|  |
| --- |
| **I APPROVE:** |
| Director of the Transmission Network Department   |  | | --- | |  | | *(name, surname, signature)* | |  | | *(date)* | |

DESIGN TASK

"RECONSTRUCTION OF THE 110/10 KV NEMENČINĖ TS 110 KV SWITCHYARD"

**INVESTMENT PROJECT NO. PPRV19063**

**CONTENT**

[1. GENERAL INFORMATION 3](#_Toc160347410)

[2. COMPOSITION OF THE PROJECT TEAM 3](#_Toc160347411)

[3. GENERAL REQUIREMENTS 5](#_Toc160347412)

[4. PART ON CONSTRUCTION 8](#_Toc160347413)

[5. PART ON ELECTRICAL ENGINEERING 11](#_Toc160347414)

[6. PART ON ELECTRICITY TRANSMISSION LINES 18](#_Toc160347415)

[7. PART ON RELAY PROTECTION AND AUTOMATION 19](#_Toc160347416)

[8. PART ON PROCESS MANAGEMENT AND AUTOMATION 25](#_Toc160347417)

[9. PART ON COLLECTION AND TRANSMISSION OF TELEINFORMATION 30](#_Toc160347418)

[10. PART ON ELECTRONIC COMMUNICATIONS (TELECOMMUNICATIONS) 32](#_Toc160347419)

[11. PART ON ELECTRICITY METERING AND MEASUREMENTS 36](#_Toc160347420)

[12. PART ON SECURITY ALARM 39](#_Toc160347421)

[13. PART ON ENVIRONMENTAL PROTECTION 41](#_Toc160347422)

[14. PART ON FIRE SAFETY AND OCCUPATIONAL SAFETY 42](#_Toc160347423)

[15. ANNEXES 43](#_Toc160347424)

# GENERAL INFORMATION

|  |  |
| --- | --- |
| **Title of the project** | Reconstruction of the 110/10 kV Nemenčinė TS 110 kV switchyard |
| **Project number** | **PPRV19063** |
| **Project preparation stage** | "Up to the key" (preparation of technical and work design) |
| **Project manager** |  |
| **Initiator** |  |
| **Type of construction** | Reconstruction/new construction |
| **Category of structures** | Special structure |
| **Address of the transformer substation** | Bažnyčios str. 25, Nemenčinė, Vilnius district municipality |

# 

# GENERAL REQUIREMENTS

* 1. The technical design shall be prepared and formalized in accordance with this design task, the Law on Construction, STR 1.04.04:2017 “Design of a Building, Expert Examination of a Design”, LST 1516:2015 “Design of a Structure”. General requirements for formalization and the provisions of other normative documents and rules regulating construction and design in force in the Republic of Lithuania, as well as the connection/technical conditions and/or special requirements set by the relevant authorities.
  2. In all cases, the technical and detailed design must be prepared as separate projects.
  3. The standard specifications attached to this design brief must be followed in the preparation of the technical design.
  4. The tables of the technical specifications of the technical project must be drawn up in accordance with the requirements of LITGRID AB (hereinafter - TSO) for the drawing up of the technical specifications of the technical project (see Annex (1)).
  5. The Contractor shall carry out all necessary works related to the preparation of the technical project, including, but not limited to, obtaining connection/technical conditions, special conditions from AB “Energijos skirstymo operatorius” (hereinafter - AB ESO) and third parties, carrying out engineering studies, and obtaining the building permits for the construction of the special structure on behalf of TSO.
  6. The connection/technical conditions issued by AB ESO to be taken into account during the design process are given in the Annex (2).
  7. In accordance with the technical regulation STR 1.04.04:2017 "Design of a Building, Expert Examination of a Design" and the technical requirements, it is mandatory to prepare a technical design with clearly marked cable routes and laying methods, switching nodes, equipment, grounding and wiring drawings, calculations, and connection diagrams of cables, structures and equipment. If necessary, the designer shall carry out the necessary engineering, geodetic, geological, geotechnical and other surveys, measurements and documentation at his/her own expense.
  8. The technical design of the TSO part shall describe the sequence and phasing of the project. The detail of the phases and durations of the contract works and the sequencing of the works shall be at a level that makes clear the scope and indicative durations of the disconnection of the operational facilities of the part of the transmission network (hereinafter - TN) to be disconnected and the durations of the phases indicated. The scope of disconnections shall be coordinated with the TSO during the preparation of the technical project of the TSO’s part of the electricity transmission network.
  9. The pre-construction and construction organisation part of the project, which includes basic information on the sequence of works, the necessary disconnections of existing installations and the estimated duration of the individual phases, must be carried over to the parts of the technical design that will be coordinated with the third parties that have issued the connection/technical conditions. Take into account the connection/technical conditions issued by third parties in the design.
  10. The Designer’s sequencing of works shall be based on the principle that the disconnection of existing electrical installations shall be carried out to the minimum extent and within the minimum time limits. For the purpose of assessing the deadlines, the timetable for human resources and technical capacity must also be included in the Construction organisation section of the technical design.
  11. In SO part of the technical design of the part of the TA, identify the works (including works in other related TS) to be carried out without disconnection, with disconnection, indicating the extent and duration of disconnections.
  12. The technical project of PT part (the organisation of construction works part) shall be agreed in writing with the AB ESO Mode Planning Division, Dispatching Management Department.
  13. The designer shall primarily be guided by the following in the sequencing of works:
      1. Ensure uninterrupted power supply through the 110kV OL Neris-Paberžė and Neris-Pabradė throughout the reconstruction;
      2. Provide for the disconnection of the existing 110kV OL Neris-Paberžė and Neris-Pabradė interconnections and, upon completion of the works, for the restoration of the integrity of the interconnections due to the retention of the transit of the above-mentioned overhead lines for the entire duration of reconstruction. The implementation of the measure will be decided after the contractor has coordinated the schedule of disconnections with the TSO and AB “Energijos skirstymo operatorius”. The separation and restoration of integrity shall be carried out by the line reconstruction contractor at his own expense;
      3. Simultaneous, long-term disconnection of 110kV OL Neris-Paberžė and Neris-Pabradė is not possible. Should such a need arise, the contractor will have to reasonably demonstrate that there is no other technical possibility to carry out the scope of work envisaged.
      4. During the preparation of the technical design of the PT part, the technical conditions for the reconstruction of the 110/10kV Nemenčinės TS issued by AB "Energijos skirstymo operatorius" were fulfilled.
  14. The technical design specifies that the contractor for the execution of the PT part of the works shall be responsible for the preparation of a schedule for the works-disconnection of the reconstruction of the site and its coordination with the TSO. A detailed schedule for the reconstruction works-disconnections shall be agreed at least 90 calendar days before the start of the on-site works. The Contractor shall update the schedule of works-disconnections and re-negotiate any changes in the progress and/or timing of the works within more than 1 month. A standard form-sample of the Works-Disconnections Schedule is available in Annex (3).
  15. The technical design of the PT part specifies that the contractor is obliged to submit to the TSO the disconnection needs for the next calendar year in the scope and within the timeframe set out in the Regulations on the Dispatching Control of the Electricity System and the internal rules of procedure of LITGRID AB (for the installations of the 330 kV part - by 1 August of the current year for the next year, for the installations of the 110 kV part - by 30 October of the current year for the following year).
  16. The technical design of the PT part specifies that the contractor is obliged to submit to the TSO the disconnection requirements for the next calendar month in the scope and within the deadlines set out in the Regulations on Dispatching Electricity System Management and the internal rules of procedure of LITGRID AB (for the installations of the 330 kV part - by the 1st day of the month of the month in question for the next month, and for the installations of the 110 kV part - by the 10th day of the month of the month of the month in question for the following month).
  17. The technical design of the PT part shall specify that any failure to coordinate with the TSO the timing of unscheduled disconnections (i.e. disconnections that do not correspond to the dates of the approved reconstruction works-disconnections schedule or that were not provided for in the reconstruction works-disconnections schedule, or that the Contractor did not provide the TSO with the information in accordance with the requirements of clauses 3.15 and 3.16 of this Chapter), the failure to coordinate the timing of the TSO, or the failure to disconnect the electrical installations at the time requested, shall not be deemed to be a disruption of the project for the TSO. Such unscheduled disconnections will not take priority over other work in the TSO's annual and monthly schedules.
  18. The technical design of the PT part of the project shall provide for the organisation of training for representatives of the TSO and for the operational personnel involved in the operational management of the equipment part of the TSO's facilities on site. The training shall be carried out on-site, with the number of sessions and dates to be determined by coordinating the works-disconnections schedule.
  19. It should be noted in the technical design that when organising works on the overhead lines of the transmission network, where disconnection and earthing of 0.4-35 kV overhead lines is required, the employees (contractor) carrying out the works shall draw up a schedule of the works to be carried out, which is to be agreed upon with the TSO and the AB ESO 20 days in advance prior to the start of the works. Upon receipt of a coordinated, approved schedule and an application for disconnection of 0.4-35 kV overhead lines from the TSO, the operational staff of AB ESO shall coordinate the time of disconnection with the consumers (if necessary). When the TSO contractors carry out works on the TSO overhead lines, the grounding, removal and installation of the crossing 0.4-35 kV overhead lines is carried out by AB ESO contractors. The 0.4-35 kV crossing OL disconnection schedule form is available in Annex (4).
  20. The commissioning of reconstructed or newly installed equipment may only be carried out in accordance with an approved one-off commissioning programme, in the presence of representatives of the Contractor and LITGRID AB RPA, and only on working days and during working hours (1 working day for commissioning). The commissioning programme shall be prepared by the Contractor and coordinated with TSO and other interested parties.
  21. In the technical design it should be The Contractor shall prepare and coordinate with the TSO the operational maintenance instructions for the RPA facilities and the standard switching sheets/programmes, and organise the testing of the automated standard switching sheets with the TSO dispatch control system (hereinafter - DCS), prior to the completion of the site by the Site Completion Committee, or by individual stages (depending on the detailed works-disconnections schedule). Standard switching sheets shall be drawn up for all new installations (circuit breakers, busbars, main circuit breakers and busbar protectors). Typical switching programmes are drawn up for transmission lines. Standard switching sheets and programmes are drawn up separately for disconnection/switch off and switch on. The list of sheets and programmes is agreed separately with TSO. The sheets and programmes, prepared and agreed by signature with the TSO System Management Centre (primary commutation) and the Infrastructure Maintenance Centre RPA personnel (operations in secondary circuits), shall be submitted to the TSO System Management Centre in hard copy (with signatures) and in \*.docx format on computer media in Lithuanian language.
  22. The technical design shall provide for the contractor's responsibility and shall be part of the scope of the project:
      1. the organisation of the participation of TSO representatives (at least 3 persons for each area) in the factory tests of 110 kV main primary electrical equipment, transmission line elements, the installation of outdoor intermediate terminal blocks and RPA indoor cabinets, theTeleinformation collection and transmission device (hereinafter - TCTD) and the telecommunication equipment, including any necessary participant's fees other than travelling expenses and accommodation costs, which will be covered by the TSO itself. The list shall take into account the list of the TSO requirements for the drafting of technical specifications for a technical project (see Annex (1)) in Table 1 "Main equipment";
      2. Organisation of the participation of TSO representatives (minimum 2 persons per domain) in the operational training of 110 kV main primary electrical equipment, transmission line elements, RPA microprocessor devices, TCTD**,** and projected active telecommunication equipment and related software at authorised manufacturer's training centres, including any necessary participation fees, excluding travel and accommodation costs, which will be covered by the TSO. The list shall take into account the list of the TSO requirements for the drafting of technical specifications for a technical project (see Annex (1) in Table 1 "Main equipment". Participation in factory testing and training will be decided by the TSO, as appropriate, once the contractor has been informed of the specific time and location of the tests;
      3. Arranging for the participation in training of TSO representatives and TSO contractor employees performing operational management services for the TSO part of the equipment on site. The number and dates of the training sessions shall be determined in the work schedule.
  23. The technical design of the project must be agreed with the TSO and ESO AB or the third parties that issued the connection/technical conditions. Submit one copy of the technical design in a digital version on computer media (CD, DVD, USB, etc.) for review. The completed and agreed technical design shall be submitted to the TSO in 2 hard copies (one of which shall be marked "Original" and shall bear the original signatures of the heads of the parts of the project and of the project manager, and shall be authenticated by the original stamp, and shall be accompanied by a copy of the original), and in a digital version on a computer medium (CD, DVD, USB, or similar). The pages of each part of the technical project shall be numbered consecutively, and each part of the technical project shall contain a table of contents and a list of the composition of the technical project documents. The requirements for the composition of the technical designs are attached in the Annex (5).
  24. The digital information of the design documentation shall be provided in \*.pdf format, the estimate and the consolidated schedule of works in \*.xls format, and the drawings, diagrams and plans in \*.dwg format. The titles of the parts of the technical design and the order in which they are arranged on the computer medium shall be identical to the printed original of the technical design.
  25. The technical design shall include a three-dimensional layout plan of all installations and buildings and drawings of all connecting cross-sections.
  26. In the technical design, design the switchgear facilities and buildings with minimal development and land enclosure. The external fence of the substation shall be designed taking into account the land area required for the expansion of the substation, if the need for expansion is specified in the design task, and maintaining safe distances in accordance with the requirements of the electrical installation code, and taking into account the requirements of the structural and electrical engineering sections of this design task.
  27. A copy of the design brief must only be included in the General part (file) of the technical design.
  28. The technical design shall include copies of the TSO responsible persons' agreement sheet for each part of the project (file).
  29. The technical design prepared for the individual parts of the project (files) of third parties and AB ESO shall include copies of the technical design approvals of these third parties and of the AB ESO part.
  30. The explanatory note of the technical design shall stipulate that the detailed lists of documentation to be submitted for the technical assessment of the reconstruction/construction of the 110 kV switchyard and for the completion of the construction shall be included in each part of the project file for each of the parts of the work project to be drawn up in accordance with documents of TSO No. NU-347 of 19/12/2014, "Requirements for the documentation to be submitted to the commission for the technical assessment of the works of the construction/construction of the energy object" (see Annex (6)) and No. NU-347 of 19/12/2014 "Requirements for documentation to be submitted to the construction completion commission for the construction/reconstruction of the energy facility" (see Annex (7). Detailed documentation lists must be agreed with TSO.
  31. Ensure compliance with the Information Security Requirements for Design and Implementation (see Annex (8)).
  32. Ensure compliance with information security requirements for the provision of services (see Annex (9)).

