Technical concept for selective automatic load shedding related to transmission connected demand facilities and CDS

Version of May 2024

Technical concept for selective automatic load shedding in transmission connected demand facilities and CDS

Contents

1. Introduction

This document describes the technical aspects and implementation for automatic selective load shedding in transmission connected demand facilities and transmission connected closed distribution systems (CDS). The context and general provisions for automatic load-shedding in case of low frequencies are described in the System Defense Plan of Elia, approved by the Ministerial decree of January 25th 2024.

This document describes the implementation of the automatic selective load shedding for two types of interfaces. Interface towards grid user's substations equipped with numerical communication (e.g. IEC 61850) and interface towards grid user's substations that are equipped with copper-wiring for the exchange of information between IED's.

This document does not include any criteria to decide whether a substation should be included in the automatic selective load shedding plan, nor does it discuss any contractual aspects. Without prejudice to the responsibilities of the Parties set out in COMMISSION REGULATION (EU) 2017/2196, also called the European network code on emergency and restoration (NC ER), it is explicitly stated that the TSO is responsible for initiating the low frequency demand disconnection (LFDD) and the grid user is responsible for disconnecting the selected load in the consumers facilities.

2. Intended audience

The intended audience of this document primarily consists of the technical staff of transmission connected demand facilities and CDS. The present technical concept document is published on Elia's website and is joined in annex of Elia's testplan.

3. General framework and Objectives

The TSO is responsible for maintaining operational security in its control area.

Hence, according to the Belgian Federal Grid Code and the NC ER, Elia is responsible for the design and implementation of the System Defense Plan. The automatic low frequency demand disconnection scheme is a part of the System Defense Plan. The System Defense Plan of Elia was approved by the Ministerial Decree on January 25th 2024.
The NC ER art. 15(4) and annex 1, the COMMISSION REGULATION (EU) 2016/1388 of 17 August 2016 establishing a Network Code on Demand Connection (NC DCC) art 19, as well as the "SAFA annex 5: Policy on Emergency and restoration", lay down specific rules for the automatic low frequency demand disconnection scheme.
According to the actual version 2.0 of the System Defense Plan, transmission connected demand facilities and transmission connected CDS have to implement 30% of its gross consumption as (netted) demand that can be disconnected at two frequency thresholds: 6% to be disconnected at 48.3 Hz and 24% to be disconnected at 48.1 Hz.
The targeted maximum total tripping time - considering measurement, calculation time of relays, tripping action of auxiliary circuits and circuit breaker opening time – depends on the reference date on which Elia has notified the grid user to provide the installation for demand disconnection, and is more specific:

- For a reference date before [date of entry into force of the NC DCC v2.0] the targeted maximum total tripping time is 300 ms.
- For a reference date after [date of entry into force of the NC DCC v2.0] the targeted maximum total tripping time is 200 ms.

4. Definitions

For the purposes of this note, the definitions provided for in Commission Regulation (EU) 2017/2196, Commission Regulation (EU) 2016/1388, Royal Decree of April 22, 2019 and the Code of Conduct defined by Creg decision (B) 2409 of October 20th 2022 shall apply.

In addition, the following definitions shall apply:

CDS = Closed Distribution System: as defined in article 2(5) of NC DCC.

Classical grid user's substation: in the context of this technical concept, this is considered as a substation at the grid user's site, where all the communication (between protections and Remote Terminal Unit, for Interlocking, etc.) is fully hardwired in copper.

IEC 61850: International standard defining communication protocols for intelligent electronic devices at electrical substations. It is a part of the International Electrotechnical Commission's (IEC) Technical Committee 57 reference architecture for electric power systems. The abstract data models defined in IEC 61850 can be mapped to a number of protocols. These protocols can run over TCP/IP networks or substation LANs using high speed switched Ethernet to obtain the necessary response times below four milliseconds for protective relaying.

IED: An Intelligent Electronic Device is a term used in the electric power industry to describe any device incorporating one or more processors with the capability to receive or send data/control from or to an external source (example: digital relays and controllers)

LFDD = Low Frequency Demand Disconnection

Numerical grid user's substation: in the context of this technical concept, this is considered as a substation at the grid user's site, where a part or all the communication in it (between protections and Remote Terminal Unit, for interlocking,…) is protocoled (e.g. the IEC61850 protocol to exchange information between equipments) instead of hardwiring.

