

Requirements for grid connection of transmission system users

AS "Augstsprieguma tīkls" proposal for the general requirements applicable for users of the electricity transmission system in accordance with Article 6, paragraph 1 of Regulation 2016/1388. The general requirements will be submitted to the Public Utilities Commission for approval after the commencing of public consultation.

July 26, 2018

#### General provisions

1. The document has been developed in accordance with **Article 6, paragraph 1** of Commission Regulation 2016/1388 of August 17, 2016, establishing a network connection code for demand facilities (hereinafter referred to as Regulation 2016/1388).
2. The transmission system operator (hereinafter - TSO), in co-ordination with the distribution system operator (AS "Sadales tikls") and the TSO`s of other countries, has specified the requirements for demand facilities connected to the transmission system, distribution facilities, connected to transmission systems, distribution systems and demand units in accordance with Regulation 2016/1388.
3. The requirements referred to in this document apply to electricity demand facilities in accordance with **Articles 3, 4, 5 and 59** of Regulation 2016/1388.
4. The requirements contained in this Document shall apply subject to Regulation 2016/1388.
5. All definitions and abbreviations have been used in accordance with Regulation 2016/1388.

#### General frequency requirements

1. In accordance with **Article 12, paragraph 1**, of Regulation 2016/1388, demand facilities connected to the transmission system, distribution facilities connected to the transmission system and distribution systems must be able to remain connected to the network and operate in following frequency ranges and their duration periods:

6.1. 47.5-48.5Hz for not less than 30 minutes;

6.2. 48.5-49.0Hz for not less than 30 minutes;

6.3. 49.0-51.0Hz unlimited;

6.4. 51.0-51.5Hz for at least 30 minutes.

#### General voltage requirements

1. In accordance with **Article 13, paragraph 1** of Regulation 2016/1388, demand facilities connected to the transmission system, distribution facilities connected to the transmission system and the distribution systems connected to the transmission system must be able to remain connected to the network and operate in following voltage ranges and duration periods periods depicted in the table 1.

Table 1

**Voltage ranges and duration time periods**

|  |  |  |
| --- | --- | --- |
| Sinchronous area, voltage level | Voltage range | Time period for operation |
| Baltics, 330kV | 0.90–1.097p.u.1 | Unlimited |
| Baltics, 330kV | 1.097–1.15p.u.1 | Not less than 20 minutes |
| Baltics, 110kV | 0.90–1.118p.u.2 | Unlimited |
| Baltics, 110kV | 1.118–1.15p.u.2 | Not less than 20 minutes |

1 – reference value for 1p.u. is 330kV;

2 – reference value for 1p.u. is 110kV.

1. In accordance with **Article 13, paragraph 7** of Regulation 2016/1388, distribution systems connected to the transmission system, with the voltage at the connection point below 110 kV must be capable of remaining connected to the network and operating in following voltage ranges and duration periods depicted in the table 2.

Table 2

**Voltage ranges and time periods**

|  |  |  |
| --- | --- | --- |
| Voltage at the connection point below 110kV | Voltage range | Time period for operation |
| 6kV | 0.85-1.1p.u.1 | Unlimited |
| 6kV | 1.1-1.2p.u.1 | Not less than 3 minutes |
| 10kV | 0.85-1.1p.u.2 | Unlimited |
| 10kV | 1.1-1.2p.u.2 | Not less than 3 minutes |
| 20kV | 0.85-1.1p.u.3 | Unlimited |
| 20kV | 1.1-1.2p.u.3 | Not less than 3 minutes |

1 – reference value for 1p.u. is 6kV

2 - reference value for 1p.u. is 10kV

3 - reference value for 1p.u. is 20kV

#### Short-circuit requirements

1. In accordance with **Article 14, paragraph 1** of Regulation 2016/1388, information on the maximum short circuit current values at the transmission network connection points shall be published and maintained by TSO on its website.
2. In accordance with **Article 14, paragraph 2** of Regulation 2016/1388, TSO shall perform calculations of maximum and minimum short-circuit currents and information on these currents shall be included in the technical regulations for grid connection.
3. In accordance with **Article 14, paragraph 4** of Regulation 2016/1388, the proposed maximum short circuit current limit value for an installation shall be indicated by the demand facility owner or distribution system operator in the grid connection application documents or in the permissible load increase application documents.