# PART ON CONSTRUCTION

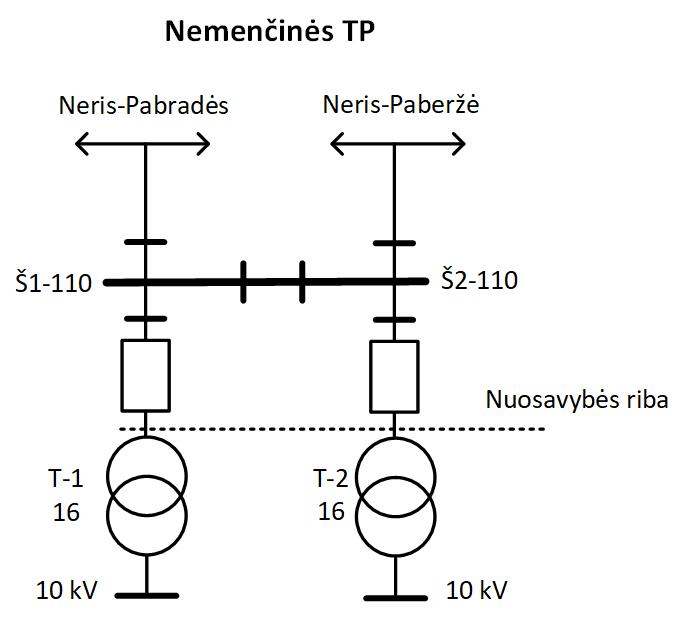
* 1. Before construction/installation work begins, the boundaries of the land shall be marked in accordance with the current "Rules for Marking the Boundaries of Land". The types of boundary markers shall be selected in accordance with the "Standards for boundary markers" approved by the National Land Service under the Ministry of Environment. Height of the boundary marker above the ground ≥20 cm. Where the boundary of the plot does not coincide with the fencing of the plot, a protective reinforced concrete post with an information board and the inscription "LITGRID AB" shall be erected next to the boundary marker. The minimum height of the column above ground level is 100 cm.
  2. The vegetation layer on the site shall be removed and stored prior to the commencement of construction works.
  3. Design work is carried out according to: Building Standard RSN 156-94 “Building Climatology”; Building Technical Regulation STR 2.05.04:2003 “Effects and Loads”; Building Technical Regulation STR 2.05.08:2005 “Design of steel structures. General Provisions”; Building Technical Regulation STR 2.05.05:2005 “Design of Concrete and Reinforced Concrete Structures”; Building Technical Regulation STR 1.04.04:2017 “Building Design, Expert Examination of a Design”; Lithuanian Standard LST EN 1992-1-1:2005 “Eurocode 2. Design of reinforced concrete structures. Part 1-1. General and building regulations”; Lithuanian standard LST EN 1993-1-1:2005 “Eurocode 3. Design of steel structures. Part 1-1. General and building regulations”; Lithuanian standard LST EN 1997-1:2005 “Eurocode 7. Geotechnical design. Part 1. Basic rules”; Lithuanian standard LST EN 1997-2:2007 “Eurocode 7. Geotechnical design. Part 2. Exploring and testing the substrate“. The minimum number of tests per substation shall be one test borehole per 20 acres, but not less than two test boreholes in the case of small-area substations; the Lithuanian standard LST EN 1536:2011 "Performance of special geotechnical works. Drilled piles”; Lithuanian standard LST EN 12699:2003 “Special geotechnical works. Shoring piles” and in accordance with other applicable national standards. The foundation anchor bolts shall comply with the requirements of LST EN ISO 17660-1:2006 and the anti-corrosion coating shall comply with the requirements of LST EN 2063:2005 (thermal spraying). The current version of the standard shall be used for design.
  4. The foundations to be designed in reinforced concrete, standard type, factory-made, precast. In exceptional cases, reinforced concrete foundations may be drilled or piled, depending on the hydrogeological conditions. The top elevation of the reinforced concrete foundation must be at least 20 cm above ground level. The standard technical requirements for foundations are given in the Annex (10)).
  5. Design separate supporting steel metal structures for each primary switching unit. The design of different types of installations on a common supporting metal structure with common foundations is only permitted if it is not possible to design otherwise (see Electrical Engineering part).
  6. The steel metal structures supporting the 110 kV open switchyard (hereinafter - OS) equipment and other steel metal structures shall be designed in accordance with the standard technical requirements in the Annex (11).
  7. The corrosion protection of steel structures supporting 110 kV OS equipment and other steel metal structures shall be designed in accordance with the standard technical requirements for hot-dip galvanising of steel structures given in the Annex (12) (the concreted part of the anchor shall not be galvanised).
  8. Design a new modular - frame substation control panel (hereinafter - SCP) for the OS, in full factory completion, assembled on site from individual modules. Single pitch roof for the installation of photovoltaic modules. The angle and direction of the slope are chosen for maximum efficiency of the photovoltaic modules. The entrance to the SCP is planned to be through the 110 kV switchyard area. Ensure access to the SCP standard technical requirements for the SCP are given in the Annex (13).
  9. Installation of an automatic heating/ventilation/air-conditioning system capable of maintaining an indoor air temperature between +10oC and +25oC. The standard technical requirements for air conditioners and their connecting parts are given in the Annex (14).
  10. The SCP shall be designed within the territory of the TS taking into account the minimum cabling distance to the installations, unless otherwise specified. A parking area for one car shall be provided adjacent to the SCP building, either on asphalt or concrete paving. A concrete pavement shall be installed for pedestrians along the SCP. Use standard factory solutions for cable routing to the SCP to protect the cabinet from frost and rodents. The cable entry system shall be agreed with the Developer at the time of preparation of the detailed design.
  11. Cables are routed from the SCP to the plant structures in cable ducts or, in some cases, in plastic pipes for short distances (up to 10 metres) in the ground. Cable ducts above ground or buried g/b, covered with g/b panels. The type of cable ducts (overhead or buried) shall be selected on the basis of an assessment of the number of cables and in accordance with the Rules for the Installation of Electrical installations in switchyards and substations (minimum distances between live conductors and insulation elements and the fixed enclosures). Fire barriers in g/b ducts shall be designed in accordance with the requirements of the General Rules for the Installation of Electrical Equipment (hereinafter - GRIEI), and g/b products shall comply with the requirements of the LST EN 13369 standard and the TSO ttandard technical requirements (see also Annexes (15) and (16)). Use special protective plastic conduits resistant to solar radiation and environmental influences for the routing of cables from the individual open switchyard equipment (hereinafter - OSE) drive or the intermediate terminal cabinet to the nearest reinforced concrete conduit. Cable protection pipes and interconnection systems shall comply with the requirements of LST EN (IEC) 61386-24. The diameter of the pipes shall be chosen according to the actual number of cables to be laid, taking into account additional cables to be laid in the future. The ends of the cable protection tubes shall be sealed at the drives and terminal cabinets with environmentally resistant sealing materials. The standard technical requirements for protective pipes for low voltage cables installed outdoors and in the ground are given in the Annex (17).
  12. The service areas shall be surfaced with concrete paving stones with grass verges (to be installed at the height of the surfacing) at least 1 metre from the horizontally protruding parts of the gears of the switches in a rectangular shape.
  13. Depending on the mounting height of the equipment to be serviced, a fixed metal service platform shall be provided when the control of the switchgear is not accessible from the ground. The metal service area is fenced on three sides with railings. Dimensions from the horizontally projecting structures of the switch gears (taking into account the swinging gear doors) not less than 1 metre, rectangular. The standard nodes of the site plan design solutions are set out in the Annex (18).
  14. The access roads to the 110 kV switchyard shall be designed to accommodate a mobile high voltage equipment laboratory. The laboratory trailer is 4.0 m high, 2.5 m wide, 13 m long and weighs 30 t.
  15. The entire area under live installations shall be constructed of crushed stone on a frost-resistant layer (hereinafter - FSL). The minimum thickness of the FSL layer is 0.3m. Crushed stone fraction fr.0/32 mm. or fr.16/32 mm. (to be adjusted during the preparation of the technical design). Geotextiles are used to protect against vegetation when installing crushed rock pavement. All remaining undeveloped land, including that of other land users and owners, on which works (e.g. construction of overhead line pylons) are to be carried out, shall be planted with perennial, low-growing, slow-growing grasses. The standard technical requirements for the surfacing of open switchyard areas are given in the Annex (19).
  16. . The territory shall be designed to adapt to the existing surface unless otherwise specified in the design task. Wherever possible, a minimum one-sided or gradual slope shall be provided to ensure that surface water runoff is discharged off-site.
  17. In the areas of dismantled structures, the ground surface shall be levelled, the excavations shall be backfilled with local or imported soil to restore the integrity of the pavement and compacted where necessary. The works shall be carried out in accordance with STR 1.06.01:2016 “Construction works. Supervision of construction” and ST 121895674.06:2009 “Excavation and site preparation works”.
  18. Drainage is designed and connected to the network as required, including the preparation and approval of connection conditions. If there are drainage networks in the substation area, the drainage shall be channelled into them. Drainage shall be provided around the SCP. Water from the roof of the designed SCP is channelled into the drainage system through a system of tin gutters and concrete spouts. Surface water is removed from the site by means of a surface water collection system and open gradients. Submit a hydrogeological survey report at the time of preparation of the technical project.
  19. The fence of the switchyard shall be designed with a height of 1.8 m, with galvanised metal posts on a concrete foundation, a reinforced concrete plinth and welded mesh panels. Minimum plinth height 60 cm. The minimum depth of the plinth slab is 10 cm. The standard technical requirements for the switchyard fence are given in the Annex (20). Interconnect the outer fence, within the property and property service boundary of Litgrid and ESO, via an isolation gap.
  20. The substation area shall be provided with a fixed single g/b toilet with a sealed suction g/b tank of at least 1,5 m in diameter with a suction pump. Protection against the ingress of surface water into the reservoir. Access to the toilet is via a concrete path. A concrete paving area around the toilet shall be built. The minimum width of the pavement is 50 cm. The maximum distance between the toilet and the carriageway is 4 m.
  21. According to the "List of Regulated Construction Products" approved by the Ministry of Environment of the Republic of Lithuania, the construction products used in the construction of the facility must have certificates issued by designated notified bodies.
  22. Manage waste generated during construction in accordance with the requirements set out in the section “Part on environmental protection”.
  23. Provide for vegetation (brush clearance) and landscaping throughout the site or within 2 metres of the fence on the outer side of the fence if the fence coincides with the boundaries of the plot.
  24. In the site layout (site plan) part of the site plan, design an informative explanatory stand at the main entrance to the site. Information on the stand:
      + the name of the customer;
      + designer;
      + name of the contractor;
      + name, surname, contact Tel. of the construction manager;
      + name, surname and contact Tel. of maintenance manager
      + project start and completion dates.

The information on the stand shall be easily legible from a distance of 5 m.

* 1. Design the restoration of the roads, access roads and adjacent land used during the project to the original design situation. In case of damage to road surfaces, structures and underground communications belonging to ESO - to rebuild them, and to provide a geodetic reconnaissance photo.
  2. Provide for the dismantling of the existing 110 kV gantries (located on the ESO side).
  3. Maintain the height of 110 kV hard busbars at least 6 metres from the road surface;
  4. Preserve, without damaging, the existing ESO sewage tanks.
  5. to coordinate the designs and solutions for the ESO part of the project with ESO, and to transfer the coordinated designs to ESO free of charge.
  6. Bird protection must be installed on the portals.

# PART ON ELECTRICAL ENGINEERING

1. 1. The principle diagram of the 110 kV part of the substation after reconstruction is shown in Figure 1.



***Figure 1.*** *110/10 kV Nemenčinė TS principle diagram after reconstruction.*

1. 1. Maintain the existing property line on the 110 kV terminals of the power transformers.
   2. The layout of the primary installations must be designed to make optimal use of the substation site.
   3. Select a maximally functional and technically economically viable 110 kV switchyard layout for the design. The design shall avoid as far as possible high-voltage electrical bridges, crossings of OL leads or busbars in different planes, and any other non-standard solutions that may impede operation, the transmission of electricity or endanger operating personnel. The principle scheme after reconstruction/new construction shall be as close as possible to the principle scheme in the design task/conditions. The uniformity of the equipment and installation solutions shall be maintained in all substation connections, unless LITGRID AB agrees to a different solution. During the design phase of the construction of the facility, if necessary, provide for temporary technical and organisational measures to meet all the requirements of LITGRID AB and third parties with regard to the phases of implementation of the project, as well as to the possibilities and deadlines for switching off the high-voltage equipment. Such measures may include: additional temporary supports, shunting bus bridges, use of temporary cable ties, etc. Any additional organisational and technical measures must be assessed and included in the project scope. LITGRID AB will not additionally cover the costs incurred as a result of the use of these temporary solutions, if such measures are required in the course of project implementation.
   4. Provide access to all substation equipment and structures. In open switchgear, the circuit breakers shall be provided with a pathway for installation, repair machinery and equipment and portable laboratories.
   5. The project shall provide information on the climatic conditions of the region, including the thickness of the insulation wall and wind speed, and specify these parameters in the technical specifications of the primary installations.
   6. The entire 110/10 kV Nemenčine TS 110 kV switchyard is being reconstructed. During the renovation, all the original equipment is being replaced with new equipment. During the reconstruction of the Nemenčinė TS 110 kV switchyard, the following existing equipment shall be transferred to the emergency reserve of LITGRID AB (see Annex (21)).

Equipment to be transferred to the emergency reserve shall be tested in accordance with the requirements of the PT Equipment Testing Regulation before dismantling. The test reports shall be submitted to the customer together with the equipment to be placed in reserve. All other primary equipment not mentioned in the above paragraph and in the list shall be dismantled and disposed of.