SCADA: Supervisory Control And Data Acquisition is a control system architecture that uses computers, networked data communications and graphical user interfaces for high-level process supervisory management, but uses other peripheral devices such as programmable logic controllers (PLC), etc. to interface to the grid elements.

Under-frequency cubicle: An under-frequency cubicle is installed in a substation to determine the grid frequency, to make the decision for load-shedding and to send the load shedding order to the grid user. It consists of multiple IEDs (Intelligent Electronic Device) per measuring point, totally independent from each other, with different measuring algorithm.

Voltage Transformer (VT): A parallel connected type of instrument transformer, designed to present negligible load to the supply being measured and have an accurate voltage ratio and phase relationship to enable accurate secondary connected metering.

5. Technical solution for the selective automatic load shedding plan

5.1. General principle

The under-frequency cubicle is installed in the substation of Elia and measures the frequency via multiple independent voltage transformers in the respective substation.

Each transmission connected demand facility is responsible for the installation and maintenance of the facilities needed to achieve the selective load shedding of the targeted load(s), upon reception of the load shedding order, up to the command termination (interface relay/IEDs/Automations and connections to sheddable bays if applicable).

The under-frequency cubicle generates a load shedding order when a frequency drop below the programmed threshold is registered. The load shedding order generated by the under-frequency cubicle, located in the Elia substation, is sent to the interface cubicle, located in in the transmission connected demand facility or CDS substation. The transmission connected demand facility or CDS is responsible to collect the load shedding order from the interface cubicle and transfer (if applicable) the signal to its internal installation.

The load shedding order is automatically forwarded by the grid user to open the circuit breaker of specific targeted feeders inside the transmission connected demand facility or CDS. This principle is presented in Figure 1.

The specific targeted feeders are selected by the grid user, to comply with the netted demand to be disconnected, as specified in the System Defense Plan of Elia.

The objective is that the grid user only selects sheddable feeders to consumer installations that act as load (passive feeders). Frequency drops can occur when the demand for electricity is greater than the supply, therefore feeders that act as injectors (active feeders) are supposed to remain connected.

