**Tehniskā uzdevuma pielikums Nr. 5**

#### 110 KV KABEĻU TEHNISKĀ SPECIFIKĀCIJA AUTOTRANSFORMATORU SAITĒM

#### TECHNICAL SPECIFICATION

110 kV cable for autotransformers

# General

Proposed Goods shall comply with the standards specified herein. However other standards may be used that are demonstrated to the Purchaser’s satisfaction that they promise to confer equal or better quality and/or performance.

|  |  |  |
| --- | --- | --- |
| Description: | Requested: | Offered: |
| All offered goods shall be type tested and shall pass routine and special tests before delivery | yes |  |
| The tests shall comply with the IEC standards for each type of the goods | yes |  |
| The cables shall be longitudinally and radial water tight, the cable sheathing shall be of material that will protect the main insulation from dangerous water-trees | yes |  |
| Low temperature testing. Sheaths shall be tested at **–35ºC** | yes |  |
| The Tenderer shall include in the tender:   * copies of type test reports * appropriate test reports of water tightness and durability against water-trees for similar construction cables shall be included in offer * calculations of conductor current carrying capacity for cables laid in ground * calculations of permissible short time currents in conductors * calculations of permissible short time currents in metallic screens of cables | please attach to the tender  in electronical .pdf format |  |

|  |  |
| --- | --- |
| Short-circuit parameters on 110 kV busbars | See below |
| Max single-phase short-circuit current | 21.6 kA |
| Max double-phase short-circuit current to earth on phase | 21.2 kA, 3I0=23.7 kA |
| Max three-phase short-circuit current | 19.7 kA |
| Peak current | 44.8 kA |

# Alternatives: Aluminium or Copper conductor

|  |  |  |
| --- | --- | --- |
| Description: | Requested: | Offered: |
| The Tenderer may propose as alternatives the cables with aluminium or copper conductor | please choose alternative: Al or Cu |  |
| The Technical Specification Form and Price Schedule shall be clearly separated and filled-in for each alternative | please prepare Tender forms separately for each alternative |  |
| Technical data (standards, cable lengths, temperatures, electrical and mechanical data) of alternatives shall be as specified in the Technical Specification Form | noted |  |