* 1. Design linear gantries with tensioned garlands to lead overhead lines to the switchyard facilities. The gantries shall be designed so that the height of the 110 kV wires from the ground surface along the entire section from the gantries to the terminal support of the overhead line shall be not less than 7 m at the maximum deflection of the wires.
  2. Only cable couplings (if designed) with surge arresters shall be permitted on a single support structure. The installation of other facilities for different purposes on the same support structure is prohibited.
  3. The colour of the insulators of all primary installations must be uniform in design. The standard colour of the isolators is brown. The only difference is in the colour of the surge arresters, whose polymer colour remains grey.
  4. 110 kV disconnectors and their earthing knives shall comply with TSO standard specifications. The actuators of the divider and earthing switches mounted on a single structure shall be equipped with electrical and mechanical interlocks to prevent manual switching of the motors of the divider or earthing switch actuators in the presence of the earthing switch or the divider, respectively. The mounting height of the splitters and fixed earth knife drives shall be such that their operation and maintenance/servicing can be carried out without the use of lifting equipment. Stationary earthing knives shall be used for earthing overhead lines, 110 kV busbars and power transformers. The standard technical requirements for 110 kV isolators are given in the Annex (22).
  5. 110 kV gas switches must comply with the TSO standard technical requirements. The location of the equipment must take into account the possibility of service platforms near the switch drives. When selecting circuit breakers, preference shall be given to circuit breakers with a drive height such that servicing can be carried out from ground level without the need for lifting equipment. If the design of the circuit breaker is not able to do so, fixed service bays for circuit breaker drives shall be provided. The technical design shall state that the sites shall be designed as part of the detailed design of the work, taking into account the safe distances between people and live parts in accordance with the requirements of the EICfor switchgear and substations and the Rules on safety in the operation of electrical installations, and taking into account the specific type of circuit breaker. It must be taken into account that ascent to the platforms during operation is required without disconnecting the voltage. The service platforms, their height and the distance from the base of the platform to live parts shall be shown on the works design drawings. The distance from the base of the platform to the lower edge of the isolator shall be not less than 2,5 m. The platforms (if provided) shall give easy access to all the indications of the actuator (gas pressure, position of the circuit breaker, indications of the status of the springs, the operation counter, the data table, etc.), which are subject to inspection during operation, as well as to the subassemblies and elements which may require minor repairs or replacement. The standard technical requirements for 110 kV SF6 gas switches are given in the Annex (23).
  6. The supply voltage to the control and operational circuits of the installations shall be 110 V DC; the use of other voltages shall be justified by technical and economic calculations.
  7. Design surge arresters to protect equipment against surges. The number, characteristics and location of surge arresters in a 110 kV switchyard shall depend on the number and location of the surge-sensitive equipment (power transformers, metering transformers or coupling capacitors, etc.). The standard technical requirements for 110 kV surge arresters and the generalised requirements for the installation of surge arresters in 110 kV transformer substations are given in Annexes (24), (25), (26).
  8. Surge arresters in power transformer connections shall be equipped with surge detectors equipped with leakage current meters. The surge meters of all surge suppressors shall be installed at a height of between 2,5 - 3 metres above the ground, so that the meter readings can be seen without the need for additional means of elevation. Additional means supplied by the surge suppressors manufacturer may be used to allow surge suppressors to be installed at a location remote from the suppressor (e.g. a combination of a sensor and a meter wired together).
  9. Each surge arrester shall be provided with a separate connection conductor (between the metallic pad of the surge suppressor and the earthing device, or between the metallic pad - the surge meter - the earthing device) of a suitable cross-section, with the conductors being solid (without splices) and of a length to maintain the technical characteristics specified by the manufacturer of surge arrester. Surge arresters and surge meters shall not be connected to the earthing equipment by means of the equipment's supporting metal structures. Combined recorders shall be connected to earthing devices in accordance with the manufacturer's instructions.
  10. As part of the technical design, a lightning protection plan shall be drawn up for the protection of the 110 kV switchyard equipment against direct lightning strikes, based on a reasonable determination of the required reliability class of the installation. Design and install the 110 kV OS lightning protection system, selecting the number of rod lightning arresters, their technical characteristics, installation height and layout. Do not design lightning rods on transformer portals. Evaluate the lightning protection equipment (lightning protection cables, lightning rods and communication towers owned by LITGRID AB) located in or near the switchyard.
  11. Use the sphere method to calculate/model lightning protection zones. Calculate/model lightning protection zones taking into account the height of the protected installations. Provide the results of the calculation/modelling with drawings in the project.
  12. The connection of lightning conductors to earthing equipment shall be designed in such a way that the length of the earthing conductor between the point of connection of the lightning conductor to the earthing conductor (TP earthing circuit) and the point of connection of the earthing conductor to the earthing conductor of the equipment susceptible to surges (power transformers, metering transformers, condensers, reactors, etc.) is not less than 15 m.
  13. Transformers with 110 kV current, voltage measurement transformers or combined current-voltage measurement transformers must comply with the TSO standard specifications. The locations, number and purpose of secondary windings of metering transformers shall be specified at the time of design, and the rated load of the secondary windings shall be calculated taking into account the loads of appliances and devices connected to the windings. Current transformers for electricity metering and measurement purposes shall be designed taking into account the nominal power rating of the power transformer and the need to ensure the required accuracy of electricity metering over the entire load range, and the possibility of converting the power transformer to a power transformer with a higher nominal power rating of not less than one standard power step. If the calculation requires current transformer cores with different transformation coefficients, there shall be no more than two of them. The switching of the transformation factors of the current transformers shall be located on the secondary side of the circuits. Cores and branches of current transformers for electrical metering and measurement have an accuracy class of 0,2s and a safety factor Fs5. The nominal long term thermal current (Icth) shall be ≥ 150 % in the connections of power transformers and interconnecting circuit breakers to current and/or combined measuring transformers. The accuracy class of the windings for electrical metering and measurement of voltage transformers is 0,2. Metering transformers used for electricity metering shall, prior to the completion of the works, be provided with verification certificates issued by the manufacturer recognised in Lithuania, by an accredited laboratory in Lithuania or in another country of the European Union, or with markings replacing the latter, confirming the accuracy of their measurement. The standard technical requirements for measuring transformers are provided in the Annex (27).
  14. The location of voltage transformers or combined current/voltage transformers in the switchgear shall be designed so that the distance from the connection terminal of any phase of the voltage transformer or combined current/voltage transformer to the edge of the roadway to be installed in the substation shall be not more than 20 m.
  15. When selecting the characteristics of the ST secondary windings for the RPA, it is necessary to assess the prospective potential increase of the current in the transmission network over the next 10 years. The nominal ST accuracy limiting factor (ALF) shall be selected with a margin of at least 20÷25 % from the value selected after calculations in the technical design.
  16. The new substation control panel (hereinafter - SCP) will be used to design the 110 kV switchyard's AC and DC self-supply panels (hereafter referred to as ACSSP and DCSSP, respectively) and a battery bank with chargers. The electricity for the self-supply of the switchyard shall be supplied by at least two independent power sources with automatic switching from one source to another. The capacity of each independent power source shall be sufficient to supply all of the switchyard's self-supply power receivers. The standard technical requirements for the switchyard's own use are provided in the Annex (28).
  17. For direct current distribution, DCSSP shall be designed with a single sectioned busbar system (L+, L- and PE busbars) with two busbar sections. The load shall be distributed as evenly as possible between busbar sections I and II. Two chargers have been designed to power the busbar sections and charge the battery bank. Each charger shall provide power to all of the TS direct current self-supply power receivers. The standard technical requirements for a direct current self-supply panel are given in the Annex (29). Standard technical requirements for the battery pack and chargers are also given in the Annexes (30) and (31).
  18. Specify in the technical design that the following conditions are to be followed in the design of the battery layout/installation during the work project:
  + The battery cells shall be mounted on at least two transverse profiles (not on shelves) to ensure maximum cooling of the battery packs. The exact number of transverse profiles is chosen according to the battery manufacturers' requirements. The arrangement of the profiles shall ensure maximum ventilation, as far as possible in all parts of the cabinet.
  + The elements shall be mounted on the profiles in such a way that there is a gap of 5-10 mm between the top cover of the element housing and the profile (the top cover of the element shall not be placed on the profile). The rear profile shall have a barrier plate or structure to hold the battery cells in their deepest position.
  + The area of the transverse profiles in contact with the battery cell body shall be electrically insulated.
  + A gap of at least 5 mm shall be left between the different battery cells of the batteries to ensure cooling and ventilation of the batteries.
  + Do not design heating/ventilation units close to batteries. The battery pack must be installed within 1000mm of chargers or other devices that can cause a spark or generate heat. If this is not possible, the batteries must be separated by a sealed partition.
  + Design ventilation openings in the battery cabinet and a double cabinet canopy with air gaps along the entire perimeter of the cabinet side walls for free air circulation with the environment. Ventilation openings shall be without filters, with grilles whose planes shall be oriented in a downward sloping direction to ensure that dust settles on the outside of the cabinet. Ventilation openings shall be provided in the upper and lower parts of the cabinet front door and rear wall, and in the case of a side cabinet, it is recommended that an opening be provided in the lower part of the side wall. The number of air gaps per grille shall not be less than 35 and the size of each air gap shall not be less than 5 x 60 mm.
  + If the battery is installed in more than one cabinet, the temperature sensors of both chargers shall be mounted as close as possible to each other, in the cabinet that corresponds more closely to the average temperature of the battery (the location of the sensors shall be agreed during the preparation of the detailed design). The sensor shall be mounted as close as possible to the centre of the battery pack, attached to the rack or cabinet structure, and thermally isolated from metal parts. The mounting location of the sensor must be protected from draughts or external heat sources.
  1. For the power supply of self-supply facilities, a 0.4 kV ACSSP with two distribution busbar sections (3f+N+PE) is to be designed, with automation of the ARA for their mutual reservation. The ACSSP shall be equipped to connect a mobile (transportable) 0,4 kV diesel generator as a supplementary source of power supply in case of emergencies. In order to ensure uniformity of the diesel generator connection in all 110 kV substations, a 0.4 kV, 63 A socket (3P+N+PE) complying with the requirements of the LST EN 60309 standard shall be designed. The socket outlet shall be designed on the outside of the SCP, in a location convenient for accessing the mobile diesel-generator to the SCP by a paved road. The standard technical requirements for the alternating current self-supply panel are given in the Annex (32).
  2. The project must ensure electricity supply for the self-supply of PT during the project.
  3. Design a solar power plant on the roof of the substation control panel (SCP) according to the requirements:
     1. The installed capacity of a solar power plant depends on the area of the roof of the SCP being designed. The SCP roof shall be single pitched and its angle and direction shall be chosen for maximum efficiency of the photovoltaic modules. The roof area must be used to accommodate the maximum possible number of photovoltaic modules. The structures supporting the modules shall be designed; the modules shall not be integrated into the roof structure. Photovoltaic modules shall be designed at least 300 mm from any roof edge and at least 70 mm from the roof surface. The location of the DC/AC voltage converter for the solar photovoltaic modules (hereinafter - SE converter) and its ancillary equipment is inside the SCP.
     2. Select one SE inverter of suitable power to be connected to the busbar section of the ACSSP, which will supply the master battery charger. Design the operating principles of the solar power plant and the loading of the ACSSP and DCSSP, making the most efficient use of the electricity generated by the SE.
     3. During project preparation, it is necessary to design the connection of the generating source (electricity generated by the solar power plant) to the 0.4 kV ACSSP. The connection of the solar power plant to the ACSSP must be designed under the condition that the electricity generated by the solar power plant cannot be fed into ESO distribution network.
     4. The inverter system selected must ensure that the solar power plant operates in this mode:
        1. The SE converter system is connected in parallel with the 0.4 kV ACSSP inlets installed from the AB ESO self-supply transformers;
     5. The inverter must have an electricity metering and monitoring system. Remote access to the solar power plant metering and monitoring system from the Customer's employees' workstations via a standard WEB browser (Microsoft Internet Explorer, Google Chrome, etc.) using the inverter's manufacturer's integrated software is required.
     6. Information on the amount of electricity produced must be available remotely:
        1. per day;
        2. per week;
        3. per month;
        4. per year;
        5. the total amount of electricity produced by the solar power plant (since its commissioning);
        6. real-time (instantaneous) power generation.
     7. Information on the status of the system must be available remotely:
        1. on/off;
        2. fault indications (error codes) for inverters;
        3. the system must be able to export data (e.g. to Microsoft Excel);

The project includes testing of the solar power plant and its automation in the presence of representatives of the Customer. The detailed requirements for the solar power plant to be installed are determined by the designer during the preparation of the technical design. Classify the SE as major equipment when drawing up the SE technical specification. The technical requirements for a solar power plant are set out in the Annex (33).

* 1. The busbars to be designed can be rigid or flexible. Rigid busbar must be installed over access roads and 110 kV busbar sections, otherwise the use of flexible conductors (wires) is allowed. Adequate mechanical resistance shall be designed for the equipment to which the rigid busbar is connected without the use of additional supporting insulators. Additional support isolators may only be used on the side of the switches if their absence would require additional inspection platforms at the switches or if the rigid busbars cannot be mounted exactly on the horizontal axis without a slope. When selecting the busbar, assess conductor heating, corona discharges, thermal and electrodynamic resistance to short-circuit currents, mechanical resistance, overcurrents, voltage losses and cost-effectiveness, ambient conditions (icing, wind effects), and determine the permissible loads for the connection points (supporting insulators or equipment connection terminals). All calculations must be included in the technical design.

The standard technical requirements for 110 kV tubular conductors are given in the Annex (34).

The standard technical requirements for 110 kV flexible conductors (wires) are given in the Annex (35). Glass-plate insulators shall be used for the installation of flexible conductors and shall be designed in accordance with the Annex (36).

* 1. The separately installed 110 kV supporting insulators shall comply with the TSO standard specifications in the Annex (37).
  2. Provide earthing contacts for the installation of movable earthing switches between the sectional switches (or on both sides of the sectional switch if the sectional switch is provided in the principle connection diagram), at the line outlets, at the voltage measuring transformers and at the 110 kV outlets of the power transformers. The contacts for placing movable earthing switches shall be located at such a height that the movable earthing switch can be connected to the contacts by means of a 110 kV insulating stick without the need for means of elevation.
  3. Design the connection method and terminals for the connection to the 110 kV inputs of the power transformers, the switchyard primary devices and the shunt conductors. The requirements for 110 kV primary equipment connection terminals are given in the Annex (38).
  4. In the technical design, to design screws to tighten the terminals for the connection of high-voltage equipment so as to ensure minimal external partial discharge when the busbar is connected (when the nut is tightened, the screw thread is not longer than the nut by more than 3 to 5 thread pitches, and the screw and nut are recessed into the inside of the terminal). The tightening torque and tightening sequence of these bolts shall comply with the manufacturer's requirements. The maximum output distance of the flexible shield from the connection terminal shall not exceed 2 mm.
  5. Design the earthing equipment in accordance with the requirements of the General Rules for the Installation of Electrical Equipment. The technology for installing earthing equipment shall be selected on the basis of the results of soil resistivity measurements. The earth loop impedance of the grounding circuit of the switchgear part of the transmission network shall not exceed 0,5 Ω at any time of the year. The earthing equipment of the transmission network switchyard is to be connected to the earthing equipment of the TS part of the distribution network. The standard technical requirements for the installation of the earthing circuit and the elements of the earthing circuit are also given in the Annexes (39) and (40).
  6. Design the power panel(s) to supply the 0,4 kV movable equipment in the AS area with single-phase (2 units) and three-phase (1 unit) sockets (single-phase auto-switch 16 A, three-phase auto-switch 32 A) fed via a leakage current relay. The number of power panels shall be chosen according to the number of connections (1 power panel shall be designed for 5 connections). The panels shall be evenly spaced throughout the substation area.
  7. Design the layout of alternating current and direct current panels, relay protection and control cabinets, with cables to cabinets and panels being fed from below.
  8. Design lighting in the substation area to allow the necessary work to be carried out during the hours of darkness for the operation of the equipment. The open switchboard lighting shall be automatically triggered by motion detectors during the hours of darkness, with the possibility of switching to manual operation mode. Provide for the use of LED luminaires (floodlights), while complying with the lighting requirements specified in HN 98:2014 "Natural and artificial lighting in workplaces. Enlightenment minimum limit values and general requirements for measurement'. The lighting shall be powered and controlled by a separate control panel mounted on the modular control panel and connected to the ACSSP.
  9. All equipment, cabinet and line designations shall be agreed with the TSO and shall comply with the requirements of the Transmission Network Operational and Technical Naming and Marking Procedure (see Annex (41)). All new electrical installations and cabinets shall have operational notices on weatherproof plates. The lettering of open switchyard equipment, DCSSP, ACSSP, RPA cabinets and automatic transfer switches shall be agreed with the TSO prior to the commencement of the manufacture of the equipment and facilities. If the reconstruction is accompanied by the replacement or new installation of equipment in other substations, there is also a requirement that all markings of the newly installed or replaced equipment, cabinets and lines in these substations must be agreed with the TSO.
  10. In the technical design, write that the technical data tables and marking of the primary equipment must comply with the TSO standard technical requirements in the Annex (42).
  11. The technical design shall provide for the installation and inspection of the newly installed primary equipment in accordance with the rules for the installation of electrical equipment and the requirements of the TSO regulatory documents.
  12. The technical design shall include a three-dimensional layout plan of the 110 kV switchyard's primary facilities and drawings of all connecting sections.
  13. The technical specifications for the equipment shall be based on the standard requirements for the equipment annexed to this design brief. The wording of the text in the column "Parameter (units of measurement), function, performance or characteristic required of the device, equipment, article or material" of the standard requirements shall not be modified when transferring the items of the standard requirements into the specifications. Nor can items of the standard requirements be excluded from the specification. If the clause is not applicable in a particular case, enter "Not applicable" in the specification instead of the specific parameter or function value, fulfilment or feature. The inclusion of additional clauses in the specification compared to the standard requirements, or the adjustment of a standard value, performance or characteristic of a parameter or function compared to the value, performance or characteristic of a parameter or function in the standard requirements, shall be described and justified in the design. The technical specifications of the technical design shall be drawn up in Lithuanian and English.