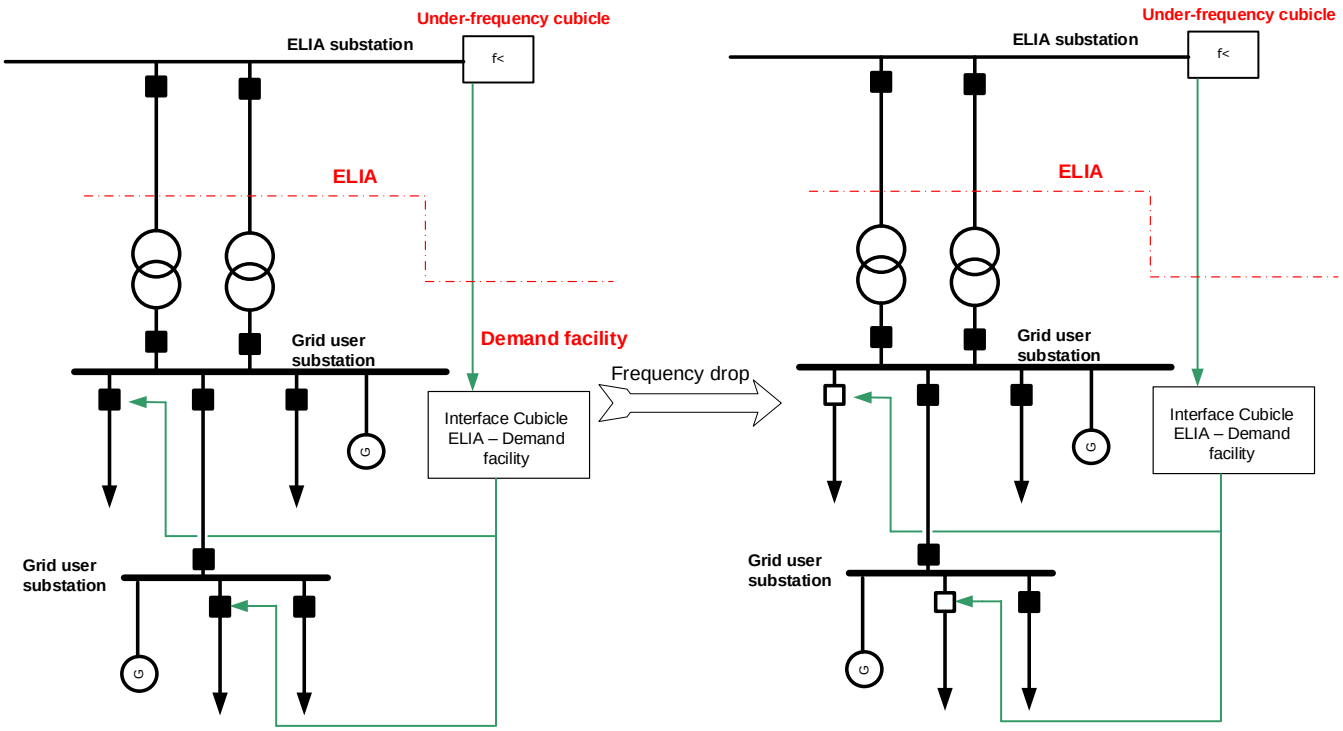

Figure 1: General principle for selective automatic under-frequency load shedding

The load shedding order is only transmitted to feeders that are selected by the grid user. The main connection between Elia and the grid user will remain unaffected and only the circuit breakers of the sheddable feeders selected by the grid user will be disconnected. This way the load connected to these feeders will be shed, the remaining feeders of the grid users' electrical facilities remain energized as indicated in Figure 1.

By using this principle, the non-sheddable feeders determined by the grid user will remain supplied.

Important: In case the selective automatic load shedding is implemented in a substation, there will be no backup solution for the automatic load shedding (e.g. opening of the TSO main circuit breaker). Therefore, the grid user must ensure that the implemented solution is available in their facilities and ensure that it stays operational to realize the required netted demand volume to be disconnected.

The grid user shall ensure that the required (netted) demand can be disconnected at all times upon receiving the load shedding order, independent of the actual status of the demand facilities e.g. shut down of some process, local electricity generation, …). To ensure this, the grid user may apply different philosophies (not exclusive):

- **Fixed** load shedding: the load shedding order goes to a number of pre-selected circuit-breakers so that the minimum amount of load to be shed will be reached at any moment, also when some demand is under maintenance. Over proportional activation could be a consequence.

- **Dynamic** load shedding: the load shedding order is directed to specific feeders depending on their actual loading or another specific logic. This way over-shedding (i.e. disconnecting more load than required) can be avoided in case of LFDD activation.
- Any other philosophies defined by the grid user to ensure to shed the minimum amount of load at any time.

Moreover, the grid user may install additional crosschecks to avoid unwanted tripping of his feeders, provided the total tripping time can be respected. For example, he may install an IED which blocks the disconnection of the load if there is no frequency drop.

5.2. Technical solution

The load shedding order generated by the under-frequency cubicle, located in the Elia substation, is sent to the interface cubicle located in the transmission connected demand facility or CDS as shown in Figure 2. The load shedding order is automatically forwarded by the grid user to open the circuit breaker of specific feeders inside the transmission connected demand facility or CDS.

The signal transmission between Elia and the installation of the grid user is performed in the following way:

1. The load shedding order is sent by the under-frequency cubicle to the interface cubicle of the grid user. The connection between the equipment is hardwired in copper. The load shedding order is sent by the under-frequency cubicle to the interface cubicle as a pulse with a pulse width of at least 100 ms.

2. When the load shedding order, coming from the under-frequency cubicle, is received by the interface cubicle of the grid user, the grid user;

   i. Automatically sends an acknowledgement signal 'ACK' to the TSO substation (local) to indicate that the shedding order is correctly received by the grid user. The acknowledgement signal is also a pulse with a pulse width of at least 100ms.

   ii. Sends the load shedding order to the circuit breaker of the sheddable feeders. The connection between the equipment is defined by the grid user but must be reliable (E.g.: hardwired in copper, communication protocol IEC 61850 or other, …).

