## **115/30 KV 90MVA POWER TRANSFORMERS**

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| Item No | Technical parameters and requirements | Value, standard | Compliance: YES/NO | Type and manufacturer of offered product | Technical documentation file name |
| 1. | Manufacturers of transformer and equipment/assemblies supplied with transformer shall be evaluated and shall provide | ISO 9001 or equivalent certificate. |  |  |  |
| 2. | Transformer shall be manufactured and tested according to | IEC 60076 standard. |  |  |  |
| 3. | Equipment supplied together transformer shall be manufactured and tested according to | IEC standard. |  |  |  |
| 4. | Factory test reports for transformer and its components (in Lithuanian and English) | * Factory test reports for transformer according to IEC 60076; * Factory test reports for transformer tap changer according to IEC 60214; * Factory test reports for built-in current |  |  |  |

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|  |  | transformers;   * Test reports for transformer oil according to IEC 60296; * Factory test reports for measurement and control devices. |  |  |  |
| 5. | The following factory tests shall be carried out for power transformers | * Measurements of transformer ratio, ohmic resistance of windings, idle-run and short-circuit losses, tap changer characteristics according to IEC 60076-1.   Resistance tests shall be performed for each tap;   * Winding insulation test at a voltage of 50 Hz, winding insulation test at induced voltage, IEC 60076-3; * Winding insulation measurements, |  |  |  |

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|  |  | capacitance (C) and dielectic loss angle (tg) measurements; Winding dielectic loss angle (tg) measurements shall be conducted at 10 kV voltage;   * Insulating oil testing according to IEC 60422; * Oil reservoir testing (for oil leaks). |  |  |  |
| 6. | Transformer operating conditions | * Ambient temperature -35 ºC ÷ +35 ºC; * Installation altitude – up to 1000 m above the sea level. |  |  |  |
| 7. | Thermal resistance | 4s in accordance with IEC 60076-5 (written confirmation by manufacturer). |  |  |  |
| 8. | Maximum grid voltage | * High-voltage winding – 123 kV; * Low-voltage winding – |  |  |  |

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|  |  | 36 kV. |  |  |  |
| 9. | High-voltage winding power | 90 MVA |  |  |  |
|  | Low-voltage winding power | 90 MVA |  |  |  |
| 10. | High-voltage winding rated voltage | 115 (+/-9x1,778) kV. |  |  |  |
| 11. | Low-voltage (primary) winding rated voltage | 30 kV. |  |  |  |
| 12. | Transformer ratio error | 0,5 |  |  |  |
| 14. | Rated frequency | 50 Hz |  |  |  |
| 15. | Number of phases | 3 |  |  |  |
| 16. | Operating mode of 110 kV neutral | Earthed/unearthed |  |  |  |
| 17. | Vector group | YN/d-11 |  |  |  |
| 18. | Idle-run losses | < 75 kW; |  |  |  |
| 19. | Short-circuit losses | < 300 kW |  |  |  |
| 20. | Idle-run current | 0.63 %. |  |  |  |
| 21. | Short circuit voltage Uk | 10.5 % |  |  |  |
| 22. | Power transformer losses, peak efficiency index (PEI) | 99,723 (99,758 would be an advantage)  Must comply with Commission Regulation (EU) No 548/2014 of 21 May 2014 |  |  |  |

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| 23. | Cooling system | ONAF  (transformer operation at its rated power shall be ensured without forced cooling) |  |  |  |
| 24. | Electric withstand of bushings to pollution according to IEC 60815 |  25 mm/kV (110 kV)   31 mm/kV (30 kV) |  |  |  |
| 25. | Transformer shall be filled with oil. Inhibited transformer oil conforming to IEC 60296 (4.0 edition) | * II – class A; * Fully inhibited oil; * Antioxidants 0,15 ÷ 0,4 wt; * Without PCB/PCT substances. |  |  |  |
| 26. | Temperature rise (oil/windings) | 60/65 K. |  |  |  |
| 27. | Insulation level | lightning impulse (1.2/50s) amplitude:   * High-voltage winding – 550 kV; * 110 kV neutral – 250 kV; * Low-voltage winding – 70 KV. * 30kv neutral – 70 kV   50 Hz frequency voltage value |  |  |  |

