency Voice System (EVS) set up between the national control centres of the different European TSOs.

At least once a year, at pre-established times, a voice communication test will be organised via the EVS between, on the one hand, an ELIA operator in the national control centre and, on the other hand, an operator of the neighbouring TSOs: Tennet (NL), RTE (FR) and Amprion (D).

There is no black-out proof direct telephone line between Elia and National Grid (UK). In the event of an outage, all communications will have to go through Nemo Link's control rooms.

At least once a year, at pre-established times, a voice communication test will be organised between an ELIA operator at the National Control Centre and a National Grid operator (UK). Nemolink's operators in Belgium and the UK will also participate in this test.

ELIA will record the times of voice communication tests performed, indicating whether the tests were passed or not.

In the event of a communication failure, an analysis will be conducted to determine the causes of the failure and appropriate measures will be taken to restore communication.

Each party will bear its own personnel costs and all other costs related to carrying out the test on its facilities.

10.4.2 Costs of conducting the test

For the tests carried out by Elia and the other TSOs, these entities shall bear the costs of testing their equipment and capacities. Each party therefore bears its own personnel costs and all other costs necessary to carry out the test on its facilities.

10.4.3 Test van het Entso-e Awareness System (EAS)

The EAS is a platform for real-time monitoring and exchange of system states between European TSOs.

At least once a year, an ELIA operator from the EAS National Control Centre shall change the system status from normal to emergency, black-out or restoration for a short period of

time, checking whether this is displayed correctly on the European electricity system overview map.

ELIA records the times of the tests carried out in the EAS, indicating whether the tests were conclusive or not.

10.4.4 Costs of conducting the test

ELIA covers the costs of this test.

11 Testing of tools and facilities (NC ER Art. 49)

11.1 Testing of main and backup power sources for ELIA's main and backup control centers

ELIA tests at least annually the adequacy of the main and backup power sources for the control centers in Schaarbeek, Merksem and Créalys, which also act as each other's backup control centers.

ELIA has an internal procedure for testing the emergency generators of the control centers in Schaarbeek, Merksem and Créalys. This procedure can be viewed by the competent authorities upon request to ELIA, but is not submitted for approval together with this Test Plan.

11.1.1 Costs of conducting the test

ELIA covers the costs of this test.

11.2 Tests related to substations deemed essential to Restoration Plan procedures

The Restoration Plan contains a list of substations deemed essential to the Restoration Plan procedures that are expected to remain operational for at least 24 hours if the primary power supply fails.

Some substations are already equipped and some will be equipped in the coming years with an emergency diesel or battery with an autonomy of at least 24h. ELIA organizes a startup test of these emergency diesels every month. In order not to unnecessarily compromise grid safety, ELIA limits itself to carrying out a startup test of the diesels, with the substation's auxiliary supplies remaining powered in the normal way.

ELIA also carries out tests on the charging and discharging capacities of batteries with an autonomy of at least 24 hours, without compromising the security of supply of grid users.

11.2.1 Costs of conducting the test

ELIA covers the costs of this test.

11.3 Testing on moving the main control center to the backup control center

ELIA has an internal procedure for moving from the main control center to the backup control center. This procedure can be viewed by the competent authorities upon request to ELIA, but is not submitted for approval along with this Test Plan.

This procedure is applied by each operator of the main control center at least once a year. ELIA records the time of such tests, indicating whether or not the test was passed.

11.3.1 Costs of conducting the test

ELIA covers the costs of this test.

12 Testing the defense measure "U-5%"

12.1.1 Introduction

The measure "reduce the reference voltage on distribution transformers by 5%" is included in the system defense plan (sections 7.1.3.1 and 7.4.4) with the objective of decreasing the voltage on the secondary side of distribution transformers by 5% in order to temporarily reduce the active power consumption[8] on distribution networks with limited impact on the end user.

In the absence of a methodology in the national regulations and in the NC DCC for the tests of the "load management" measure on consumption facilities, ELIA defines, in this test plan, the conditions and periodicity of the tests.

ELIA has the authority to do so in accordance with Articles 43(1) and 43(2) of the NC RE, which mention that each DSO shall regularly assess the proper functioning of all equipment and capabilities in the defense plan and the restoration plan and define it in a test plan.