# 1.1. 110 kV cables

| Description: | Requested: | Offered: |
| --- | --- | --- |
| Manufacturer | please indicate |  |
| Type No. | please specify |  |
| Reference standards (where applicable) | IEC60840, IEC60287, IEC60228, IEC60229, EN60071-1, EN60071-2 |  |
| Power network system earthing | directly earthed |  |
| Total quantity of the 110 kV cables | See below |  |
| 110 kV cables connection | according to technical design |  |
| Electrical data | See below |  |
| Operating voltage U0/U | 64 / 110 kV |  |
| Rated voltage | 123 kV |  |
| Impulse withstand voltage | 550 kV |  |
| Rated frequency | 50 Hz |  |
| Current carrying capacity, when cables are installed in free air, formation – flat, distance between neighbour cable centers – according to technical design, load factor = 1, ambient temperature +25ºC, conductor temperature 65ºC | at least 700 A |  |
| Current carrying capacity, when three single phase cables installed according to technical design, in separate unfilled PE pipes, soil temperature +15ºC, thermal resistivity of soil 1.0 K⋅m/W, cable metallic screens and metallic foils are single point bonded, load factor = 1, nearby is laid parallel similar cable at 2 m distance. Consider other external heat sources in cable route, e.g. heat pipes, other cables etc. | at least 700 A,  conductor  temperature 65ºC |  |
| conductor  temperature 90ºC |  |
| Permissible short time current in conductor (initial temperature before short circuit 65ºC, final temperature after short circuit 250ºC) | kA (0,6 s) |  |
| Permissible short time current in Cu metallic screen (initial temperature before short circuit 65ºC, final temperature after short circuit 250ºC) | kA (0,6 s) |  |
| Max. conductor DC-resistance at +25ºC | Ω/km |  |
| Max. conductor 700 A AC-resistance at +25ºC | Ω/km |  |
| Metallic screen DC-resistance at +25ºC | Ω/km |  |
| Metallic screen 700 A AC-resistance at +25ºC | Ω/km |  |
| Capacitance | μF/km |  |
| Inductance | mH/km |  |
| Three-phase load losses in the conductor at current 700 A | W/m |  |
| Three-phase load losses in the metallic screens at current 700 A | W/m |  |
| Total three-phase load losses at current 700 A | W/m |  |
| Estimated service life endurance of the cable | years |  |
| Max. conductor operating temperature | ≥65ºC |  |
| Max permissible conductor temperature at short-circuit current for 0,6 s | 250ºC |  |
| Max permissible metallic screen temperature at short-circuit current for 0,6 s | 250ºC |  |
| Construction | See below |  |
| Type of manufacturing | please specify the type of manufacturing in full words |  |
| Single core cable | yes |  |
| The cable shall be longitudinally and radial watertight | yes |  |
| Conductor | See below |  |
| Round, segmental stranded and compacted longitudinally watertight conductor. Watertightening by swellable material in the wire interstices and semi-conducting water-swellable tape over conductor. | yes |  |
| Nominal cross-sectional area | mm2 |  |
| Number of segments | please specify the type of manufacturing in full words |  |
| Approximate diameter over conductor | mm |  |
| Material of the conductor | please choose version: aluminium or copper |  |
| Conductor screen | See below |  |
| Semi-conducting copolymer compound | yes |  |
| Nominal thickness of conductor screen | mm |  |
| Main insulation | See below |  |
| Superclean extruded cross-linked polyethylene compound | yes |  |
| Nominal thickness of main insulation | ≥15.0 mm |  |
| Minimum point thickness | ≥13.5 mm |  |
| Approximate outer diameter over main insulation | mm |  |
| The cable sheathing shall be of material that will protect the main insulation from dangerous water-trees | yes |  |
| Insulation screen | See below |  |
| Semi-conducting copolymer compound | yes |  |
| Nominal thickness of insulation screen | mm |  |
| Bedding | See below |  |
| Semi-conducting water swellable tape | yes |  |
| Metallic screen of copper | See below |  |
| A layer of copper wire helix and a copper contact tape counter helix | yes |  |
| Cross-sectional area of metallic screen | mm2 |  |
| Binder tape | See below |  |
| Semi-conducting water-swellable foam tape | yes |  |
| Metallic foil | See below |  |
| Longitudinal aluminium tape tightly bonded to sheath | yes |  |
| Nominal thickness of metallic foil | mm |  |
| Outer sheath | See below |  |
| Extruded high density polyethylene compound, graphite coated | yes |  |
| Nominal thickness of the outer sheath | ≥4.0 mm |  |
| Each separate cable ends are prepared for installation | See below |  |
| Pulling eye | yes |  |
| Water tight end sheathing | yes |  |
| Data of complete cable | See below |  |
| Approximate diameter of complete cable with possible deviation | mm (± %) |  |
| Approximate weight of complete cable | t/km |  |
| Weight of used copper per km of cable | t/km |  |
| Weight of used aluminium per km of cable | t/km |  |
| Marking | See below |  |
| Embossed on the outer sheath: manufacturer, year, identification No. of manufacturing | yes |  |
| Printed on the outer sheath: manufacturer, cable type, year of manufacturing, length marking in meters | yes |  |
| Mechanical data | See below |  |
| Bending radius at installation | m |  |
| Bending radius after final installation | m |  |
| Maximum puling tension with pulling eye | kN |  |
| Max sidewall pressure | kN/m |  |
| Delivery | See below |  |
| Delivery on cable drums | yes |  |
| Material of cable drum | please indicate |  |
| Weight of cable drum | kg |  |

# 1.2. Equipment for the earthing of metallic screen

| Description: | Requested: | Offered: |
| --- | --- | --- |
| Equipment for earthing of metallic screen at end-terminations | See below |  |
| All equipment needed for earthing of metallic screen through surge arresters | yes |  |
| All the cables between end-terminations and surge arresters-earthing boxes | yes |  |
| Conductor cross-section of cables between end-terminations and earthing boxes shall be at least as the cross-section of metallic screen | yes |  |
| Number of earthing through surge arresters sets | pc. |  |
| Degree of protection | ≥IP-54 |  |
| Earthing boxes will be installed on the end-terminations supports | yes |  |
| Earthing boxes design from non-corroding cast aluminium or stainless steel | yes |  |
| Earthing cable | See below |  |
| Nearby the main power cables shall be installed earthing cable for single-point earthing of the main power cable | yes |  |
| Earthing cable (length – according to technical design) with appropriate insulation shall be included in the scope of supply | yes |  |
| Nominal cross-sectional area of the earthing cable | mm2 |  |
| Material of the conductor | copper |  |
| Technical description of the all earthing equipment shall be attached to the Tender | please attach to the tender |  |