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|  |  | that transformer maintains for a period of 1 min:   * High-voltage winding – 230 kV; * 110 kV neutral – 100 kV; * Low-voltage winding – 28 kV. |  |  |  |
| 28. | Sound pressure level at a distance of 0.3 m (ONAN) | 60 dB (A) +3 dB(A). |  |  |  |
| 29. | Sound pressure level at a distance of 1 m (ONAF) | 65 dB (A) +3 dB(A) |  |  |  |
| 30. | Control-protection system signals | Gas impact;   * Oil flow impact; * High oil temperature; * High winding temperature; * Low oil level. |  |  |  |
| 31. | Voltage of protection and alarm circuits | 110 V DC. |  |  |  |
| 32. | Voltage of control circuits | 230 V, 50 Hz. |  |  |  |
| 33. | Voltage of cooling system motors | 230/400 V, 50 Hz. |  |  |  |
| 34. | In each phase, the transformer has current transformers installed on the 110 kV incomer and neutral grounding busbar. Parameters (transformer ratio, accuracy class, load) | - First core: 5P30; 30VA (for differential protection of transformer; |  |  |  |

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|  | Note. If it is not possible to install the current transformers with the specified number of cores on the transformer incomers, 3 and 4 cores shall be installed separately. | parameters to be selected at the time of design);   * Second core: 5P30; 30VA (for backup overcurrent protection of transformer; parameters to be selected at the time of design); * Third core: 5P30; 30VA (for longitudinal differential protection of overhead line; parameters to be selected at the time of design); * Forth core: 0,5SFs5; 10VA (parameters for commercial metering to be selected at the time of design) * Transformer’s neutral earthing transformer |  |  |  |

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|  |  | parameters shall be selected at the time of design |  |  |  |
| 35. | Permitted transformer overloads according to | IEC 60354. |  |  |  |
| 36. | The transformer oil to be protected from contact with air by | Film protection. |  |  |  |
| 37. | Transformer tank cover secured by | Screws, with the possibility to remove the active part of the transformer from the tank by unscrewing them; |  |  |  |
| 38. | Transformer surface coating method | * Anticorrosive painting; * Number of layers – 3; * Warranty period for coating – 10 years; * Total coating thickness – 240 µm; * Color or external layer – RAL7032; * Paint and painting method description. |  |  |  |
| 39. | Lifetime | 40 years |  |  |  |
| 40. | Warranty period | 2 years. |  |  |  |

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| 41. | The following is required for the installation of the transformer | The presence of a manufacturer's representative. |  |  |  |
| 42. | During the warranty period | Power transformer shall be considered defective if the insulating oil exceeds the thresholds as determined by chromatographic analysis. Thresholds for chromatographic analysis, µl/l: H2 -100; CH4 - 100; C2H4-100; C2H6-50; C2H2-10; CO-600; CO2-8000. |  |  |  |
| 43. | Inscriptions on the main elements of transformer must be in Lithuanian (to be agreed at the time of contract signature) | * Designations for phases of high-voltage winding: ‘A’, ‘B’, ‘C’, ‘0’; * Designations for phases of low-voltage winding: ‘a’, ‘b’, ‘c’. |  |  |  |
| 44. | Documentation of the transformer and its components | * Passports of the transformer and its components (in Lithuanian or English); * Technical description (in |  |  |  |

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| Item No | Technical parameters and requirements | Value, standard | Compliance: YES/NO | Type and manufacturer of offered product | Technical documentation file name |
|  |  | Lithuanian or English);   * Instructions for transportation, storage, installation and operation (in Lithuanian); * Technical description and operating instructions (manual) for transformer components and auxiliary products (in Lithuanian or English); * Transformer oil certificate and safety data sheet (in English or Lithuanian) * Declarations of conformity. |  |  |  |
| 45. | Drawings | * dimensional; * arrangement of conservator and ladders; * winding taps; * coolers; |  |  |  |

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|  |  | * current transformer installation; * incomer installation; * diagram of transformer grounding points; * tap changer; * tap changer control diagram. |  |  |  |
| 46. | Factory acceptance tests for power transformer : | Owner to be informed of planned FAT 3 weeks in advance. 2 Owner’s representatives can attend FAT. |  |  |  |

## **COMPLETE SET OF 115/30 KV POWER TRASNFORMER**

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| Item No | Technical parameters and requirements | Q-ty | Compliance: YES/NO | Type and manufacture r of offered product | Technical documentation file name |

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| 1. | Hermetic porcelain high-voltage bushings with oil impregnated paper insulation (IEC 60137) (Haefely Trench COT type). Bushings shall be equipped with:   * Measuring tap for the measurement of R, C, tg of the main insulation layer; * Measuring tap for the measurement of R, C, tg of the outer insulation layer. * Oil level indicator. | 4 pcs.  (110kV - 3 pcs., neutral - 1 pcs.). |  |  |  |
| 2. | Plug-in overvoltage limiters. | 3 pcs. |  |  |  |