# PART ON ELECTRICITY TRANSMISSION LINES

* 1. Design the replacement of the 110 kV OL from the Nemenčinė and Neris-Pabradė supports, from the anchor-end pylon No. 19 to the new line gantries to be installed, in such a way that the existing electrical capacities of the OL are not compromised (type of wires for the Nemenčinė branch - 122-AL1/20-ST1A or analogue, for the Neris - Pabradė branch - 149-AL1/24-ST1A or analogue).
  2. Design of the installation of new tensile isolator garlands, linear reinforcement on the section support No. 19 - portal.
  3. Design lightning protection cables from the end support No. 19 to the linear gantries and provide calculations of thermal resistance to short-circuit currents.
  4. Provide calculations and results for the selection of electromechanical characteristics of wires, lightning protection cables, insulators, linear fittings.
  5. Design the adjustment works for the OL wires and lightning protection cables in the reconstructed anchor span (support-portal).
  6. The results of the calculation of the tensile forces and deflections of the wires and lightning protection cables of the reconstructed OL anchor-portal span are presented for the installation and steady-state modes.
  7. Provide a longitudinal profile of the reconstructed anchor span. The profile shall include, but not be limited to, the deflections of lightning protection cables and wires, the distances between the wire and the cable, the distances between the wires and the ground and the distances from the wires to the ground surface and to the various civil engineering structures under normal and emergency operation of the OL. The height of the wires from the ground along the entire stretch from the gantries to the end support of the overhead line shall not be less than 7 metres at the maximum deflection of the wires.
  8. Provide route plans of the section to be reconstructed, identifying the position of the existing edge wires and the position of the projected edge wires in a horizontal projection.
  9. Design and select the OL elements in accordance with the standard specifications given in Annexes (36), (43), (44), (45), (46), (47), (48), (49), (50).
  10. Prepare a file of technical specifications in accordance with the requirements set out in the Annex (1).
  11. The reconstruction must be carried out within the boundaries of the existing plot of land. The boundaries of the existing protection zone for electricity networks shall not be extended during the reconstruction and shall be marked on the drawings. If it appears that the proposed technical solutions extend the boundaries of the existing protection zones, do the following:
      1. to establish and register in the Real Estate Register the easement(s) conferring the right to construct, maintain and use underground/overground communications. Carry out all the actions necessary to establish and register the easement(s) in the Real Estate Register (drawing up the land plot plan(s) with the easement(s) to be established, organising the signing of the easement agreements, payment of compensation, etc.).  Provide an extract(s) from the Central Data Bank of the Real Estate Register of the land plot(s) confirming the registration of the easement(s) in the Real Estate Register, and any other necessary third-party consents, at the time of coordination of the technical design.
      2. Submit the consent of the owner(s) of the land plot(s) or the state or municipal land trustee for the establishment of a protection zone for electricity grids in accordance with Article 7 of the Law on Special Land Use Conditions of the Republic of Lithuania. Indicate on the drawings the existing and projected protection zones for electricity networks.
      3. Identify and register in the Real Estate Cadastre and in the Real Estate Register the areas subject to special land use conditions (electricity network protection zones). Carry out all the necessary steps for the registration of these areas in the Real Estate Cadastre and the Real Estate Register. Provide extracts from the Central Data Bank of the Real Estate Register of the land parcels, confirming the registration of areas subject to special land use conditions (electricity network protection zones).
  12. submit to the manager of the Real Estate Cadastre and the Real Estate Register in accordance with the procedure established by the laws of the Real Estate Cadastre and the Real Estate Register, a notification of newly established and/or changed/abolished territories, where special land use conditions are applied, i.e. the protection zones for power grids, together with the territorial data for the established territories, as specified in the regulations of the Cadastre of Real Estate, drawn up in accordance with the specification of the spatial data set of the territories where special land use conditions are applied. The notification must be submitted within 10 working days of the date of issue of the building permit.

# PART ON RELAY PROTECTION AND AUTOMATION

* 1. General part:
     1. Perform the necessary calculations to guide the selection of transformers, RPA principles and devices for EIC measurements;
     2. Perform RPA coordination, configuration, setting changes and complex tests in accordance with the requirements of the LITGRID AB Transmission Network Facilities Operation Regulation, the EIC, the Rules for the Operation of Power Plants and Electricity Networks;
     3. Carry out complex tests of the RPA equipment in accordance with the requirements of the AB LITGRID RPA complex test schedule, which is attached in the Annex (51);
     4. The RPA equipment shall be microprocessor-based with a self-monitoring system that meets the requirements of the EIR and other technical and regulatory documents. Standard technical requirements for microprocessor relays and controllers are given in the Annex (52). Other requirements for microprocessor relays and controllers not specified in the standard technical requirements are selected during the development of the technical design;
     5. The new RPA and control equipment shall have all the necessary interfaces for the connection of communication paths and secondary circuits, for the fulfilment of measurement, protection, automation, monitoring and control functions;
     6. Draw up structural diagrams in the technical design:
        1. RPA connection to metering transformers;
        2. Control units for the main equipment of the substation;
        3. 110 kV RPA equipment functional connections and element layouts in cabinets;
        4. interactions between the functions of the RPA equipment;
        5. A functional diagram of the logical interactions between the operational units of the communication apparatus in GOOSE messages (to provide a preliminary list of GOOSE messages) or in wired communications;
        6. a functional diagram of the connection of the RPA equipment to the substation data network (hereinafter - SDN);
        7. Functional diagram of the RPA surveillance system (monitoring);
        8. Direct current supply to the RPA equipment;
     7. The RPA structural diagrams shall be based on the description of the development of standard relay protection and automation functional diagrams of 110 kV transformer substations of Litgrid AB transmission network in the technical designs, which is provided in the Annex (53).
     8. Each RPA device shall have an integrated light alarm to indicate malfunctioning of the device, effects of functions and automation, and other RPA operations as required;
     9. Each microprocessor-based RPA device shall have an integrated emergency process recorder recording operating and emergency currents voltages and freely selectable internal and external signals.
     10. Each microprocessor-based RPA device shall have an event recorder function to record the operation of all types of internal logic (including protections and automation) of the device.
     11. RPA devices with different connections shall be housed in separate cabinets;
     12. Provide a 10-15% reserve for binary inputs/outputs and RPA terminals.
  2. Interfaces and data exchange between the RPA and other substation equipment:
     1. Data exchanges between RPA devices and TCTD shall be carried out using IEC61850 ed.2.0 protocol (vertical communication);
     2. Each RPA device shall be connected to two separate SDN switches via separate interfaces to ensure the reliability of the information exchange. The duplicated data traffic over these dual connections shall be controlled by the IEC 62439 (PRP) protocol;
     3. The secondary circuits of the current and voltage transformers of each connection shall be connected to the relays by copper cables;
     4. The secondary circuits of each connected to RPA (control, process signals, etc.) shall be connected to the relays by copper cables;
     5. The cables and wiring of the secondary circuits of the RPA shall be copper stranded, with flame retardant insulation. All cables in the RPA circuits, including those connecting the secondary circuits of the 110 kV switchgear devices to the microprocessor devices, shall be shielded (concentric copper tape shielding) and shall be provided with potential equalisation. The standard technical requirements for control cables connecting the relay protection/automation and open switchgear primary installations are given in the Annex (54), and for the wiring for the internal installation of outdoor and indoor cabinets in the Annex (55);
     6. Other logical communications (unless otherwise specified in the design task), between the connected device and other RPA of the connected device, organised by IEC 61850 ed.2.0 GOOSE messages (horizontal communication), shall only be used in logical circuits where the failure of the communication channel, or the partial disconnection of the communication channel, shall not impair, alter or modify the conditions for reliability, selectivity and availability of the relay protection and the automation;
     7. The equipment used in the RPA data exchange using the IEC 61850 ed.2.0 protocol (together with its internal software version) must be fully interoperable and must be documented by the manufacturer that the device and its software has been tested and operates in accordance with IEC 61850 ed.2.0 standard;
     8. The part on RPA of the technical project describes the principles for the organisation and execution of data exchange between the RPA and other substation equipment, using IEC61850 ed.2.0 protocol or wired connections.
  3. The following basic functions must be designed and implemented in each connected controller:
     1. directional, minimum 4-stage, zero-sequence current protection function;
     2. directional, minimum 4-stage, maximum current protection function;
     3. the function of accelerating the protectors by short-circuiting the circuit breaker;
     4. Minimum voltage interlock in the power transformer's plug-in controller for inter-phase short-circuit protection;
     5. Automation (automatic reactivation (AR), voltage control, synchronism control);
     6. SRD function (with current control and with repeating the circuit breaker disconnect command without blocking the AR);
     7. Integrity control function for voltage circuits;
     8. integrity control function for current circuits;
     9. redundant maximum current protection and zero-sequence current protection functions that are triggered in the event of a fault in voltage circuits;
     10. Control of 110 kV circuit breaker and other switchyard;
     11. LCD display with the capability to create mnemoschemes of switched primary devices and switched RPA secondary circuits or functions. The mnemoscheme and measurements of the connected switched primary devices shall be stored and programmed/displayed on a single sheet of the LCD display (the display of the controller and a version of its firmware with support for multiple displayed schematic sheets);
     12. Control method selection (relay/TSO DCS);
     13. Controlled switchgear (circuit breaker, switches, earthing switches, RPA functions), control and safety interlocks;
     14. collecting the connection signals transmitted to the DCS;
     15. an event and emergency process recorder, recording operating and emergency mode currents and voltages, with the possibility to freely select/assign/name internal function, logic and external signals to be recorded;
     16. the possibility to enter at least 4 groups of provisions;
     17. at least 8 light indicators to display the effects of protections and alarms;
     18. switch resource calculation function;
  4. The main functions of a substation co-frequency controller:
     1. Voltage and current measurement of battery chargers, fault signals;
     2. earthing signal for direct current busbars;
     3. Measurement, signalling, control of self-supplied voltages of ACS and DCS;
     4. Signalling and control of lighting and indoor infrastructure in OSE;
     5. local/remote control function;
     6. other signals, controls and measurements not assigned to a specific connection.
  5. Technical requirements for RPA cabinets installed in the substation control room (hereinafter - indoor cabinets):
     1. New RPA indoor cabinets shall be equipped according to the standard technical requirements specified in the Annex (56). Other equipment not specified in the standard technical requirements for a complete indoor cabinet shall be selected during the preparation of the detailed design;
     2. A completed TSO inspection report of the installation of the main and other RPA equipment in the RPA indoor cabinets during factory testing (with the endorsements of the maintenance engineer and the contractor/cabinet manufacturer's representative) shall be attached to the factory test programmes and reports provided by the cabinet manufacturer. The form of the protocol is provided in the Annex (57).
     3. The electromechanical relays of the RPA electrical circuits shall comply with the standard technical requirements given in the Annex (58). Other types of electromechanical relays not specified in the standard technical requirements shall be selected during the development of the detailed design.
  6. Technical requirements for outdoor intermediate terminal cabinets for installation in open switchyard:
     1. Intermediate terminal cabinets to be installed in open switchgear (at circuit breakers and metering transformers, terminal isolation cabinets (hereinafter - TIC), etc.) shall be of a new, outdoor type and shall be designed with a grey RAL 7035 anticorrosive powder-coating. For sealing cable entry openings, cabinets shall be provided with individual cable sleeves for each cable, which shall be clamped and secured. Other technical requirements for external (outdoor) terminal cabinets are given in the Annex (59), and the remaining requirements for intermediate terminal cabinets not specified in the standard technical requirements shall be selected at the time of preparation of the detailed design;
     2. A completed customer's Inspection Report for the assembly of main and other RPA equipment in field intermediate terminal cabinets during factory testing (with the endorsements of the maintenance technician and the contractor's/cabinet assembly manufacturer's representative) shall be included with the factory test programmes and protocols provided by the cabinet manufacturer. The form of the protocol is provided in the Annex (60).
  7. The relay protection and automation functions are controlled from the RPA devices and the TSO DCS:
     1. Changes to groups of RPA provisions;
     2. Upgrading SRD to higher level installations;
     3. Control of automation functions;
  8. RPA equipment monitoring system (monitoring):
     1. The monitoring system is virtually separated from the control system and the RPA terminal uses a common interface;
     2. The RPA terminals of each feeder shall be subject to local continuous monitoring of the status of the feeder's equipment and their status shall be reported to the TSO's DCS;
     3. The workstations of the TSO RPA engineers shall be able to remotely monitor the RPA terminals from their workstations using the software provided by their manufacturer. The data shall be transmitted via the internal TSO technological routing network (VPN) to the existing monitoring data collection workstations at the TSO headquarters (Viršuliškių skg. 99B, Vilnius) and to the workstations of the engineers of the RPA of the region that operates the TSO Infrastructure Maintenance Centre;
     4. The software suites provided by the manufacturer of the RPA terminals for local/remote monitoring of the relay protection and control equipment (including fault record scanning and analysis) shall be provided;
     5. The RPA terminal uses the same interface for monitoring as for data exchange in SDN with the TSPA IEC 61850 ed.2.0 protocol via PTD switches;
     6. The monitoring of the isolation monitoring device for direct current circuits shall be carried out via an Ethernet interface (to be connected to the SDN). For the transmission of information from the perspective to the centralised monitoring system, the device shall support MODBUS TCP/IP, IEC60870-5-104 or IEC61850 ed.2.0 protocols;
  9. Software and documentation:
     1. The RPA equipment shall be supplied with real-time operating system adapted and specialised technological software suites with licences, provided by the equipment manufacturer itself, to enable the user to execute protection algorithms, registration and analysis of protection functioning, and additional real-time monitoring of incoming and outgoing data, both locally (at the substation) and remotely (at remote workstations of RPA engineers). The software enables the user to associate different working options with external devices and RPA modes of the object, and to activate additional functions;
     2. Licensed (not open source) specialised software capable of real-time monitoring and analysis of incoming and outgoing IEC 61850 ed.2.0 protocol data shall be provided. The functionality of this software package, with the ability to provide data control and analysis data in real time with the attributes specified in the IEC 61850 ed.2.0 standard, with the ability to import and, after import, to read the structure file of the IEC 61850 ed.2.0 protocol packets installed by the manufacturer on the RPA terminals, configured at the time of the debugging, and which are transmitted in the IEC 61850 ed.2.0 protocol, with the ability to import the substation configuration structure file with the data transfer volumes from all TS RPA terminals to the DCS in vertical communication and, after import, to read the data in real time from the RPA terminals in the substation IEC 61850 structure, with the ability to analyse and monitor in real time simultaneously the technical parameters of all GOOSE messages in horizontal communication with the attributes provided for in IEC 61850 ed.2.0 standard;
     3. User descriptions, user manuals, technical service descriptions (in hard copy and \*.docx format on computer media, in English and Lithuanian), functional, principle, assembly and microprocessor internal configurations (settings, logic, list of IEC61850 ed.2.0 signals to be received and handed over to the horizontal communication), configuration diagrams of the RPA equipment, devices, software (hard copies and \*.dwg format on computer media), as well as the configuration of the equipment and software, in English and Lithuanian;
     4. The drawings for the RPA part of both the technical and detailed designs shall be in hard copy and in \*.dwg format on computer media, with the possibility for the user to modify/correct the drawings during operation.
  10. Changes and interfaces related to distribution network RPA:
      1. Reconstruction-related additions or changes to the RPA circuits of the distribution network must be designed in a separate technical design file;
      2. For the interconnection of cables between the transmission and distribution circuits of the RPA facilities, terminal isolation cabinets (hereinafter - TIC) are to be designed for each power transformer at the boundary of the territories of the individual countries;
      3. The load disconnection automation in the event of a voltage drop in the 110 kV network and the installation of a load shedding automation (hereinafter - LSA) in the distribution part of the network, through a separate automatic switch, to feed the TIC, the relay protection and the 110 kV transformer supplying the automation of that connection, requires open triangular secondary voltage circuits. The ADN is not connected to these circuits;
      4. The disconnection commands for T-1 and T-2 110 kV circuit breakers shall be fed directly from the RPA end relays of the distribution network power transformers (not from the controllers) to both tripping coils of the circuit breakers (not via the controllers);
      5. a signal shall be fed from the RPA terminal relays of the power transformers of the distribution network to the T-1 and T-2 110 kV circuit breaker controllers to detect their triggering in the control system of the transmission network equipment, for the start-up of the SRD and for the logic of the AR;
      6. use current transformers installed in the inlets of the power transformers to connect the 110 kV side protectors of the power transformers of the distribution network;
      7. other reconstruction-related additions and modifications to the RPA circuits of the distribution network must be designed.
  11. Installation of other RPA equipment:
      1. a direct current circuit isolation device shall be designed and installed to continuously monitor the insulation resistance of direct current busbars, to alarm when it is low and to selectively identify the affected group of equipment. The device shall have an Ethernet 10/100 Base-T interface (to be connected to the SDN). Remote monitoring of the insulation control unit at remote RPA engineer workstations;
      2. All automatic switches in OSE and control panel cabinets used for operational changeovers shall be designed in locations not less than 1 m from the floor (OSE from ground level);
      3. The contacts of the terminal relays of the RPA devices controlling the switchgear shall be capable of interrupting the current of the control coils of the switchgear at the rated voltage;
      4. Cables, wires and conductors of secondary circuits connected to terminal sets or devices shall be marked with special labels (markings) stating:
         1. for cable conductors, the numbers of the terminal set and the terminal to which it is to be connected, the name of the cable (in accordance with the principle diagrams of the work project and the cable logbook;
         2. for indoor wiring in RPA indoor and outdoor intermediate terminal enclosures - the numbers of both ends where the wire (cable conductor) is connected: the terminal block and the terminal to which it is connected;
         3. for cables - cable type, cable designation (according to the cable log of the work project), addresses of the end connection points (from/to), length;
      5. For the control of divider and earthing switch drives, the appropriate contacts shall be integrated in the plug-in controllers.
  12. Evaluation, design and modification of other transmission network facilities (*Neris TS, Pabradė TS, Paberžė TS*) in connection with the substation reconstruction:
      1. the technical design shall provide for comprehensive testing of the RPA devices in all the above mentioned transmission network facilities related to the reconstruction;
      2. describe in the technical design and provide calculation conclusions for the necessary RPA modifications to be made to the reconstructed transmission network facilities concerned;
      3. Include in the cost of this project and provide in the technical design the need for the installation of the RPA equipment, its debugging, configuration, cross-testing, modification of the provisions of the new and existing RPA equipment, updating of the documentation, and the coordination with the TSO for the reconstruction of the above mentioned transmission network facilities related to this facility;
      4. all necessary corrections and additions to the installation and principle diagrams shall be made to the other aforementioned transmission network facilities related to the reconstruction of the substation;
  13. Issuing and amending the RPA provisions.
      1. When drawing up the timetable, it shall include the time required to prepare the calculation tasks for the TSO RPA provisions.
      2. Evaluate/ take into account the deadlines for issuing RPA provisions when scheduling disconnections.
      3. The calculation of the RPA regulations starts after the main equipment has been aligned in accordance with the technical specifications of the technical project of the part of the TSO that has been subject to expert examination.
      4. For a new substation or switchyard being reconstructed or constructed in a single phase (for one or more of its connections), the RPA provisions shall be issued for a period of 3 months after the approval of the main equipment.
      5. For a new substation or switchyard being reconstructed or constructed in several phases (for one or more connections within it), the RPA Regulations are issued on a phase-by-phase basis, with the first phase being issued within 3 months after the approval of the main equipment. The RPA provisions are issued for subsequent phases after the completion of each phase within 3 months.
      6. For temporary interconnection schemes that require temporary interconnections in several phases at a substation or switchyard under reconstruction or under construction (for one or more connections), the RPA provisions shall be issued within 3 weeks, after the coordination of the temporary interconnection scheme and the schedule of disconnections with TSO.
      7. In substations and switchyards where the need to change the RPA provisions is related to a substation under construction or reconstruction (one or more connections), the changes to the RPA provisions shall be carried out at the time of switching on the reconstructed or newly constructed substation. In such cases, the RPA provisions shall be issued before the reconstructed or newly built substation or switchyard (one or more of its connections) is switched on after the last phase of reconstruction or construction.