The aforementioned method for signal transmission is applicable for each grid user substation connected to the respective substation of Elia.

In case two or more grid users are connected to the same substation of Elia, the under-frequency cubicle generates one signal which is sent to the interface cubicles of each grid user, connected in a parallel configuration. Each grid user sends an acknowledge signal 'ACK' from its interface cubicle back to Elia's frequency cubicle if the load shedding order from Elia has been correctly received by the grid user.

To limit the consequences of an unwanted and unforeseen sending of a tripping order by an individual under-frequency cubicle, Elia will limit the number of different grid users connected to the same under-frequency cubicle.

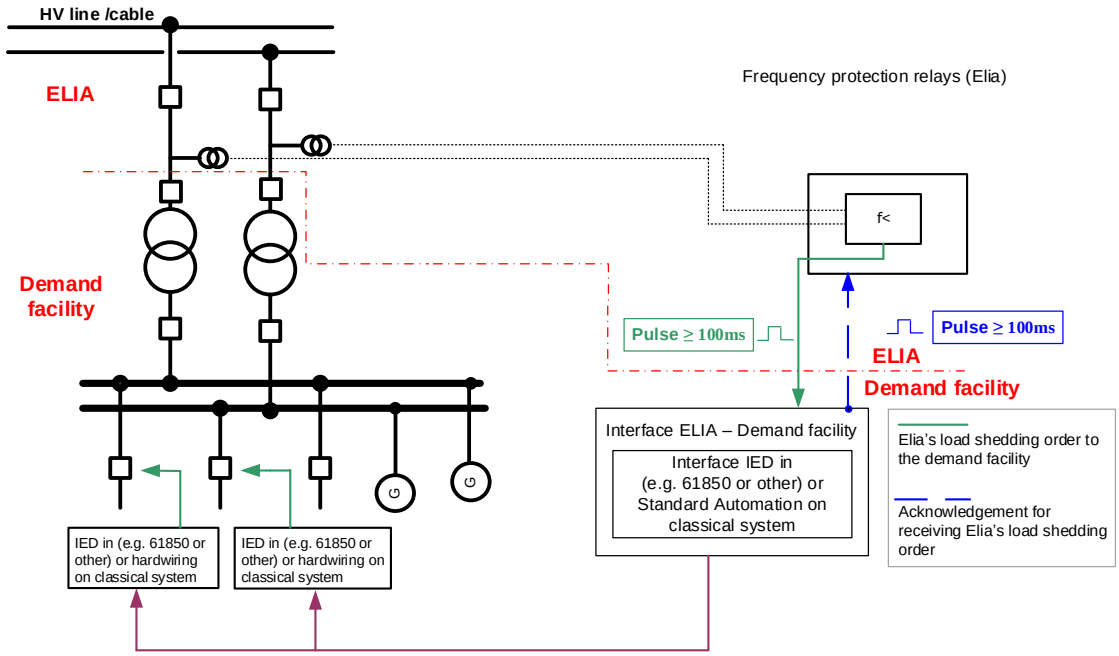

Figure 2 - Detailed principle for selective automatic under-frequency load shedding

The implemented technical solution should always respect the maximum total tripping time - considering measurement, calculation time of relays, tripping action of auxiliary circuits and circuit breaker opening time – with a maximum defined in § 3 of this document.

The grid user may implement local additional cross checks of the frequency drop at its own responsibility and without exceeding the tripping time[1] equal to half the value defined in § 3 of this document.

After having received the trip command, the grid users shall strive to respect a maximum operating time of half the value defined in § 3 for having opened all the circuit breakers of sheddable feeders (also if additional cross checks are applied by the grid user).

5.3. Interface cubicle Elia-grid user

Elia's under-frequency cubicle and the grid user's interface cubicle are connected through an auxiliary relay, namely a fast electromechanical relay. The interface cubicle will use the available 110Vdc that is supplied by the grid user. If no interface cubicle or not enough space is available in the existing cubicle, it could be necessary to add a new interface cubicle. This will have to be analyzed in the detailed implementation study.