# 1.3. Outdoor end-terminations in substations and towers

|  |  |  |
| --- | --- | --- |
| Description: | Requested: | Offered: |
| Manufacturer | please indicate |  |
| Type No. | please specify |  |
| Number of units | 12 units |  |
| The electrical data are the same as for the cable or better | yes |  |
| The current carrying capacity | at least 700 A, but not less than for the cable |  |
| Applicable standards | IEC 60840 |  |
| The complete end-termination diameter | mm |  |
| The complete end-termination length | mm |  |
| The complete end-termination weight | kg |  |
| Composite insulator – requested solution or better | HTV (high tempe-rature vulcanizing) |  |
| The creepage distance (phase – ground voltage) | ≥43.3 mm/kV |  |
| Flash-over distance | mm |  |
| Intended for outdoor installation | yes |  |
| Ambient air temperature range | -40°C up to +40°C |  |
| All metal components are of corrosion-resistant materials or effectively protected against corrosion | yes |  |

# 1.4. Services and technical documentation to be submitted by the Supplier

| Description: | Requested: | Offered: |
| --- | --- | --- |
| Installation of cable joints shall be made by the Supplier | yes |  |
| Installation of end-terminations shall be made by the Supplier | yes |  |
| The Supplier is responsible for the performed cable joints and end-terminations installation until entire cable line has passed tests and commissioning successfully | yes |  |
| Supervision of installation of the cables shall be made by the Supplier | yes |  |
| Installed cable line should be entirely commissioned by the Supplier, the tests and commissioning are included in the Contract Price | yes |  |
| In the case of any discrepancies between planned and actual time of installation and commissioning, the Supplier is no way released from the obligation to perform entire commissioning without the Contract Price exchanges | yes |  |
| Within 5 days after commissioning the Supplier shall submit to the Customer the protocols of performed tests and commissioning. The protocols should be written in the Latvian.  Note: The take-over deed about the performed tests and commissioning will be signed by the Customer only after receipt of the protocols. | yes |  |
| List of recommendable test procedures to be performed during operation of cable line according to applicable IEC standards | please attach to the Tender |  |
| Below mentioned routine, sample and electrical tests according to IEC 60840, IEC 60228, IEC 60229 issuing the test report | See below |  |
| Electrical resistance determining of cable conductor by DC acc. IEC 60840, clause 10.5 | yes |  |
| Electrical resistance determining of cable metal screen by DC (outer sheath check) acc. IEC 60840, clause 10.5 | yes |  |
| Capacitance of cable conductor acc. IEC 60840, clause 10.10 | yes |  |
| Dielectric dissipation factor tan Δ in accordance with IEC 60840, clause 12.4.5 | yes |  |
| Heating cycle voltage test in accordance with IEC 60840, clause 12.4.6 | yes |  |
| Outer sheath check acc. IEC60840, clause 9.4, referring to IEC60229, clause 3: 25 kV DC, 1 minute | yes |  |
| Voltage test with 2.5 Uo, 50 Hz, 30 minutes acc. IEC 60840, clause 9.3 | yes |  |
| Repeat electrical resistance of cable conductor (main insulation 2500-10000V DC) if test failed | yes |  |
| Partial discharge test acc. IEC 60840, clause 9.2 and acc. IEC 60840, clause 10.6; 10.7; 10.8; 10.13   * Measurement of thickness of insulation and oversheath * Measurement of diameters. * Measurement of thickness of metallic sheath. | yes |  |
| Other tests: | please indicate if any |  |
| Below mentioned cable tests after installation issuing the test report | See below |  |
| DC voltage test of outer sheath acc. IEC 60229, Clause 5. | yes |  |
| AC voltage test for main insulation (IEC 60840, Clause 16.3) | Uo, 24 h, 50 Hz |  |
| Contact tightness/resistance determining between metallic screen at cable end-terminations and connected earthing circuit | yes |  |
| Other tests: | please indicate if any |  |