# PART ON PROCESS MANAGEMENT AND AUTOMATION

1. 1. Tele-management of switchgear and earthing switches of all newly designed 110 kV connections from the TSO DCS shall be provided.
   2. Control methods for switchgear and earthing switches must be installed:
      1. Local control - control of the plant is carried out directly from the plant's drive control cabinet;
      2. Remote control - control of the equipment is carried out from the TSO's DCS or from the individual controller of the connected (installation). The following remote control modes are available:
         1. control from a connection controller - control of the equipment is carried out directly from the individual controller of the connection controller. This is a back-up method of remote control;
         2. management from the TSO DCS. This is the main method of remote control;
         3. Control disabled - control of the equipment is disabled.
   3. Switching off, switching to local or remote control is done in the drive cabinet of the controlled device.
   4. Switching from remote control mode (from the TSO DCS) to remote control mode (from the plug-in controller) shall be carried out on the individual plug-in controller, which shall be equipped with a key for switching remote control modes, or, in the absence of such an option, by means of a remote control mode switching key fitted as an accessory.
   5. In order to prevent erroneous control operations, operational interlocks for remote control of switchgear (circuit breakers, switchgear dividers) and earthing switches shall be provided as follows:
      1. interlocks implemented in divider and earthing switch drives (the "divider-earthing switch(es)" are mounted in a single unit), where it is not allowed to switch on the divider while the earthing knife is switched on and vice versa. The control of the divider/earthing switch shall be blocked irrespective of the location from which the divider/earthing switch is controlled (from the DVS, from the RPA controller or locally from the drive);
      2. logic interlocks, which are implemented in substation equipment controllers and prevent the operation of substation switchyard and earthing switches when a certain logic switching sequence is not followed. The sequence logic for the operation of switchgear and earthing switches shall be agreed in advance with the TSO.
      3. when logic interlocks are implemented by GOOSE messages in horizontal communication between the connected RPA controllers, their logic shall include the possibility to disable the interlocks of the connected RPA controller by means of a human-machine interface when switching to local control, and to activate the logic of the interlocks automatically when switching to remote. The logic of the block tripping mode shall only be enabled in the event of failures of adjacent pluggable controllers when no information about the positions of the switching apparatus is received from them.
   6. In the technical design, assess the condition and usability of the distribution network blocks.
   7. A failure of a higher tier of control systems must not interfere with the operation of the other control tiers.
   8. It must be possible to control the same equipment from only one location at a time.
   9. For the on/off switching of transformers, it shall be possible to control the 110 kV connections of the power transformers from the controllers of the distribution network equipment by blocking the control commands from the control systems of the transmission network and vice versa to the 110 kV switchgear and earthing apparatus and the earth electrodes required for the above function.
   10. The change of control rights of the 110 kV transformer connection between the controllers of the distribution network equipment and the controllers of the transmission network equipment shall be made from the TSO DCS. In case of transfer of rights to another remote control system, the remote control of 110 kV equipment from the transmission network is blocked in the DCS.
   11. Ranking of management priorities in descending order:
       1. Control from the TSO DCS is the main way of controlling substation equipment;
       2. control from the connected (device) controller. This control method must have all the logic interlocks (switching sequence interlocks) necessary for the control implemented in the controller of this plug-in/device. This is a back-up remote control method that is used when it is not possible to control devices from the TSO DCS;
       3. local control - from the drive control cabinet. This is the repair management method. Devices controlled in this way have no logic interlocks, except for mechanical interlocks implemented in the devices themselves.
   12. The following real-time information (direction of transmission to the TSO DCS) on the status of the equipment shall be transmitted:

| **No.** | **Characterisation of real-time information** |
| --- | --- |
| ***Alarm system for the 110 kV part of the TS:*** | |
| 1. | Positions of all switchgear and earthing switches. |
| 2. | Triggering of relay protectors and automation (for each protector). |
| 3. | Control and blocking states for RPA functions of devices. |
| 4. | Equipment failures in PT operation. |
| 5. | Mapping of RPA Connector Provision Groups. |
| 6. | The remote control mode of the connected remote is switched to: |
| 6.1. | Control from the DCS; |
| 6.2. | Control from a plug-in (device) controller; |
| 7. | The remote control mode of the connected devices is switched to: |
| 7.1. | Remote control; |
| 7.2. | Local governance; |
| 7.3. | Off (neither remote nor local control modes are possible). |
| 8. | Voltage transformer low side voltage aj positions. |
| 9. | The status of the aj installed in electricity metering voltage circuits. |
| 10. | Common signal for loss of continuous operational voltage to PT devices. |
| 11 | PT fire alarm status and effects. |
| 12. | Status of 110 kV circuit breaker control circuits. |
| 13. | Faults in the connecting RPA and control terminals, faults in the power circuits of the RPA and control terminals. Signals are formed ( aggregated at the level of substation RPA and control terminals) according to the plug-in to which these RPA and control terminals belong. |
| 14. | Positions of the automatic switches (as) for switch control circuits and drive supply circuits. Signals are generated separately for each circuit breaker according to the type of circuits (control or drive supply circuits). A common signal is generated when the automatic switches that power the above circuits share a common power supply. Applies to automatic switches mounted in circuit breaker drives and/or ACSSP, DCSSP. |
| 15. | Positions of automatic switches for control circuits and power supply circuits of connecting switches and earthing switches. Signals are generated separately for each connection according to the type of circuits (control or drive supply circuits). A common signal is generated when these circuits share a common power supply. Applies to automatic switches installed in plug-in isolators and earthing switches and/or ACSSP, DCSSP. |
| 16. | Information on the selection of remote control rights (between the controllers of the transformer operating organisation and the controllers of the substation of the transmission network) of a 110 kV power transformer. |
| ***General-purpose alarm volumes for PT part of installations:*** | |
| 17. | PT ACSSP status of lead-in and sectional aisles, status and effect of ARA. |
| 18. | PT DCSSP busbar and section busbar statuses, earthing alarm, DCSSP battery charger statuses. |
| 19. | Heating circuits for circuit breakers, switches, and earthing switches for drives aj. The heating circuits for the drive heating circuits of the connecting circuit breakers, isolators and earthing switches shall be combined for the whole transformer substation. |
| 20. | The positions of the heating circuits for secondary switchgear cabinets in open switchgear. These heating circuits are combined in a single group for the whole transformer substation. |
| 21. | The positions of the power circuits of the TCTD, communication equipment, momentary data controller (MDC) and commercial data controller (CDC). Faults in the TCTD communication circuits with RPA terminals (controllers). |
| 22. | TCTD monitoring signals: |
| 22.1. | Status of TCTD communication channels |
| 22.2. | Status of the performance of TCTD functions |
| 22.3. | TCTD information security control |
| 23. | The positions of the space heating circuits in the VP. These heating circuits are combined in a single group for the whole transformer substation. |
| 24. | The positions of the power supplies for the ventilation and air-conditioning systems in the VP premises. The automatic switches in this group are combined into one group per building. |
| 25. | Automatic switches of the ACSSP group supplying circuits which do not fall into any of the categories listed above. |
| 26. | Automatic switches of the DCSSP group supplying circuits which do not fall into any of the above categories. |
| 27. | Solar power plant connection positions. |
| 28. | A generalised signal due to a failure of the solar power plant or the inverter(s) of the solar power plant. |
| ***Signalling volumes for distribution network (DN) part of equipment*** | |
| 29. | The effect of transformer protectors on the disconnection of equipment in operation or under operational control on the transmission grid. The effects of the protections (main and standby) of a single power transformer give rise to a single generalised signal. |
| 30. | The effect of the protections on the ST part of the equipment on the disconnection of equipment in operation or under operational control in the transmission network. A single generalised signal shall be generated from the protectors of the ST part acting on the disconnection of PT part of the equipment (excluding the protectors of the power transformers). |
| 31. | Summarised signals for triggering of ST part of the devices after LSA and non-synchronous automatic repetitive switching (NARS) impact on these devices. A single aggregated signal for the whole transformer substation. |
| 32. | Summarised signals due to the triggering of ST part of devices after the effect of automatic frequency shedding (AFS) and frequent automatic repetitive switching (FARS) on these devices. For AFS and FARS effects, a single generalised signal is generated for the whole transformer substation. |
| 33. | Power transformer neutral earth positions. |
|  | ***General remarks*** |
| 34. | Use the following contacts for signalling the position of devices:  1. The off state of the devices shall correspond to a normally open auxiliary contact;  2. Switched on state - closed auxiliary contact;  3. This shall apply to circuit breakers, disconnectors, earthing switches, automatic transfer switches and other switchgear not listed here. |
| 35. | When generalized signals are formed for the states of as, the generalized signal shall not include aj whose normal states are different from those of most other as included in the specific group. The aggregated signal shall contain only as with the same normal states, i.e. either normally off or normally on. |
| 36. | Separate tables shall be created to explain the generalised groups of as, including: the physical location of the as (cabinet, terminal block, ACSSP, etc.), the schematic name of the as, and the functional name of the as (its functional use). |

* 1. The following real-time measurements (hereinafter - TM) shall be transmitted:

| **No.** | **Characterisation of real-time measurements** |
| --- | --- |
| ***Measurements of the 110 kV part of TS:*** | |
| 1. | Through a transformer on the 110 kV side: |
| 1.1. | Active power P [MW]; |
| 1.2. | Reactive power Q [MVar]; |
| 1.3. | Current I [A]. |
| 1.4 | Distance to the point of failure [km]. |
| 2. | 110 kV busbar sections: |
| 2.1. | Voltage U [kV]; |
| 2.2. | Frequency f [Hz]. |
| 3. | Outdoor (OSE-110) temperature t [°C]. |
| 4. | Transmission network alternating current self-supply panel (ACSSP): |
| 4.1. | Phase current If [A] of the ACSSP input (only one phase required); |
| 4.2. | Line voltage UL [V] of the busbar section of ACSSP (required from the two other remaining phases where no phase current is measured). |
| 5. | Transmission network direct current self-consumption shield (DCSSP): |
| 5.1. | DCSSP battery charger current [A]; |
| 5.2. | Battery voltage U [V] for DCSSP batteries. |
| 6. | Transmission network equipment control room (ECR): |
| 6.1. | Control room temperature t [°C]; |
| 6.2. | Relative humidity of the control room [%] |
| ***General remarks*** | |
| 7. | Measurements of 110 kV connections must be transmitted within the specified tolerance, i.e. ≤ 1 %. For 0.4 kV ACSSP, 0.2 kV DCSSP, temperature measurements can be transmitted with an error of ≤ 2.5 %. |
| 8. | The measurements of P, Q, U , I of the 110 kV inputs of the power transformers shall be transmitted from the momentary data controller (MDC) and, alternatively, from the RPA devices. Alternative measurements from RPA devices can be transmitted with an error of ≤ 2.5 %. |

* 1. Control commands shall be transmitted in real time to the following devices (direction of transmission to the TCTD):

| **No.** | **Description of the installations controlled from the TSO DCS** |
| --- | --- |
| ***Equipment of the 110 kV TS part of the PT:*** | |
| 1. | Control of all switching apparatus and earthing switches in the transmission network. |
| 2. | Receivers/transmitters for telecommand transmission network equipment: |
| 2.1. | Control of individual commands (switching off/on) of receivers/transmitters; |
| 2.2. | Control of all commands (switching off/on) for receivers/transmitters. |
| 3. | Management of RPA provisions groups for transmission network devices. |
| 4. | RPA function management for transmission network devices. |
| 5. | Switching the control rights of a 110 kV transformer connection. |
| 6. | Control of the ACSSP automatic switches of the transmission network, control of the ACSSP 0,4 kV ARA function. A physical key shall be provided in the control panel room for deactivation/activation of the 0,4 kV ARA automation. |
| 7. | Control of 110 kV linear voltage transformers on the transmission grid (for voltage transformers installed on 110 kV lines downstream of the line side of the line isolator). |

* 1. The list of signals shall be prepared, coordinated with the TSO and tested in accordance with the TSO-approved description of the requirements for remote control of the equipment of transformer substations and switchyards on the transmission grid, as set out in the Annex (61).
  2. The technical design shall foresee the need for operational name changes and/or other related works (preparation of signal lists for the objects, coordination with TSO, testing, changes to instructions, diagrams and other documentation) to be carried out in other transmission network objects related to the reconstruction of this object *(110kV part of Neris TS, Pabradė TS, and Paberžė TS)*. Identify in the technical design the work to be carried out on other transmission network assets on an asset-by-asset basis. In the case of changes to other facilities in the transmission network, the signal lists for these facilities shall be prepared, coordinated with the TSO, and the testing shall be carried out on a substation/facility-by-substation basis, in accordance with the TSO's approved Remote Control Requirements for Transmission Network Transformer Substations and Switchyard Facility Requirements Schedule.
  3. The TSO shall provide lists of teleinformation (signals, control and measurements) of other transmission network objects (related to the reconstruction of the 110/10 kV Nemenčinė TS) to the organisation providing the design service. Further completion, adjustment and coordination of the scope of the teleinformation lists of other transmission network objects with the TSO responsible employees shall be carried out within the teleinformation lists provided. The lists shall include a separate section for newly designed and incorporated teleinformation (signals, control and measurement).
  4. In the teleinformation lists of other transmission network objects (related to the reconstruction of the 110/10 kV Nemenčinė TS) provided by the designers of the contracting entity, all teleinformation (signals, control and measurements) directly belonging to, or related to, the protection, control and measurement of the connections of the 110/10 kV Nemenčinė TS shall be indicated. During the design process, the need for changing the names or states of this teleinformation shall be evaluated, taking into account the requirements of the TSO remote management inventory. If necessary, the names of the relevant signals or statuses, commands or measurements shall be adjusted.
  5. All existing and newly added teleinformation related to the reconstruction of the 110/10 kV Nemenčinė TS shall be tested for other transmission network objects.
  6. The designers of the contracted organisation shall review the existing teleinformation lists of other transmission network objects (related to the reconstruction of the 110/10 kV Nemenčinė TS) and assess the need for tele-information that does not directly belong to, or is not related to, the connections of the 110/10 kV Nemenčinė TS, but that may be impacted by the implementation of the new connections of the 110/10 kV Nemenčinės TS (change of names, change of states, addition of new teleinformation, deletion of the existing teleinformation). If such a need arises, existing lists of teleinformation shall be adjusted and testing shall be carried out accordingly for existing or newly added teleinformation from other transmission network entities.