[1] Time between the moment that the load shedding pulse signal from Elia appears in the interface cubicle and the moment that the circuit breaker(s) of the grid user has/have interrupted the electric current to the load(s).

A security criterion is applied to avoid erroneous trip due to maintenance faults ("defaut de tournevis"). Instead of one contact, two separate trip contacts are used, one contact in the plus (+) signal and one contact on the min(-) signal to issue a trip command (as presented in Figure 3). The shed action is released when both trip contacts are activated. The auxiliary relay presented in Figure 3 ensures the separation between polarities of Elia and grid user's equipment. In case of use of a fast electromechanical relay an additional operating time of approximately 8 ms will be introduced to the trip signal, which will be part of the operating time of Elia's installation. Nevertheless, the use of fast electromechanical relays was retained to guarantee the signal is sent and received correctly.

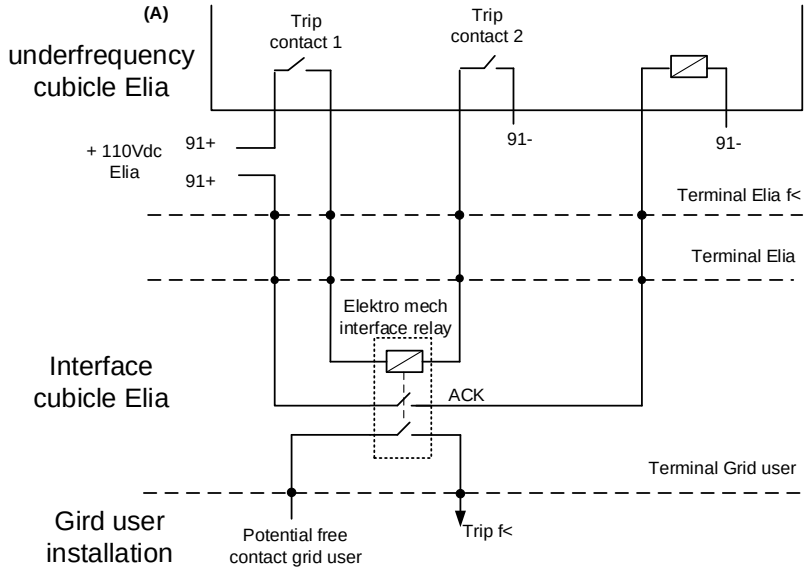

Figure 3 – Principle scheme for connection between under-frequency cubicle (Elia) and interface cubicle (grid user) by use of an electromechanical relay

The interface is used to exchange the following signals:

- TRIP command: Elia will control an auxiliary relay in the interface cubicle. In case of a numerical interface IED, the IED will perform the task of auxiliary relay.
- ACK signal: Elia will read an auxiliary relay in the interface cubicle. In case of a numerical interface IED, where no auxiliary relays are used, this signal is directly sent by the interface IED.
- The signal of acknowledgement (ACK) received from the grid user is at least recorded in one of the frequency relays of the under-frequency cubicle.

The under-frequency cubicle is the property of Elia, who owns the HV substation where it will be placed. Elia is responsible for installation and maintenance of the under-frequency cubicle.

6. Implementation

Elia will inform (in writing) the grid user two years in advance of the planned commission date of the under-frequency cubicle in Elia's substation. The grid user has two years for preparing and realizing the equipment needed for disconnection of the required demand volumes within his demand facility.

The implementation will be planned, executed, and tested in close collaboration between Elia and the grid user.

A hardwired connection between the under-frequency cubicle and the interface cubicle will be implemented by Elia. The connection between the interface cubicle and the selected circuit breakers will be implemented by the grid user.

The interface between TSO and the interface cubicle is described in detail in section 5.3. In case auxiliary relays are used, they will be provided and taken care of by the grid user.

Due to the different technologies, the implementation at the grid user's side may differ based on the type of substation and selected principle. Therefore, a description on the possible implementation is displayed for each case.