#### Reactive power requirements

1. In accordance with **Article 15, paragraph 1** of Regulation 2016/1388, demand facilities and the distribution systems connected to the transmission system must be able to maintain stable operation at their connection point in the reactive power range in accordance to following requirements:
	1. for transmission system connected demand facilities the actual reactive power range for imports and exports must not exceed 48% of their maximum import capacity or maximum export capacity (whichever is the greater) or to exceed the active capacity ratio of 0.9 for import or export;
	2. for transmission system connected distribution systems the actual reactive power range for imports and exports shall not be wider than:
		1. 48% (i.e., power factor 0.9) of the maximum import capacity or maximum export capacity (whichever is greater) during the import/consumption of reactive power; and
		2. 48% (i.e., a power factor of 0.9) of the maximum import capacity or maximum export capacity (whichever is greater) during the period of reactive power export (production).
2. Notwithstanding the requirements for reactive power set forth in **Article 12**, a fee for the import or export of reactive energy may be applied for transmission connected demand facilities and distribution systems connected to the transmission system in accordance with the regulatory enactments of the Republic of Latvia.

#### Relay protection and protective automatics requirements

1. In accordance with **Article 16, paragraphs 1 and 4 and Article 17, paragraphs 1 and 3** of the Regulation 2016/1388, TSOs shall respect the following principles when defining the settings of the relay protection and protective automation devices:
	1. Relay protection and automation settings and actions for the transmission system connection equipment (up to the connection point) where the demand facilities or distribution systems are connected to the transmission system are determined by the TSO;
	2. The relay protection and protective automation settings and actions for the demand facility equipment connected to the tranmsission system or for the distribution system equipment connected to the transmission system are defined by the respective owners of the connected equipment;
	3. The TSO equipment, the demand facility equipment connected to the transmission system and the distribution system equipment connected to the transmission system must be equipped with relay protection and protective automatics, which operate at various types of contingencies: short circuits, unacceptable current overloads to the equipment, phase-assymetric operating modes, unacceptable over-saturation modes (U/f function) of transformers and auto-transformers, at unacceptable overvoltages, at the non-synchronous operation of transmission networks, at unacceptable assymetric modes of load current;
	4. Demand facility equipment connected to the transmission system and distribution system equipment connected to the transmission system must be provided with the main relay protection and the reserve relay protection. Relay protection that protects the connection from various types of short-circuits without time-delay or, which is the only protection for the said connection from a particular type of interference is regarded as the main relay protection. Reserve relay protection is providing the back-up protection for the equipment connected at the connection point in case of failure of the main relay protection;
	5. For the TSO equipment relay protection and automation settings and actions are determined in TSO relay protection and automation setting cards;
	6. The owners of demand facility equipment connected to the transmission system and the owners of the distribution system connected to the transmission system must provide the automation performing automatic load rejection at frequency deviation and automatic load rejection at the voltage deviation with the automatic reclosure upon the frequency and voltage restoration. The settings of both automations and the volume of the interruptible load shall be determined by the TSO, by agreeing on the capacities with the owner of the equipment, taking into account the requirements of **Article 18**;
	7. The TSO and the owner of the connected equipment mutually co-ordinate the relay protection and automation settings and their effect on the connection point equipment to ensure their mutual selective operation at the disturbances in the transmission network and in the owner's equipment described in **Article 13, paragraph 3**;
	8. Both TSO and owner relay protection without time-delay must disconnect short circuits, causing a decrease of phase-to-ground voltage or phase-to-phase voltage down to 0.6Unom or below at the connection point;
	9. For connection point equipment 110kV and 330kV circuit breakers, for intermediate and low voltage circuit breakers of transformers and auto-transformers circuit-breaker failure protection must be provided with a tripping time setting of no more than 0.15s;
	10. The relay protection settings must be selected to ensure the thermal resistance of the connection point equipment to short circuits, the elimination of inadmissible over-excitation (voltage/frequency parameters) of transformers and auto-transformers and the disconnection of the currents above the permissible rating of respective equipment.

#### Information exchange

1. In accordance with **Article 18, paragraphs 1, 2 and 3** of Regulation 2016/1388, the information exchange standards and the data to be submitted shall be posted and maintained on the TSO web site.