# PART ON COLLECTION AND TRANSMISSION OF TELEINFORMATION

1. 1. The collection and transmission of teleinformation shall be carried out via a new Teleinformation collection and transmission device (TCTD).
   2. The TCTD must be designed and installed in accordance with the requirements:
      1. standard technical requirements for teleinformation collection and transmission equipment (see Annex (62));
      2. the description of the basic requirements for the remote control of the equipment of transformer substations and switchyards in the transmission grid, the requirements for the collection and transmission of tele-information, and the other annexes to the description (see Annex (61)).
   3. The data exchange with the STO TCTD shall be designed according to the requirements:
      1. technical specifications issued by the STO;
      2. the Regulations on Employment Relations between Electrical Workers of the TSO and the STO (see Annex).  (63)).
   4. The TCTD must exchange data:
      1. IEC 60870-5-104 (Slave) protocol with the TSO DCS;
      2. IEC 60870-5-104 (Master) protocol, reserve;
      3. IEC 61850 ed. 2 (Client) with RPA devices, reservation according to IEC 62439 (PRP).
      4. IEC 60870-5-101 (Master and Slave) protocols with STO TCTD;
      5. time synchronisation via SNTP protocol from the substation time synchronisation unit (STSU).
   5. Signals shall be generated and transmitted to the DCS to monitor the status of the TCTD:
      1. Status of TCTD communication channels;
      2. State of play of the TCTD functions;
      3. TCTD information security control.
   6. Physical interconnection of TCTD for data exchange:
      1. connects the TCTD to the STO via multi-mode fibre optic lines, using fibre optic splitters and fibre optic/electrical converters;
      2. with general purpose (hereinafter - GP) and substation data network (hereinafter - SDN) switches, using shielded (≥5 cat) flexible interconnection cables or fibre optic multimode interconnection cables conforming to the requirements of the IEC 11801 standard and manufactured and tested by a manufacturer with a quality management system in place and certified according to ISO 9001 or its equivalent;
      3. all fibre optic cables used must be glass fibre;
      4. fibre optic to electrical converters shall meet the requirements of the clauses of the standard technical requirements for teleinformation collection and transmission equipment (see Annex (62))
         1. requirements for standards (points 1.1, 1.3);
         2. requirements for environmental conditions (point 2);
         3. hardware requirements (point 3);
         4. the parameters of the data exchange interfaces shall be aligned with the parameters of the TCTD interfaces (point 6.3);
         5. DC power supply with a nominal voltage of 220 VDC or 110 VDC or 48 VDC (to be selected at the time of design), with operation within the limits of tolerance of the input voltage in accordance with (point 4.4.4).
   7. Time synchronisation:
      1. Time synchronisation of substation equipment is carried out by the substation time synchronisation unit (STSU);
      2. The STSU must be designed and compliant with:
         1. typical requirements for the design of substation time synchronisation equipment (see Annex (64));
         2. the description of the basic requirements for the remote control of the equipment of transformer substations and switchyards in the transmission grid, the requirements for the collection and transmission of teleinformation, and the other annexes to the description (see Annex (61)).
   8. All equipment supplied shall be new, fully assembled and tested by the manufacturer, compatible with each other and with other substation equipment, and suitable for use in transformer substations and switchyards.
   9. The equipment shall be powered from a direct current self-supply panel (hereinafter - DCSSP) in accordance with the requirements for equipment power supply (see Annex (65)).
   10. Installation of equipment - dismantling:
       1. The equipment (TCTD, STSU and other packaged equipment) shall be installed in a cabinet, in accordance with the requirements of the GRIEE, ensuring the installation method and the required operating conditions as specified by the equipment manufacturer;
       2. equipment serviced from two sides shall be installed in a swing-out cabinet frame or in a double-sided service cabinet with access to the equipment from both sides;
       3. the cabinet must comply with the standard technical requirements (see Annex (66));
   11. Testing and trials:
       1. The factory acceptance test (FAT) of TCTD and STSU shall be carried out in accordance with a pre-agreed programme, with the participation of TSO representatives and the submission of a test report;
       2. Site acceptance test (SAT) of the TCTD data exchange after the equipment has been installed on site according to the design, with a test report.
   12. The equipment must be complete:
       1. with software for configuration, functions and licences;
       2. with technical descriptions of hardware and software;
       3. documentation of data exchange protocol matches.
   13. Requirements for the collection, transmission and management of teleinformation in the reconstruction-related transmission network facilities specified in the DT *(Neris TS, Pabradė TS)*:
       1. the changes to the teleinformation volumes in the TSO facilities involved in the reconstruction shall be assessed and the necessary changes to the collection, transmission and management of teleinformation shall be designed and implemented;
       2. During the design coordination process, the technical solutions shall be agreed and complete lists of signals in the TCTD configuration, including signals in the reconstructed part, signals to be deleted during the reconstruction and new signals, shall be prepared and submitted;
       3. In case of insufficient resources of the TCTD, the hardware and software of the TCTD must be upgraded or supplemented and the configuration of the TCTD must be performed.
   14. Qualification and works:
       1. The installation and configuration of TCTD and packaged equipment shall be carried out by personnel certified by the equipment manufacturer or its authorised agents at centres certified by the equipment manufacturer. Certificates of competence shall be submitted before the start of work;
       2. When connecting devices to the TSO's technological network, the devices' factory access passwords must be agreed with the TSO and changed;
       3. the work shall be planned and executed in such a way that the data link and the TCTD are configured and tested before the commissioning of each phase.
   15. The teleinformation capture and transmission part of the technical and detailed design shall be contained in separate TIS files.

# PART ON ELECTRONIC COMMUNICATIONS (TELECOMMUNICATIONS)

* 1. Design and install the necessary infrastructure for the technological data transmission network (TDTN) to be integrated into the existing TSO telecommunications network for data transmission to the TSO's primary and backup data centres.
  2. **Lines of communication.**
     + 1. Design and installation of the relocation of the existing 24-fibre lightning protection cable (hereinafter - LPC), the existing LPC with FOC coupling No PN-Ne, to the newly designed and installed OL portal.
       2. The existing single-mode 24-fibre fibre optic cable (to the AB ESO control panel) is retained and moved to the telecommunications cabinet of the LITGRID AB control panel, terminating in a fibre distribution panel (FDP) with E2000/APC type connectors.
       3. Carry out fibre re-welding works (four fibres) at the 110 kV OL Neris-Pabradė support No. 82 in the LPC with FOC coupling PN-82 and dismantle the underground fibre optic cable installed in the coupling PN-82.
       4. The marking of the coupling must be made with materials resistant to weather, temperature and sunlight.
       5. Design a LPC with FOC spare wrapping and securing device in the gantry below the existing phase wires to avoid disconnection of the OL line when servicing the LPC with FOC-FOC coupling.
       6. Design new 50 mm diameter, minimum 3 mm wall thickness, steel protection pipes to take the FOC from the portal to the newly designed and installed communication manholes (dismantle redundant and unused manholes).
       7. For the protection of the fibre optic cable from the LPC with FOC-FOC coupling to the newly designed and installed communication manhole, PE pipes with a diameter of 32 mm and a minimum wall thickness of 2.4 mm shall be designed. The outer and inner surfaces of the pipe shall be smooth.
       8. The Contractor shall notify the Customer in advance of the planned interruption of the connection of not more than 4 (four) hours per month, at least 14 (fourteen) days prior to the commencement of the planned works. At least three months before the planned start of the works, for planned interruptions of more than 4 (four) hours per month
       9. Only one fibre optic cable can be switched per week. The technical design shall include a preliminary plan for the disconnection works (LITGRID AB instruction NU-165 of 22/05/2018), as set out in the Annex (67).
       10. Design and install a single-mode 24-fibre fibre optic cable (hereinafter - FOC) inlet to the design control panel from the LPC with FOC-FOC coupling to be designed in the portal, maintaining the existing connections.
       11. Provide and install a new entry seal for the entry of the projected 24-fibre fibre-optic cable into the existing coupling.
       12. The fibre optic welding scheme and the number of fibres to be welded are subject to refinement during project development.
       13. Typical requirements for the design of FOC are given in the Annex (68):
       14. fibre type for single mode (SM) cable - ITU-T G.652D
       15. fibre type for multimode (MM) cable - ITU-T G.651.
       16. All FOC are terminated in newly installed fibre distribution facilities (FDP). Typical requirements for FDP design are given in the Annex (69);
       17. ODF connector type for single-mode (SM) cable - E2000/APC;
       18. ODF connector type for multimode (MM) cable - SC/PC.
       19. Inside the telecommunications cabinet, at the side of the cabinet, leave only the minimum stock of FOC required for handling FDP after removal from the cabinet.
       20. Leave process FOC stocks in manholes or crawl spaces.
       21. Design and install the necessary fibre optic cables to connect or switch the equipment. Connecting fibre optic cables between cabinets shall be routed in flame-retardant protective conduits.
       22. In order to maintain independent FOC runs, underground FOC shall only be installed in newly designed and installed Ø110 mm HDPE 1250N communication cable duct systems (CCDS) pipes.
       23. Typical requirements for communication protection pipes are given in the Annex (70).
       24. The ends of the protective pipes in which the FOC is laid shall be sealed with fire-resistant foam.
       25. Communication manholes shall be installed only within the substation site. Dismantle unnecessary communication manholes.
       26. Typical requirements for communication manholes are given in the Annex (71).
       27. Upon completion of the fibre optic cable installation work, provide fibre optic passports for all fibres and original reflectograms of the fibres in \*.sor format in accordance with the requirements set out in the Annexes (6) and (7).
  3. **Technological data transmission network**
     1. **IP/ MPLS network**
        1. Design and installation of the technological data transmission network (TDTN) equipment to be integrated into the existing LITGRID AB IP/MPLS network:
           1. MPLS router for 110/10 kV Nemenčinė TS with the required number of SFP modules;
           2. Add the required number of SFP modules to the existing MPLS routers in the connected Pabradės TS and Neris TS;
           3. Connection of the Pabradė TS - 110/10 kV Nemenčinė TS - Neris TS router circuits via fibre optic fibres;
           4. A general purpose (GP) industrial switchgear 110/10 kV Nemenčinė TS with the required number of SFP modules;
           5. The router and switch are mounted in a 19-inch frame in the communications cabinet.
        2. Design and install communication channels:
           1. For TCTD data transmission;
           2. For RPA monitoring;
           3. For security, fire and video surveillance systems;
           4. For grounding monitoring of NSRS;
           5. For data transfer between commercial and technical metering devices. The SFP modules to be used shall be properly selected (compatible with the Ethernet media converters installed in the CEMC and TMC) and shall be connected to the ports of the BP switch;
           6. Computer workstation access;
           7. Privileged (PAW) computer workstations for access (2 units);
           8. For other TS systems under design.
     2. **Substation data network**
        1. Design and install a substation data network (hereinafter - SDN) for data exchange between the substation's TCTD, RPA devices and the substation's time synchronisation unit (STSU), ensuring the requirements of IEC 61850 and IEC 62439-3 standards.
        2. In the draft work project, provide a completed device list and device communication protocol setup table for the assignment of IP addresses and VLAN.
        3. SDN network must be designed and installed according to the priorities of the information to be transmitted.
        4. SDN switches shall be mounted on a DIN rail in RPA cabinets;
        5. SDN switches are mounted in a 19-inch frame in the TCTD cabinet;;
        6. The SDN network ring changeover time shall be tested and a report submitted.
     3. The TCTD and SDN are designed according to the standard structural scheme of the TCTD of LITGRID AB transformer substation.
     4. The routers, GP and SDN switches are bundled with the licences of the data network management and monitoring system used by LITGRID AB.
     5. All SFP modules to be designed must be original industrial type, from the same manufacturer as the equipment to which they will be connected.
     6. In commercial and technical metering cabinets, the design of media converters shall comply with:
        1. Data transmission is compatible with the SFP module connected to the GP switch;
        2. IEC-61850-3 ed.2 standard requirements for environmental conditions and hardware;
        3. Power supply without external power supplies.
  4. **Telecommunications infrastructure**
     1. Design and install power supply systems for telecommunications equipment.
        1. working from two direct current shield (DCS) busbar sections of a substation's direct current battery bank.
        2. the telecommunications equipment shall be provided with a power supply to ensure the functioning of the communications equipment for at least 8 hours.
        3. the requirements for the design of the electrical power supply for telecommunications and TCTD against DCSSP.
     2. Design and install the required number of new telecommunications cabinets, taking into account the equipment manufacturers' recommendations for installation and environmental conditions.
     3. Telecommunications cabinets shall be designed in accordance with the requirements for internal telecommunications cabinets in control panels and communications equipment.
  5. **General requirements**
     1. The data links shall be in place before the start of the comprehensive testing of the Stage I installations.
     2. The installation, configuration and testing of the newly deployed data communications equipment must be designed and carried out.
     3. Telecommunications and infrastructure equipment shall be designed and installed new.
     4. The telecommunications part of the technical design shall be presented as a separate chapter or file and the detailed design as a separate file.
     5. Describe and provide solutions in the technical design for the necessary data transmission changes to be made to other transmission network facilities related to the reconstruction: Pabrade TS and Neris TS.
     6. The telecommunication solutions shall be developed in accordance with the TSO-approved Remote Control Requirements for Transmission Network Transformer Substations and Switchyard Equipment as set out in the Annex (61).
  6. Telecommunications and infrastructure equipment must be designed and installed according to standard specifications:
     1. For the design of the fibre optic cable (see Annex (68) );
     2. For connecting fibre optic cables (see Annex (72));
     3. For the design of the fibre distribution unit (see Annex (69));
     4. For communication protection pipes (see Annex (70));
     5. For communication wells (see Annex (71)).
     6. For the design of the electrical power supply for telecommunications and TCTD against DCSSP (see Annex (65));
     7. For the telecommunications power supply (see Annex (73));
     8. For telecommunication indoor cabinets in control panels and communication hardware (see Annex (66));
     9. For radio relay equipment (see Annex (74));
     10. MPLS router (see Annex (75));
     11. For industrial data network switches (see Annex (76));
     12. Ethernet media converters (see Annex (77));
     13. Typical TS TDTN diagram (see Annex (78));
     14. Example of tables and a list of devices (see Annex (79));