Despite the description on possible implementation for each type of substation, each grid user shall decide on the type of implementation in their substation(s).

7. Maintenance policy

As a general rule, the owner of an installation is responsible for its maintenance.

Elia will carry out maintenance and inspections on its load shedding installations with a periodicity of 10 years, in accordance with its maintenance policy.

Elia recommends that the grid user will carry out maintenance on its load shedding installations in line with suppliers' recommendations and with a maximum periodicity of 10 years. These results must be made available for the TSO to consult.

A compliance test (see chapter8) will be done after each maintenance to check that the total tripping time is still guaranteed.

Each entity can request curative or adaptative maintenance reports from the other entity concerning their installation for load shedding in case of discussion or malfunction of the installation.

8. Compliance testing

According to article 47 of the NC ER, Elia shall execute testing on the low frequency demand disconnection relays implemented on its installations, within a period to be defined at national level and following the methodology laid down in Article 37(6) and Article 39(5) of Regulation (EU) 2016/1388. The details of this test are described in the test plan of Elia (available on Elia's website) in accordance with article 43 (2) of the NC ER.

8.1. Site Acceptance Tests (SAT)

Before taking into service the (new) installation for demand disconnection in a transmission connected demand facility or CDS, site acceptance tests shall be performed. The involved parties: Elia and the grid user(s), will duly inform each other about the implementation of this (new) installation and align on the timing for the commissioning test.

During the SAT test, the full installation for demand disconnection will be tested, in close collaboration between Elia and grid user(s). The objective is to assess the proper functioning of the whole installation and equipment, as well as respecting the targeted maximum total operating time as defined in § 3.

Elia will provide a test schedule concerning the SAT test of the complete installation, which needs to be performed in close collaboration with the grid user. The tests to be performed on own equipment, without coordination, will be prepared and executed by the concerned entity and the results will be made available to be assessed by the TSO during the overlapping testing.

For test on existing demand facilities, Elia and the grid user take precautions to avoid unwanted load interruptions during the test. If the circuit breaker opening cannot be performed during the test, the total tripping time will be estimated conservatively by adding the maximum circuit breaker opening time to the measured time.

The arrival of the loadshedding order is measured by the grid user at the terminals closest to the circuit breaker.

For a remote disconnection, the signal transfer time between the frequency cubicle, the interface cubicle and to terminals close to the circuit breaker must also be included.

Elia and the grid user will both sign a test certificate confirming the installation was tested and the results fulfil the specifications as foreseen in section 5.2. A template of the test schedule / test certificate is added to annex 1 (NL) and annex 2 (FR) of this document.

In case the technical concept for demand disconnection will be changed, the concerned entity shall duly notify the other entity of this change. A new SAT may be required and shall be executed in close collaboration with the other entity.

In case of significant modifications in the grid user's installation with an important impact on the load shedding installation, the grid user must inform Elia. In such case, Elia and the grid user will decide if a new SAT will be necessary.

8.2. Commissioning

If the SAT did succeed, the installation for demand disconnection will be put in service in mutual agreement by Elia and the grid user.

If it is determined during SAT testing that the maximum allowable operating time is exceeded, then the following action shall be taken:

If the determined total operation time exceeds one and a half times the allowed operation time, then the installation for demand disconnection is not put into service. The entities concerned shall determine an action plan to comply within a reasonable time.

If the determined total operation time is less than one and a half times the allowed operation time, then the installation for demand disconnection shall be put into service. Nevertheless, the entities concerned shall determine an action plan to comply with the rules within a reasonable period of time.

The grid user is informed by Elia in advance of the moment of commissioning.

8.3. Periodic tests

Each entity shall define and perform the necessary tests of its installations after any maintenance. Apart from the SAT, no periodic overlapping test will be performed.