In accordance with Article 75 of the Code of Conduct, ELIA has, after consultation with the network users concerned, in this case the public DSOs concerned, concluded an agreement on the procedure described in this section for the performance of the tests of the load management measure. This agreement has been formalised in Annex 13 of the collaboration agreement established between ELIA and the public DSOs. Where applicable, such an agreement between Elia and a DSSO will be notified in the connection contract between ELIA and the relevant DSO.

12.1.2 Costs of conducting the test

For the tests carried out by Elia and the public DSOs, these entities bear the costs of testing their equipment and capacities. Each party therefore bears its own personnel costs and all other costs necessary to carry out the test on its facilities. Where a CRFD participates in the test, the costs of the tests shall be borne in accordance with the provisions laid down in Article 76 of the Code of Conduct. The tests are therefore carried out at the expense of the transmission system user (CDSO) whose equipment and capacities must be tested. If the result of these tests shows that the operation is compliant, Elia will reimburse the costs of the transmission system user.

12.1.3 Periodicity of the test

The "load management" signal is tested every 5 years on a defined substation in the network in consultation with the DSOs concerned and, where relevant, the CDSOs concerned.

12.1.4 Description of the test

Before starting the test, the active power on the secondary side of the transformer(s) shall be measured at a sufficiently high resolution for at least 30 minutes. Taking into account the continuous variations of the power, a reference value is calculated from this.

The signal is tested as follows:

1. ELIA and the relevant DSO or the relevant CDSO, if relevant, select the transformer substation affected by the U-5% signal. Preferably, a substation is selected from which mainly domestic consumers are fed, where the load is resistive in nature.

[8] The consumption of active power by the asynchronous driving load will remain almost constant if the voltage decreases by 5%.

2. ELIA and the affected DSO or the affected CDSO, if relevant, reconfigure the signal U-5% used for the test to perform the test only at the affected transformation station.
3. ELIA shall activate the test signal at the time previously defined by ELIA and the DSO or CDSO concerned, if relevant.
4. ELIA and the DSO or CDSO involved, if relevant, shall restore the original configuration.

12.1.5 Passing criteria of the test

For a primarily resistive load, active power is expected to decrease by 9% when the voltage decreases by 5%. In practice, the load is not purely resistive and not completely constant during the duration of the test.

The test is considered successful if the instruction given through ELIA's management system leads to an adjustment of tap positions of the distribution transformer(s) concerned in the right direction so that a clear load drop compared to the reference value can be observed in the first five minutes after activation of the U-5% signal.

If multiple test on different substations over time show that the impact on active power is less than 5%, this defense action should be questioned.

13 Testing provisions for automatic resynchronization

During system restoration, as soon as two asynchronous zones can be resynchronized the synchronization leader will select a substation equipped with an asynchronous coupler, as described in section 10.1 of the restoration plan. Proper operation of an asynchronous coupler is important so as not to delay grid restoration.

ELIA assesses the conformity of the automatic resynchronization facility. There are four tests to assess the conformity of automatic resynchronization facilities:

- A **qualification test** that takes place before the equipment is ordered from the supplier to verify that the quality and performance do match what ELIA expects from this equipment;
- A **pre-FAT test performed** at the factory by the supplier to verify that the equipment to be delivered does indeed meet the specifications provided by ELIA;
- A **FAT test** performed by ELIA to confirm the results of the pre-FAT test performed by the supplier.
- An **actual no-load test** performed by ELIA when the facility is connected to verify that the facility is connected correctly.

The following is a non-exhaustive list of the components tested:

- Measurement as appropriate of the on and off values
- Measurement of delays
- Checking the indicator lights
- Control of the alarms specific to the relay (such as the alarm faulty power supply, the alarm faulty relay, mains imbalance ...)

Facilities for automatic resynchronization are also regularly used during any restoration of transformer voltage after a planned or unplanned power outage. These devices are also monitored continuously. In the event of a failure, an alarm is triggered.

In the event of an alarm indicating a malfunction or a detected malfunction, ELIA performs an in-depth analysis to identify the cause of the problem and restoration or replace the faulty equipment.

13.1.1 Costs of conducting the test

Elia shall bear the costs of its staff and any other costs relating to the performance of the test on its installations.

14 Definitions and acronyms

The definitions of NC ER, NC SOGL, NC DCC, RfG NC and NC HVDC apply to the test plan but are not explicitly included in this section.

Black Start Capability: "Standalone Start Capability" as defined in Section 2(45) of the NC RfG.

Black-Start Procedure: A list of actions that must be performed by the operator of a PGM in order to perform the Black-Start service.