# PART ON ELECTRICITY METERING AND MEASUREMENTS

* 1. Design electricity metering:
     1. commercial master and overlapping electricity metering for power transformers in 110 kV connections;
     2. control (technical) electricity metering at the 0.4 kV solar power plant's connections to the TSO ACSSP.
  2. The connection of the AC distribution panel of the transmission network to the substation's self-supply panel and the commercial metering cabinet of the transmission network (PT SR CEMC) shall be designed in accordance with AB ESO Connection/Technical Specifications for the Reconstruction or Construction of TS 110 kV Switchyard in the Annex (2).
  3. For electricity meters installed in the 110 kV connections of power transformers, a metal commercial electricity metering cabinet (CEMC) shall be designed in the area belonging to the transmission network near the cable duct. The technical requirements and equipment of the CEMC shall comply with the standard technical requirements for outdoor commercial metering cabinets given in the Annex (80). The requirements for specifying the complement of the CEMC are described in more detail in the following clauses.
  4. Install the control (technical) electricity meters for the 0.4 kV connections of the solar power plant in the control (technical) metering cabinet TMC in the 110 kV switchgear control panel (VP). The technical requirements and equipment of the TMC shall be in accordance with the standard technical requirements for internal control/technical control cabinets given in the Annex (81)*.* The requirements for specifying the composition of the TMC are described in more detail in the following paragraphs.
  5. CEMC must be designed and installed:
     1. Four commercial electricity meters - two main and two duplicate meters. The electricity meters are electronic, with two independent current loops (CL1 and CL2), external dimensions 323x178x57 mm. Space must be left for the installation of two similar electricity meters;
     2. four test terminals (external dimensions 230x140x50 mm) for connecting electricity meters;
     3. The electricity meters and test terminals shall be mounted on a mounting plate which shall be hinged inside the CEMC and shall be ready for sealing in the closed position;
     4. ARA of voltage circuits of commercial master electricity meters with automated restoration of the normal meter connection scheme after the occurrence of a voltage fault in the own voltage transformer. The scheme of the ARA shall be equipped with keys for manual disconnection of the ARA. The devices and control handles of the ARA shall be located under a sealed cover;
     5. a complete automated electricity accounting system (AEAS) data acquisition and transmission controller (panel external dimensions 510x315x190 mm) in an electrical box with equipment compatible with the data transmission technology of the Lithuanian mobile operator, if such equipment is to be installed in accordance with the TSO wishes;
     6. a controller for collecting and transmitting momentary data in an electrical box (external dimensions 510x315x190 mm).
     7. 12VDC redundant power supply unit for redundancy of commercial main and redundant meter voltage circuits.
  6. The TMC cabinet shall be designed and equipped with:
     1. control (technical) electricity meters for the 0.4 kV solar power plant connected to the TSO ACSSP. Electronic electricity meters with two independent current loops (CL1 and CL2), external dimensions 323x178x57mm.;
     2. Test clamps (external dimensions 230x140x50 mm) for connecting electricity meters;
     3. 12 VDC redundant power supply unit for redundancy of voltage circuits of electricity meters.
  7. The connection of commercial master meters for power transformer connections shall be made to separate (separate from relay protection, other measuring instruments or automation equipment) current and voltage transformer measuring windings. Commercial duplicate electricity meters shall be connected to the measuring windings of other current and voltage transformers. Commercial duplicate electricity meters can be connected together, with other metering devices or automation equipment.
  8. The requirements for new 110 kV current and voltage transformers or combined current and voltage transformers are specified in chapter 5 of this Design task.
  9. In commercial master meter voltage circuits installed in power transformer connections, ARA shall be designed between the installed power transformers in the power transformer connections or the busbar voltage transformers. The ratings of the relays used in the ARA shall be selected taking into account the winding voltages and connected loads. The ARA shall operate when the voltage drop in any phase is below 70% Uv. Trigger time - 2 seconds.
  10. The control/technical electricity meters of the solar power plant shall be connected via 0.72 V XX/5 A current transformers, which shall be calculated taking into account the installed capacity of the solar power plant. The selected current transformers shall comply with the requirements of the GRIEE and the standards, have the capability of sealing the secondary circuits, and shall bear verification certificates issued by the manufacturer recognised in Lithuania, by an accredited laboratory in Lithuania or in another European Union country, or by a marking that replaces the latter, confirming the accuracy of their measurement.
  11. After the installation of the electrical metering, the actual loads on the windings and cores of the current and voltage transformers used for the electrical metering, as well as the voltage drops (ΔU,%) of the voltage circuits used for the electrical metering shall be measured, and the protocols of verification of the loads and the measurement of ΔU shall be reported.
  12. For the transmission of active power (P) and reactive power (Q) flow signs from electricity meters and their mapping in the TSO AEAS and DCS, the requirements of the description of the remote control requirements for the equipment of transformer substations and switchyards on the transmission network in the Annex (61) shall apply to the directions of connection for electricity meters.
  13. It should be noted in the design that the test terminals, the electricity meters, the configured automated metering controller and the configured momentary data acquisition and transmission controller necessary for the project will be provided by the TSO for installation. The handover of the equipment will be formalised by signing a "Transfer - acceptance act for the equipment and materials to be installed". The technical requirements for the automated electricity metering system data acquisition and transmission controller, as assembled in electrical boxes, are set out in the Annex (82) and (83) respectively*.*
  14. The prefabricated first current loops of the electricity meters installed in the CEMC and TMC, “CL1”, shall be connected to the automated electricity metering system data acquisition and transmission controller (KDV) installed in the cabinet of the CEMC and the current loops of the meters installed in the “CL2” (except for the meters installed at the 0.4kV connection of the solar power plant), shall be connected to the momentary data controller (MDC) installed in the same cabinet.

Commercial main and commercial duplicate meters of 110 kV power transformer connections for information reservation shall be connected in different current loops of KDV and MDC (as an example of grouping could be T101P + T102D or similar). When designing the transmission of commercial and momentary information from electricity meters to the TSO information systems, the KDV and MDC current loops must be maximised for reliability of data transmission.

* 1. The KDV shall be connected to the substation 110 kV switchyard’s VP or to the optical Ethernet access (general purpose Ethernet switch) of the communication equipment to be designed elsewhere in the telecommunications cabinet by design, via a multimode fibre optic cable, using the Ethernet media converters installed in the CEMC. The KDV Ethernet port is RJ-45. The KDV connection (Ethernet and, if requested by the TSO, the network of a Lithuanian mobile operator) and the data transmission shall be coordinated with the TSO AEAS (EMCOS) data acquisition server.
  2. The MDV shall be connected to the substation 110 kV switchyard’s VP or, as per the design, elsewhere in the telecommunication cabinet by an optical Ethernet access (general purpose Ethernet switch) in accordance with the full MDC monitoring scheme, allowing remote monitoring, parameter modification and scanning of the operating status of the MDC and its components via LAN. The interconnection of the MDC to the general-purpose Ethernet switch shall be designed and implemented over multimode fibre optic cable, using the Ethernet media converters installed in the CEMC. The real-time momentary data of electricity meters shall be transmitted from the MDC to the TSO’s DCS. The Ethernet port(s) of the MDC are RJ-45. The communication with the MDC, the transmission of momentary data from the electricity meters to the TSO’s DCS and the monitoring of the MDC shall be coordinated.
  3. All Ethernet media converters used to communicate with the controllers shall have integrated power supplies. The standard specifications for Ethernet media converters are given in the Annex (77) .
  4. All CEMC design equipment and devices shall be suitable for operation in a confined space (enclosures with protection rating ≥ IP 54 outdoor type) at ambient temperatures from – 25°C to +55°C.
  5. All terminal cabinets (terminal blocks) for 110 kV current and voltage transformers shall comply with the standard technical requirements for outdoor intermediate terminal cabinets in the Annex (59).
  6. The earthing of the secondary circuits of the current and voltage transformers and the switching of the coefficients of the current transformers (by selecting the cores with the branches at the time of design) shall be designed to be installed in ST terminal cabinets (terminal blocks).
  7. The sockets, lighting, anti-condensation heating in the CEMC and terminal cabinets (terminals), as appropriate, shall be provided with a separate reserved power supply from the transmission network alternating current self-supply panel (TN ACSSP). The 12VDC redundant power supply unit for the redundancy of the power meter voltage circuits, the Ethernet media converters, the data acquisition and transmission controllers (KDV and MDC) are to be fed from the substation's DC mains, and the CEMC is to be equipped with an industrial-type XXVDC/230VAC voltage converter.
  8. Connection cables and conductors for all elements of the electrical metering scheme (including conductors for the internal mounting of electrical metering and terminal cabinets, and current loop wiring) shall be insulated, single-wire, with copper conductors. The cross-section of the conductors of the current loops shall be 0,75 ÷ 1,00 mm2. The connection cables for the elements of the electricity metering scheme shall be fitted with a protective shield of concentric copper tape. A potential equalisation network shall be calculated and designed to protect shielded cables. The requirements for the method of laying cables shall be specified in the construction section of the project. Other standard technical requirements for control cables are given in the Annex (54) and for wiring for internal mounting of outdoor and indoor cabinets in the Annex (55).
  9. All covers for sealing in electrical accounts shall be solid and made of non-perforated material.
  10. An alarm shall be designed for the status of the off-position of the signalling contacts of the automatic switches in the voltage circuits of the electricity metering circuits and the signals shall be transmitted to the TSO’s DCS. The CEMC shall be equipped with a local visual indication of the position of the signal contacts for the status of the above automatic switches.
  11. The reconstruction shall include the dismantling and disposal of the existing unusable electricity metering cabinets, electricity meters and T-1 and T-2 power transformers in the 10 kV connections of the TSO commercial electricity metering cabling and other unusable equipment. The dismantled KDV, all electricity meters and test terminals and other coordinated electricity metering equipment shall be handed over to the Customer (TSO Infrastructure Supervision Centre, Eastern Region) at the time of the project.
  12. The technical requirements for these electricity metering systems and for the reading and transmission of commercial and momentary information from electricity metering systems are subject to change. All changes must be agreed with the TSO at the time of preparation of the technical design.

# PART ON SECURITY ALARM

1. 1. The level of protection of a transformer substation (switchyard) is selected individually, regardless of the type of scheme. The possible physical protection levels for a transformer substation are: Physical protection level 2 and physical protection level 3.
   2. **Physical security system (physical security level 2):**
      1. basic requirements for equipment and works:
         1. The security systems to be designed shall send and receive information over an existing 802.3 Ethernet LAN, IP routed, MPLS-VPN data network using TCP, unicast UDP data delivery protocols. Active telecommunications equipment for network configuration and enhancement, which shall comply with standard technical requirements (see Annex (84));
         2. designing subnetworks with the parameters required for the security systems to function properly;
         3. designing tests to assess the design parameters of communication channels;
         4. designing devices must be compatible with the mapping and management tools at security posts and with the format of data repositories in data centres;
         5. if the use of existing mapping and management tools is no longer feasible or cannot achieve the required parameters, it is necessary to envisage means of extending them;
         6. the security alarm solutions shall comply with the requirements of the physical and operational security levels provided for in the Order of the Minister of Energy of the Republic of Lithuania of 15 January 2019 No.1-9 "On Approval of the Physical and Operational Security Requirements for the Protection of the Energy Enterprises of Importance to the National Security of the Republic of Lithuania and for the Protection of the Energy Infrastructure of Strategic or Significant Importance to the National Security of the Republic of Lithuania", and with the requirements for the security levels of security level no lower than security level 2 in accordance with the LST EN50131-1 standard;
         7. when designing, it is necessary to take into account the strong electromagnetic fields in the area of the switchyard (due to short circuits, switching and atmospheric overvoltages);
         8. the design of the equipment shall ensure that all programmed parameters are preserved in the event of a voltage loss;
         9. means for remote administration of the system must be provided;
         10. design a new cabinet for the security systems in the facility (in the communications room), including their electrical supply. The cabinet shall comply with the standard technical requirements for indoor telecommunications cabinets (see Annex (66));
         11. cabling is designed inside and outside the building in accordance with the Rules for the Installation of Electrical Lines and Wiring and other normative documents;
         12. earthing and surge protection shall be designed in accordance with the requirements of the General Rules for the Installation of Electrical Equipment (Chapter 8);
         13. the surface of the designed metal structural elements must be protected against corrosion;
      2. requirements for a protective alarm system for transmission network facilities:
         1. the system shall be designed in accordance with LST EN50131 "Alarm systems. Intrusion alarm systems", LST EN50133 "Alarm systems. Access control systems for ensuring security", LST EN50136 "Alarm systems. Alarm Transmission Systems and Devices" and other specified mandatory requirements;
         2. Functional description of the system: an intrusion alarm system based on IP technology shall be designed for the protection of buildings and premises within the site. The requirements for the control panel are given in the Annex (85). The first protection zone consists of the door leaves of buildings, controlled by magnetic contact sensors (if there are windows, magnetic contact and glass-break sensors shall be provided for their control). The requirements for magnetic contacts are given in the Annex (86). The second protection zone consists of passive infrared (PIR) sensors for building spaces. The requirements for PIR sensors are given in the Annex (87). The security control unit (control panel) shall be provided in an interior room outside the restricted entrance area. The system is controlled by a control panel and a card reader, which are installed inside the room at each entrance door. The control panel adjacent to the reader shall provide a clear indication of the system status. It shall be possible to operate the system in several ways: (a) identification card and code; (b) identification card only or code only;
         3. The requirements for card readers and IP controllers are given in the Annex (88);
         4. the readers must be connected to a functioning server of the access control system located in the duplicate data centre of Kaunas 330 kV TS Biruliškiai village, Kaunas district;
         5. each of the sensors is connected to a separate beam. A minimum margin of at least 10% of the rays shall be provided;
         6. if a telecommunications room is provided in the building, its alarm shall be controlled independently of the other rooms;
         7. the system shall operate autonomously in the event of loss of main power for 24 hours in standby mode followed by 30 minutes in alarm mode;
         8. the indoor alarm shall be sounded by an outdoor optical sounder;
      3. technical requirements for a video surveillance system for the transmission network facilities area:
         1. functional description of the system: a controlled camera is designed to view the area. The location and height of the camera shall be chosen to maximise the view. The boundaries of the control area are the outer boundaries of the site. The camera shall be mounted on a lighting pole or other structures in the area, and the specific mounting location shall be agreed with the Customer's representatives. The controlled camera reacts to perimeter breaches and automatically turns to the location of the breach. Fixed cameras shall be designed in the control panels and communication rooms. The location and height of the cameras shall be chosen to maximise the view. The cameras are connected to a telecommunications network and the video signal is transmitted to a digital recorder with video management system software using H.264 video compression. Existing digital recorder is installed in Ukmergė TS Statikai village, Deltuvos str. 47A
         2. The main characteristics of the coded video signal to be transmitted:
            1. Full HD (1920x1080) frame size for recording and displaying;
            2. a transmission rate of at least 12,5 frames per second at minimum signal compression;
            3. H.264 compression format;
         3. type of cameras: digital cameras connected to Litgrid AB's telecommunications network using a fibre-optic cable or a computer network cable and galvanic isolators.
         4. The requirements for digitally controlled cameras are given in the Annex (89).
         5. The requirements for fixed cameras are also set out in the Annexes (90) ir (91):
         6. The system must be able to operate autonomously in the event of a loss of main power for at least 4 hours;
         7. video archive of 31 days (if the existing video recorder does not have sufficient internal memory to provide 31 days of video, the internal memory must be expanded or an additional external networked storage array must be installed that is compatible with the specified existing installed video recorder);
      4. Requirements for an area motion detection system for transmission network facilities:
         1. the system shall be designed in accordance with LST EN50131 "Alarm systems. Intrusion alarm systems", LST EN50133 "Alarm systems. Access control systems for ensuring security", LST EN50136 "Alarm systems. Alarm transmission systems and equipment" recommendations and other mandatory requirements set by the TSO;
         2. Functional description of the system: sensors shall be designed to protect the access to the communication and power transmission facilities, substation control panel (hereinafter - SCP) located in the territory of the facility and shall be connected to the intrusion alarm system of SCP. The first section consists of the entrance and access gates, controlled by magnetic contact sensors;
         3. The second section consists of passive infrared (PIR) sensors that monitor the area's power transmission facilities and building entrance doorways. Motion detectors shall also be provided at access roads, gates and gateways. Requirements for outdoor motion detectors are given in the Annex (92). The triggering of sensors and building alarms in the area generates a control signal that directs the cameras to the trigger point. When the sensor is triggered, the sounder on the building is not triggered, the controlled cameras and security lighting react, and the alarm signal is routed to the remote monitoring centre at the security post;
         4. Connecting the sensors in the area to the control panel, expanding it as needed. A separate beam is projected for each of the sensors. A minimum margin of at least 10% of the rays shall be provided;
         5. The area motion detection system shall be controlled by a control panel in the building and a card reader designed and installed at the entrance gate or gate;
         6. The area and indoor alarms are managed separately;
         7. The system shall provide a sufficient number of programmable outputs to control the prepositions of the controlled cameras.
         8. The outdoor sensors shall be installed in such a way as to prevent the sensor window from being covered during wet weather or snowstorms.
      5. Technical requirements for fire alarms:
         1. Fire alarm systems in buildings shall be designed in accordance with LST EN 60849 and LST EN 54 series standards.
         2. A separate Fire Panel shall be designed for a protected area greater than 200 m2 .
         3. For protected areas of less than 200 m2 , the fire alarm detectors shall be connected to the fire alarm control panel.
         4. Fire alarm effects shall be transmitted to the burglar alarm and DCS systems.
         5. The requirements for the fire alarm system are given in the Annex (93).
      6. Technical requirements for the facility's locks and locking system:
         1. The facility must have a serial locking system, according to the existing locking system plan (hierarchy). The system uses cylinders and keys with an electronic locking system;
         2. Requirements for cylinders (lock cores) are given in the Annex (94);
         3. Requirements for padlocks are given in the Annex (95);
         4. The serial locking system shall be installed upon completion and in the presence of the Customer's representative.