9. Bibliography

1) Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on electricity emergency and restoration. Link: Regulation - 2017/2196 - EN - EUR-Lex (europa.eu)
2) Belgian Federal Grid Code and the NC ER. Link:
3) COMMISSION REGULATION (EU) 2016/1388: Network Code on Demand Connection. Link: COMMISSION REGULATION (EU) 2016/ 1388 - of 17 August 2016 - establishing a Network Code on Demand Connection (europa.eu)
4) "SAFA annex 5: Policy on Emergency and restoration" link: Policy on Emergency and Restoration (entsoe.eu)
5) Belgian legal framework. Link: Belgium (elia.be)
6) Code of Conduct defined by Creg decision (B) 2409 of October 20th 2022
   Link: https://www.creg.be/fr/publications/decision-b2409
7) System Defense Plan of Elia. Link: https://www.elia.be/-/media/project/elia/elia-site/electricity-market-and-system---document-library/restoration-services---rsp-and-emergency-situations/2024/20240301_system_defence_plan_non-confidential-website_en.pdf
8) Test plan of Elia. Link: https://www.elia.be/-/media/project/elia/elia-site/electricity-market-and-system/emergency-situations/20230317_test-plan_en.pdf

Annex 1: Test validatiecertificaat NL

elia | Elia Group Versie_00_04/20214	**Frequentie rack** **SAT-validatiecertificaat** Dit certificaat bevestigt dat het systeem met de hieronder vermelde referentie werd aanvaard na de tests ter plaatse. D.w.z. dat de functies van het systeem correct werken overeenkomstig de standaarden, plannen, gelndividualiseerde studies van Elia, de toegelaten maximumtijden enz., en dat het dus klaar is om in dienst te worden genomen.

Automatisch ingevuld
In te vullen – vrije invoer
In te vullen – picklist

0. Algemene gegevens

Leverancier:	xxx
Serienummer kast	
PU ELIA:	
Projectnummer (TRxxxxx):	
Type afschakeling	
Drempel F1 of F2 veranderd sinds FAT	

Aanwezig	Onderneming

DATUM SAT: van ____ tot ____
DATUM INDIENSTSTELLING : ____

ALGEMENE OPMERKINGEN

Omschrijving van het probleem	Beschrijving van de oplossing	Opmerkingen

1. Administratieve controles		Opmerkingen:
1.1	Stemmen de gegevens in infraref overeen met de realiteit?	
1.2	Zijn de firmware-versie en configuratie Vxx.xx?	
1.3	Zijn de versies van de settings/parametrie van elk relais dezelfde dan ASR?	
1.4	Is het FAT-rapport beschikbaar en gevalideerd?	
1.5	Zijn de plannen beschikbaar en up-to-date (principe, bedrading)?	
1.6	Visuele controle (identificatieplaatjes, externe bedrading, aarding ...)	
2. Tests van de continuïteit van de bedrading		**Opmerkingen:**
2.1	Controle van de spanningsmetingen op het scherm van het relais bij de injectie van 20-40-60 V in de TP-kring	
2.2	Afzonderlijke controle van alle uitschakelkringen	
3. Tests van de externe functies		**Opmerkingen:**
3.1	Werkt het malfunction alarm correct op het DCS en EMS?	
3.2	Controle van de functies in verband met de uitschakeling:	
	Uitschakelingsdrempel F1 en F2?	
	Melding uitschakeling F1 en F2 in het DCS en EMS?	
	Start BEN?	
4. Optionele tests		**Opmerkingen:**
De netgebruiker moet de geschikte veiligheidsmaatregelen treffen voor deze test!!! (ongewenste uitschakelingen vermijden)		Als de test niet kan gebeuren met de uitschakeling van de VS, zal de totale tijd op een conservatieve manier worden ingeschat door de maximale openingstijd van de VS aan de gemeten tijd toe te voegen, om te bepalen of aan de 100ms of de 200ms is voldaan. De aankomst van het loadshedding order wordt gemeten op de klemmen die zich het dichtst bij de VS bevinden. Bij een tele uitschakeling moet de verzendingstijd naar de VS ook worden meegerekend.
3.3	Uitschakelingstest met:	
	Totale tijd (van meting tot opening vermogenschakelaar) < 200 ms?	
	Tijd bij de netgebruiker (ontvangst uitschakelingsmelding in interface tot opening vermogenschakelaars) < 100 ms?	
	Download van de perturbografie van een relais met de ACK in het SAT-dossier?	
Uit te voeren indien de drempel F1 of F2 werd gewijzigd vanuit de FAT		
3.4	Nauwkeurigheidstest F1 (1 test per relais)	
3.5	Nauwkeurigheidstest F2 (1 test per relais)	
4. Administratieve afsluiting		**Opmerkingen:**
4.1	SAT-rapport, OCC-bestanden, eventueel SAT-rapport van de netgebruiker ... geüpload op de server	
5. Handtekening		