Black Out Procedure: A list of actions to be taken by the operator of a PGM that are intended to restore operational safety in the MGP after a power outage.

EC 12 SoS Security of Supply: Working Group of the Electricity Commission 12 of Synergrid on the themes of the defense plan, the restoration plan and the test plan.

Code of Conduct: The Code of Good Conduct, adopted by the CREG by Decision (B) 2409 of 20 October 2022, and as amended from time to time, establishing the conditions for connection to and access to the transmission system and the methods for calculating or determining the conditions for the provision of ancillary services and access to cross-border infrastructure, including capacity allocation and congestion management procedures;

RSP Agreement: a contract between ELIA and a Restoration Service Provider providing a Restoration Service in accordance with the Model Contract for Restoration Services.

CREG = Commission de Régulation de l'Électricité et du Gaz **DSP = Defense Service Provider:** "defense service provider" as defined in Article 3(1) of the NC ER

Anti-aliasing filter : Limiting the frequency of an analog input signal to a measuring instrument using an analog low-pass filter, so that only frequencies less than half the sample rate are transmitted. This helps to avoid misreadings.

Island operation: as defined in Article 2 (43) of the NC RfG.

Houseload operation: as defined in Paragraph 2 (44) of the Nc RfG

FRR = Frequency Restoration Reserves: as defined in Article 3(2)(7) of the NC SOGL

DSO = Distribution System Operator. The use of DSOs in this document is to be understood as the operator of a public distribution system. For the avoidance of doubt, a DSOR should not be interpreted as a subcategory-of a DSO in this document. The requirements of the DSFM are explicitly mentioned.

CDSO = Closed Distribution System Operator

Black-Start Provider Group = combination of technical units including the main generator(s) and Black-sarter(s) capable of providing the Black-Start service

TSO = Transmission System Operator: as defined in Article 2, 8 of the Law of 29 April 1999 on the organisation of the electricity market.

Black Start Restoration Site: Power generation facility, consisting of one or more PGMs connected to the same connection point to the transmission grid, and capable of providing some restoration service.

LAN (Local Area Network) = Local Area Network

LFDD (Low Frequency Demand Disconnection) = low-frequency net load disconnection, also known as automatic sub-frequency disconnection.

LFSM-O = Limited Frequency Sensitive Mode - Overfrequency : as defined in Article 2(37) of the NC MER.

LFSM-U = Limited Frequency Sensitive Mode - Underfrequency : as defined in Article 2(38) of the NC MER.

Minister of Energy: the federal minister or secretary of state responsible for energy.

NCC = National Control Center

NC DCC = network code on the connection of distribution networks and demand facilities. Commission Regulation (EU) 2016/1388 of 17 August 2016 establishing a network code on the connection of distribution systems and demand facilities.

NC ER = network code on the state of emergency and restoration of the electricity network. Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on the connection of distribution systems and demand facilities.

NC HVDC = HVDC network code. Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on the requirements for grid connection of high-voltage direct current systems and non-synchronous direct current generator farms.

NC RfG = Network Code on Requirements for Power Generation Facilities. Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of electricity generation installations.

PGM = electricity generation unit, as defined in Paragraph 2(5) of the RfG NC

Restoration plan: "Restoration plan" as defined in Article 3(5) of the NC RE, i.e. "all the technical and organisational measures necessary for the restoration of the network to its normal state".

RSP = Restoration Service Provider: "Restoration Service Provider" as defined in Article 3(2) of the CR NC.

RTF = Federal Technical Regulation : Royal Decree of 29 November 2024 establishing a technical regulation for the management of the electricity transmission system and access to it.

SCADA = Supervisory Control and Data Acquisition

Synergrid: Federation of Electricity and Gas Network Operators

SOGL = System Operating Guideline. Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on the operation of the electricity transmission system

TCC = Centralised remote control: a signal with a frequency of more than 50 Hz sent by the DSOs on the distribution network to control certain consumption installations (public lighting, storage heating, etc.) or to send specific signals (day/night tariff change).

SGU = Significant Grid User

RFP zone: Frequency-Power Tuning Zone, as defined in Article 3(2)(12) of the NC SOGL. For Belgium, this corresponds to the ELIA area.

15 Annexe 1 : Technical concept for selective automatic load shedding related to transmission connected demand facilities and CDS

https://www.elia.be/-/media/project/elia/elia-site/electricity-market-and-system/emergency-situations/20240522_lfdd_technical-concept-for-selective-automatic-load-shedding-for-industries-v06-1.pdf