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| 3. | Three-phase tap changer with vacuum contactor (IEC 60214):   * Tap changer on the 110 kV side that operates automatically under load; * Number of taps – 19; * Voltage increment – 1,778; * Mechanical life – 500000 operations; * Tap changer control cabinet protection rating – ≥ IP-54, with natural ventilation; * BCD converter to transmit the tap changer position signals to the control system; * Tap changer control cabinet must have a tap changer position indicator; * Tap changer control cabinet must have a tap changer counter; * Tap changer control cabinet must have a handle for manual operation; * Tap changer control cabinet must be equipped with automatic electric heating (heating element must be resistant to voltage surges up to 280 V); * Tap changer control cabinet must have a temperature regulator; * Tap changer control cabinet must have lighting that is switched on automatically   when the cabinet door is opened;   * Tap changer control cabinet shall be equipped with automatic circuit breakers for the main, control, heating and alarm circuits with separate inlets; * Technical data table shall be installed in the tap changer control cabinet. | 1 set  Page 88 of 332 |  |  |  |

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| 4. | Conservator with oil level indications and signal (MIN, MAX oil level) transmitted to the control system. | 2 sets |  |  |  |
| 5. | Conditioning system with automatic control devices. | 1 set |  |  |  |
| 6. | Radiators, hot-dip galvanized, coating thickness not less than 85 µm. | 1 set |  |  |  |
| 7. | The radiators shall be connected to the tank via two (1 at the top and 1 at the bottom) rubber disc valves. | 1 set |  |  |  |
| 8. | A Buchholz relay with a test valve for gas sampling mounted up to  1.5 m above ground. | 1 set |  |  |  |
| 9. | Portable instrument: a gas analyzer with a connector/adapter for collecting and analyzing a gas sample from the Buchholz relay test valve located at a height of 1.5 m. | 1 pcs. |  |  |  |
| 10. | Flow relay. | 1 pcs. |  |  |  |
| 11. | Protection against increase in oil pressure (shut-off valve, safety valves). | 1 set |  |  |  |
| 12. | Pointer thermometer with signal transmitted to the control system;   * For measuring the temperature of the windings; * For measuring the temperature of the upper layers of oil. Sensors of thermometers shall have protection against mechanical damage. | 1 set |  |  |  |
| 13. | 2 ball-type valves for oil sampling. Oil samples shall be taken from the top and bottom of the tank. |  |  |  |  |

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| 14. | Transformer oil for commissioning/startup and normal operation of the transformer. |  |  |  |  |
| 15. | Breathers with oil seal and self-indicating silica gel. | 2 sets |  |  |  |
| 16. | Self-indicating silica gel must be free of cobalt or its compounds. |  |  |  |  |
| 17. | Control cables (cables shall be protected against mechanical damage). |  |  |  |  |
| 18. | Connection terminals of control cables shall be installed in the distribution cabinet. |  |  |  |  |
| 19. | Distribution cabinet (lock to be agreed at the time of design). |  |  |  |  |
| 20. | An adequate amount of holes with seals shall be provided for cable routing in the lower part of the distribution cabinet. |  |  |  |  |
| 21. | Ladder for climbing on top of the transformer. | 1 pcs. |  |  |  |
| 22. | Ladder for visual inspection of Buchholz relay without de-energizing it. | 1 pcs. |  |  |  |
| 23. | Lifting loops. | 4 pcs. |  |  |  |
| 24. | Jack lift supports. | 4 pcs. |  |  |  |
| 25. | Table with technical data (mounted on the body of the transformer). | 1 pcs. |  |  |  |
| 26. | Connection terminal for grounding. | 2 pcs. |  |  |  |
| 27. | Wheels for mounting the transformer on rails. | 4 sets |  |  |  |
| 28. | Wheel locking devices mounted on the rails. | 2 sets |  |  |  |

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| 29. | 110kV connection terminals (to be agreed at the time of design). | 4 pcs.  (110kV - 3 pcs., neutral - 1 pcs.). |  |  |  |
| 30. | 30kV connection terminals with covers (to be agreed at the time of design). | 3 pcs. (Suitable for connecting a busbar). |  |  |  |
| 31. | Manufacturer’s power transformer operation manual. |  |  |  |  |
| 32. | Impact recorders on the transformer shall be sealed for transportation. The manufacturer shall provide a transport report for these recorders after installation. |  |  |  |  |
| 33. | After switching on the transformer, a chromatographic analysis of the oil (from the upper and lower oil layers) shall be carried out within the time limits set out in the applicable regulatory documents. | 5 times |  |  |  |