#### Demand disconnection and demand reconnection

1. In accordance with **Article 19, paragraph 1** of Regulation 2016/1388, which concerns demand disconnection at low frequency, all demand facilities connected to the transmission system and all distribution systems connected to the transmission system must be equipped with an installation capable of automatically disconnecting 100% of the actual load at a reduced frequency and disconnection logic based on low frequency, as well as on low frequency and frequency variation speed combinations. The device must provide the ability to change the operation settings in the range 47-50Hz with a step not exceeding 0.05Hz. This equipment must activate this function to at least 65% of the actual load. Settings and Effects of the equipment are defined by PSO, in coordination with the transmission system connected distribution system operators or the owners of the demand facility connected to the transmission system, and indicated in the relay protection and automation setting cards.
2. In accordance with **Article 19, paragraph 2** of Regulation 2016/1388, in relation to the functional abilities to disconnect the demand at low voltages, demand facilities connected to the transmission system and distribution systems connected to the transmission system must be equipped with an equipment capable of automatically disconnecting 100% of the actual load at low voltage This equipment must activate this function to at least 65% of the actual load, if the voltage at the connection point is less than 0.9p.u. Settings and Effects of the equipment are defined by PSO, in coordination with the transmission system connected distribution system operators or the owners of the demand facility connected to the transmission system, and indicated in the relay protection and automation setting cards.
3. In accordance with **Article 19, paragraph 4** of Regulation 2016/1388, for all demand facilities connected to the transmission system and distribution systems connected to the transmission system, conditions regarding the ability to re-connect after disconnection or disconnection, are specified by the TSO in the relay protection and automation setting cards, in accordance with the following principles:
	1. the automatic re-connection of the demand facility and distribution system is permitted when the frequency at the connection point is in the range from 49.0Hz to 51.0Hz and the voltage at the connection point is within the range corresponding to the "unlimited" operation mode described in **Article 7,** and **Article 8**;
	2. the time settings for re-connection of demand facilities and distribution system connections are defined by the TSO so that the voltage restoration at the connection point will occur after the fault in the transmission network has been cleared;
	3. when installing the connection, the owner of the demand facility and the distribution system operator must provide all the necessary equipment to ensure the provision of requirements defined in points **18.1** and **18.2**.

#### Power quality

1. Pursuant to **Article 20** of Regulation 2016/1388, the owners of demand facility connected to the transmission system and the operators of distribution system connected to the transmission system shall ensure that their connection to the network does not cause certain disturbances or fluctuations in the network supply voltage at the connection point in accordance with the standard LVS EN 50160.

**Operational notification procedure**

1. In accordance with **Article 22, paragraph 3** of Regulation 2016/1388, information on the procedure for the declaration of service is published by TSO on its website.

#### Special requirements for connection of demand units providing demand respone services for active power control, reactive power control and mitigation of transmission congestions.

1. In accordance with **Article 28, paragraph 2** of Regulation 2016/1388, demand units providing a demand response for active capacity control, demand response for controlling reactive power, or demand response to mitigate transmission constraints, either individually or collectively, in case the unit is not the part of a demand facility connected to the transmission system, as a third party established part of the demand unit must meet the following requirements:
	1. In accordance with Article 28, paragraph 2, sub-point c) of Regulation 2016/1388, it must be capable of operating throughout the normal voltage range of the system at the connection point as specified in paragraphs 7 and 8;
	2. In accordance with Article 28, paragraph 2, sub-point f) of Regulation 2016/1388, it must be possible to adjust its demand capacity during the period specified in the Baltic Balancing Market Rules.
	3. In accordance with Article 28, paragraph 2, sub-point i) of Regulation 2016/1388, the notification procedure for modification of the demand response shall be indicated in the service contract.
	4. In accordance with **Article 28, paragraph 2, sub-point k)** of Regulation 2016/1388, regarding the rate of change of frequency withstand capability, demand units are able to remain connected to the network and operate until the protection of the network voltage loss trips them. As the network voltage loss protection one should use the frequency deviation speed protection with a set point of 2.5Hz/s. The measurement time interval should not exceed 500ms.

#### Special requirements for connection of demand units providing demand response services for system frequency control.

1. In accordance with **Article 29, paragraph 2, sub-point d)** of Regulation 2016/1388, the frequency response dead-band is ± 200mHz.
2. In accordance with **Article 29, paragraph 2, sub-point e)** of Regulation 2016/1388, the maximum frequency deviation to respond to is -1.0Hz and + 1.5Hz from the nominal value of 50.00Hz.

#### Compliance testing and comissioning

1. Compliance tests should be carried out in accordance with Regulation 2016/1388. Additional requirements are not specified by SO and TSO. Compliance tests and the procedure for their implementation are set out in the Decision of the Public Utilities Commission of June 26, 2013, No. 1/4 "Network Code".
2. The commissioning must be carried out in accordance with Regulation 2016/1388. Additional requirements are not specified by SO. Commissioning should be carried out in accordance with the Decision No. 1/4 of the Public Utilities Commission of June 26, 2013, "Network Code" and Decision No. 1/6 of the Council of the Public Utilities Commission of 22 February 2012 "System Connection Requirements for Electricity Producers". Additional requirements are not specified by SO.

#### Final provisions

1. SO and TSO, in accordance with the requirements of **Article 6, paragraph 7** of Regulation 2016/1388, is entitled to submit changes to these requirements to the Public Utilities Commission.
2. The TSO reviews this Document for all demand systems connected to the transmission system, distribution systems (also existing ones) connected to the transmission system that affect the frequency stability if the power transmission system synchronization area in Latvia changes. All required changes to this document are submitted by TSO`s to the Public Utilities Commission for approval.