Voor goedkeuring:

Voor ELIA	Voor de netgebruiker
Naam, datum en handtekening:	**Naam, datum en handtekening:**

Annex 2: Certificat de validation de test FR

elia | Elia Group Version_00_04/2024	**Rack de délestage en sous fréquence** **Certificat de validation SAT** Ce certificat certifie que le système référencé ci-dessous a été accepté suite aux tests sur site. C'ad que les fonctionnalité du système fonctionnent conformément aux standards, plans, études particularisées d'Elia, temps maximum autorisés, ... et est donc prêt à être mis en service

Remplissage automatique
A compléter - entrée libre
A compléter - picklist

0. Données générales

Supplier:	xxx
Cubicle serial number	
PU ELIA:	
Project number (TRxxxxx):	
Type de délestage	
Seuil F1 ou F2 changé depuis la FAT	

Présents	Company

SAT DATE: from ____ to ____
MISE EN SERVICE DATE: ____

REMARQUES GENERALES:

Description du problème	Description de la solution	Commentaires

1. Vérifications administratives		Commentaires:
1.1 Données dans infraref correspondent à la réalité?		
1.2 Version firmware et config sont Vxx.xx?		
1.3 Les versions des settings/paramétrie de chaque relais correspondent à ASR?		
1.4 Le rapport de FAT est disponible et validé?		
1.5 Les plans sont disponibles et à jour (principe, câblage)?		
1.6 Contrôle visuel (plaques de repérage, câblage externe, mise à la terre, ...)		
2. Tests continuité de câblage		**Commentaires:**
2.1 Vérification mesures tensions sur l'ecran du relais lors d'injection 20-40-60V sur le circuit TP		
2.2 Vérification de tous les circuits de déclenchement séparément		
3. Tests fonctionnalités externes		**Commentaires:**
3.1 L'alarme malfunction fonctionne correctement sur le DCS et l'EMS?		
3.2 Vérification des fonctionnalités liées au déclenchement:		
Seuil de déclenhement F1 et F2?		
Signalisation trip F1 et F2 sur le DCS et l'EMS?		
Démarrage BEN?		
4. Tests optionnels		**Commentaires:**
L'utilisateur de réseau doit prendre les mesures de sécurité adéquates pour ce test!!! (éviter les déclenchements intempestifs)		Dans le cas où le test ne peut être effectué avec l'ouverture du disjoncteur comprise, le temps total sera estimé de manière conservative sur base du test réalisé. Au temps mesuré, l'utilisateur de réseau ajoutera une marge qui prend en compte le temps d'ouverture maximum du disjoncteur afin de déterminer si le critère des 100ms / 200ms maximum est respecté. L'ordre de délestage sera mesuré sur les bornes au plus près du DV. Si teletrip, il faut également inclure le temps de la transmission.
3.3 Test de déclenchement avec:		
Temps total (depuis mesure jusqu'à l'ouverture du disjoncteur) <200ms?		
Temps côté utilisateur de réseau (de la réception trip à l'interface jusqu'à l'ouverture des disjoncteurs)<100ms		
Téléchargement de la perturbographie d'un relais contenant le ACK dans le dossier de SAT?		
A réaliser si seuil F1 ou F2 a été changé depuis la FAT		
3.4 Test de précision F1 (1 test par relais)		
3.5 Test de précision F2 (1 test par relais)		
4. Fermeture administrative		**Commentaires:**
4.1 Rapport SAT, fichiers OCC, rapport de SAT utilisateur de réseau eventuel, ... téléchargé sur le serveur		
5. Signature		

Pour approbation:

Pour ELIA	Pour l'utilisateur de réseau
nom, date et signature :	nom, date et signature :