# PART ON ENVIRONMENTAL PROTECTION

* 1. In the technical design, in accordance with the provisions of STR 1.04.04:2017 "Building Design, Expert Examination of a Design", develop the environmental requirements, including but not limited to the requirements set out in this chapter. The technical design must include details of:
     1. hazardous and non-hazardous waste generated during project implementation and operation, specifying their names, codes and quantities, including dismantling of equipment that is not required by the TSO;
     2. the estimated area, thickness and volume of topsoil to be harvested during the project, the location of temporary storage of the harvested topsoil and its use;
     3. requirements for equipment suppliers to provide information on the quantities and brands of chemicals (SF6 gas and oil) contained in equipment, as well as their certificates and safety data sheets;
     4. Describe the measures to be taken by the contractor on the construction site to reduce noise, air or ground pollution and other factors affecting people and the environment.
  2. The Contractor shall:
     1. organise and carry out, at its own expense and without prejudice to environmental protection requirements, the collection, sorting, labelling, temporary storage and transfer to the appropriate waste managers for the type of waste generated during the implementation of the project and the packaging waste from the new installations, and to keep records of the waste and submit reports in accordance with the procedure laid down by law;
     2. dismantle the dismantled equipment that is not required for the purposes of the TSO, transfer the resulting secondary raw materials (metals) to the specified recycling company (with which the TSO has a valid contract) on behalf of the TSO, in the presence of the responsible personnel of the TSO Eastern Region, and transfer the resulting waste to the appropriate waste management companies according to the waste type at the TSO's own cost. Dismantled oily electrical equipment containing hazardous waste may be handed over by the contractor to the waste manager undisassembled, after having been drained of oil, provided that the waste manager is licensed to deal with such waste and issues a hazardous waste consignment note for the total weight of the equipment;
     3. submit an overall waste report to the site's technical assessment committee, together with documents certifying the transfer of the waste; the documents must include the name and address of the site under construction;
     4. keep records of imported taxable packaging and taxable products in accordance with the "Law on Packaging and Packaging Waste Management", the "Law on Waste Management" and other legislation. Submit reports to the TSO and, if necessary, prepare a tax return and pay tax on the basis of these reports;

# PART ON FIRE SAFETY AND OCCUPATIONAL SAFETY

* 1. The design shall contain the necessary calculations and indicate the degree of fire resistance of the control panel, the fire load category (where it is necessary to determine it), the fire hazard class, the fire resistance of the structures of the building, the fire resistance capacity of the buildings and the structures, and shall contain the other fire safety requirements in accordance with the Basic Requirements for Fire Safety, as approved by the Director of the Department of Fire Protection and Rescue under the Ministry of the Interior, Order No. 1-388 of 7 December 2010, and other legal acts.
  2. The locations of the building structure through which cables pass shall not reduce the fire requirements of the structure itself. Openings in fire barriers for the construction of utility services shall be sealed with fire sealing systems in accordance with the requirements laid down in the normative document Basic requirements for fire safety.
  3. Provide at least one location for the earthing of firefighting equipment away from electrical installations and process buildings. The earthing straps for earthing fire appliances/equipment shall have an unpainted gap of 50 mm for application of the earthing switch. Add a galvanised metal bolt with a diameter of 10 mm and a length of 20, 30 mm, with a wing nut of 10 mm diameter, to the same strip (50-70 mm from the unpainted part). The earthing points shall be marked "Place for earthing fire-fighting equipment".
  4. The SCP shall be equipped with a fire alarm system in accordance with the requirements of the section “Requirements for protective systems” and shall be equipped with at least two fire extinguishers containing at least 4 kg of extinguishing agent.
  5. The technical design shall include design solutions setting out the technical measures, methods of work, ensuring the safety and health of workers.

# ANNEXES

**LITGRID AB requirements for the drafting of technical specifications for a technical design, 17 pages.**

**2. *Conditions for the relocation (reconstruction) of electricity networks and installations No. ISK21-50626, 3 pages.***

**3. *Standard form for the schedule of works and disconnections, 1 page.***

**4. *0,4-35 kV crossing OL disconnection schedule form, 1 page.***

**5. *LITGRID AB requirements for the composition of the technical design, 12 pages.***

**6. *Requirements for documentation to be submitted to the Commission for the technical assessment of the construction/reconstruction works of an energy facility, 47 pages.***

**7. *Requirements for documentation to be submitted to the commission for the completion of the construction/reconstruction of an energy facility, 3 pages.***

**8. *Minimum information security requirements for design and implementation V1.1, 10 pages.***

**9. *Minimum information security requirements for the provision of services V1.1, 12 pages.***

**10. *Standard technical requirements for factory reinforced concrete foundations for electrical equipment of 330-110 kV voltage transformer substations and open switchyards, 3 pages.***

**11. *Standard technical requirements for steel structures supporting electrical equipment for open switchyards, 330-110 kV, 3 pages.***

**12. *Standard technical requirements for hot-dip galvanizing of steel structures of 110-400 kV substations, switchyard equipment and overhead lines, 4 pages.***

**13. *Standard technical requirements for the control panel for 400-110 kV voltage transformer substations, 7 pages.***

**14. *Standard technical requirements for transformer substation conditioners and associated equipment for 400-110 kV voltage transformer substations, 4 pages.***

**15. *Standard technical requirements for reinforced concrete overhead cable ducts for 330-110 kV voltage transformer substations and open switchyards, 2 pages.***

**16. *Standard technical requirements for buried reinforced concrete cable ducts for open switchyards and cable ducts of 330-110 kV voltage transformer substations, 2 pages.***

**17. *Standard technical requirements for protective pipes for low-voltage cables to be installed from ground level to the gear/terminal cabinets of equipment, 3 pages.***

**18. *Typical site plan nodes for the design task for 400-110 kV voltage transformer substations and open switchyards 4 pages.***

**19. *Standard technical requirements for the surfacing of 330-110 kV voltage transformer substations and open switchgear areas, 3 pages.***

**20. *Standard technical requirements for fences for 330-110 kV transformer substations and open switchyards, 3 pages.***

**21. *List of equipment to be dismantled and transferred to Litgrid AB emergency reserve, 1 page.***

**22. *Standard technical requirements for 110 kV separators, 6 pages.***

**23. *Standard technical requirements for 110 kV SF6 gas circuit breakers, 8 pages.***

**24. *Standard technical requirements for 110 kV surge arresters for line discharge class 2, 5 pages.***

**25. *Standard technical requirements for 110 kV surge arresters for line discharge class 3, 5 pages.***

**26. *Generalised requirements for the installation of surge arresters in 110 kV transformer substations, 6 pages.***

**27. *Standard technical requirements for 110 kV metering transformers, 11 pages.***

**28. *Technical requirements for the self-supply of transformer substations and switchyards on the transmission network, 11 pages.***

**29. *Standard technical requirements for a direct current self-supply panel, 7 pages.***

**30. *Standard technical requirements for stationary accumulator batteries, 3 pages.***

**31. *Standard technical requirements for battery chargers, 3 pages.***

**32. *Standard technical requirements for an alternating current self-supply panel, 7 pages.***

**33. *Technical requirements for a solar power plant, 1 page.***

**34. *Standard technical requirements for 400-110 kV tubular conductors, 2 pages.***

**35. *Standard technical requirements for flexible conductors (wires) for use in 400-110 kV substations, 3 pages.***

**36. *Standard technical requirements for glass-plate insulators for overhead lines of 330-110 kV, 2 pages.***

**37. *Standard technical requirements for 400-330-110 kV supporting insulators, 3 pages.***

**38. *Standard technical requirements for 400-330-110 kV primary equipment connection terminals, 6 pages.***

**39. *Requirements for the installation of an earthing circuit for 400-330-110 kV voltage transformer substations, 3 pages.***

**40. *Standard technical requirements for earthing circuit elements of 400-330-110 kV voltage transformer substations, 2 pages.***

**41. *Description of the procedure for establishing and marking operational and technical names of the transmission network, 43 pages.***

**42. *Standard technical requirements for technical data sheets for primary installations, 31 pages.***

**43. *Standard technical requirements for lightning protection cables for 400-110 kV overhead lines (without fibre optic cable), 3 pages.***

**44. *Standard technical requirements for clamps for supporting aluminium conductors with steel stranded cores for 400-110 kV overhead lines, 3 pages.***

**45. *Standard technical requirements for vibration dampers for 110 kV overhead lines (Stockbridge type), 3 pages.***

**46. *Standard technical requirements for uninsulated aluminium wires with steel stranded cores of voltage 400-110 kV OL, 4 pages.***

**47. *Standard technical requirements for bolted type tension clamps for 400-110 kV OL wires and lightning protection cables without FOC, 3 pages.***

**48. *Standard technical requirements for tension clamps of the compression type for 400-110 kV OL wires and lightning protection cables without FOC, 3 pages.***

**49. *Standard technical requirements for wedge-type tension clamps for 400-110 kV OL wires and lightning protection cables without FOC, 3 pages.***

**50. *Standard technical requirements for the composition of glass insulator garlands for 400-110 kV overhead lines, 4 pages.***

**51. *RPA complex test schedule V1.1 24 pages.***

**52. *Standard technical requirements for microprocessor relays and controllers for relay protection and automation for 400/330/110/10 kV substations, 10 pages.***

**53. *Litgrid AB Description of the implementation of the standard structural diagrams for relay protection and automation in the technical designs of 110 kV transformer substations in the transmission network, 24 pages.***

**54. *Standard technical requirements for control cables connecting relay protection/automation and open switchgear primary equipment, 6 pages.***

**55. *Standard technical requirements for wiring for internal mounting of outdoor and indoor cabinets, 2 pages.***

**56. *Standard technical requirements for indoor cabinets for relay protection and automation, 7 pages.***

**57. *Customer's inspection report of the set-up of the main and other RPA equipment in the RPA indoor cabinets during factory tests, 10 pages.***

**58. *Standard technical requirements for electromechanical relays for RPA circuits, 6 pages.***

**59. *Standard technical requirements for outdoor intermediate terminal cabinets, 7 pages.***

**60. *Customer's inspection report of the assembly of main and other RPA equipment in outdoor intermediate terminal cabinets during factory tests, 9 pages.***

**61. *Description of requirements for remote control of transmission network transformer substations and switchyard equipment, 287 pages.***

**62. *Standard technical requirements for teleinformation collection and transmission equipment, 8 pages.***

**63. *Standard terms and conditions for the relationship between the transmission system operator and the network user in the operation of electrical installations, 46 pages.***

**64. *Standard technical requirements for time synchronisation equipment for substations, 5 pages.***

**65. *Requirements for the design of telecommunications and TCTD power supply from DCSSP, 3 pages.***

**66. *Standard technical requirements for telecommunication indoor cabinets in control panels and communication apparatus, 5 pages.***

**67. Typical plan for disconnection works, 1 page.**

**68. *Typical requirements for the design of a fibre optic cable, 3 pages.***

**69. *Typical requirements for the design of a fibre distribution plant, 2 pages.***

**70. *Typical requirements for communication protection tubes, 3 pages.***

**71. *Typical requirements for communication manholes, 2 pages.***

**72. *Standard technical requirements for fibre optic interconnecting cables, 2 pages.***

**73. *Standard technical requirements for a telecommunications power supply, 2 pages.***

**74. *Standard technical requirements for radio relay equipment, 4 pages.***

**75. *Standard technical requirements for an MPLS router, 5 pages.***

**76. *Standard technical requirements for industrial data network switches, 5 pages.***

**77. *Standard technical requirements for Ethernet media converters, 3 pages.***

**78. *Typical structural diagram of the data network of Litgrid AB transformer substation, 1 page.***

**79. *Device communication protocol setup tables and device list, 1 page.***

**80. *Standard technical requirements for outdoor commercial metering cabinets, 9 pages.***

**81. *Standard technical requirements for internal control (technical) cabinets, 9 pages.***

**82. *Standard technical requirements for commercial data reading controllers (CDC) for electricity meters, 8 pages.***

**83. *Standard technical requirements for momentary data recognition controllers (MDC) for electricity meters, 10 pages.***

**84. *Standard technical requirements for general-purpose data network switches, 5 pages.***

**85. *Standard technical requirements for a security alarm control panel, 2 pages.***

**86. *Standard technical requirements for magnetic contact, 1 page.***

**87. *Standard technical requirements for indoor motion sensor, 1 page.***

**88. *Standard technical requirements for an IP access control controller, 2 pages.***

**89. *Standard technical requirements for a guided video camera, 2 pages.***

**90. *Standard technical requirements for fixed video camera, 2 page.***

**91. *Standard technical requirements for a fixed outdoor video camera, 2 page.***

**92. *Standard technical requirements for an outdoor motion sensor, 1 page.***

**93. *Standard technical requirements for a fire detection panel (for protected areas exceeding 200 m2), 5 pages.***

**94. *Standard technical requirements for cylinders for series locking system, 1 page.***

**95. *Standard technical requirements for serial locking systems for padlocks, 1 page***