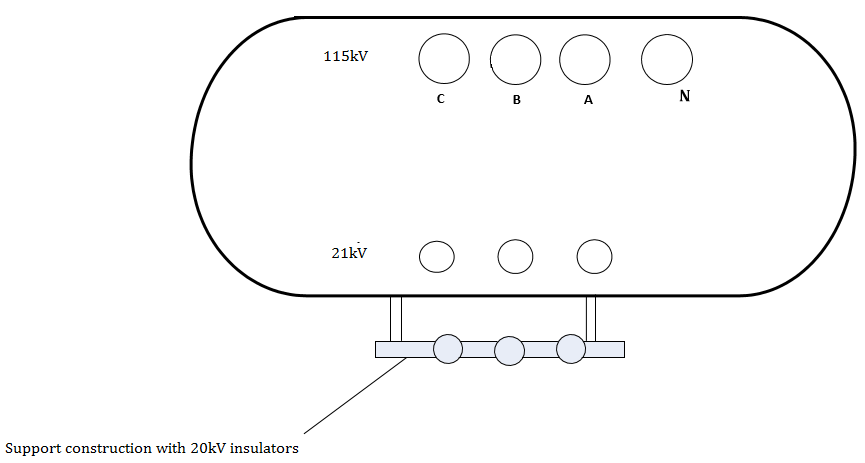
TECHNICAL SPECIFICATION/ TEHNISKĀ SPECIFIKĀCIJA Nr. TS 2320.001 v1

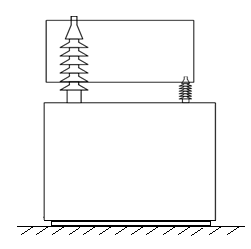
High voltage transformer 110/20, 6.3MVA /Augstsprieguma transformators 110/20kV, 6.3MVA

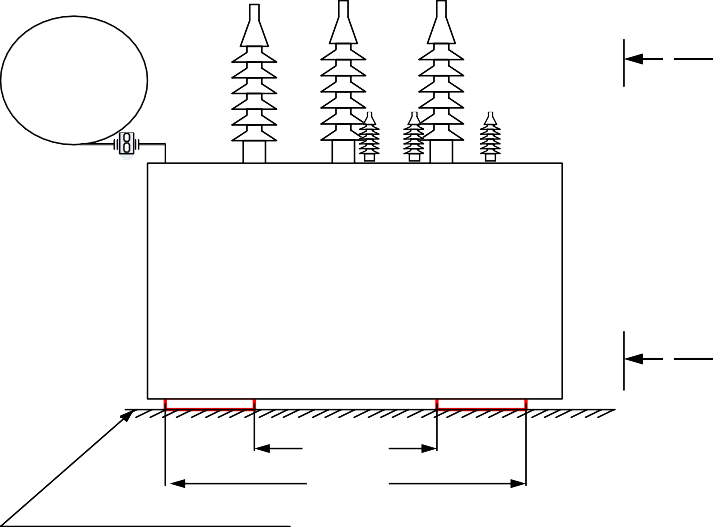
| **Nr.** | **Description** | **Minimum technical requirement** | **Specific technical description of the offered product** | **Source[[1]](#footnote-2)** | **Remarks** |
| --- | --- | --- | --- | --- | --- |
| **General information** | | |  |  |  |
|  | Manufacturer (name and location) | Specify |  |  |  |
|  | 2320.001 High voltage transformer 110/20kV, 6.3MVA/  Augstsprieguma transformators 110/20kV, 6.3MVA | Specify type reference |  |  |  |
|  | The EAN code used to mark the product, if such has been assigned | Specify |  |  |  |
|  | Specify whether when using the EAN code, the manufacturer offers the possibility to receive digital technical information about the product (type, manufacturer, technical parameters, instructions for use, etc.) | Specify |  |  |  |
| **Standards** | | |  |  |  |
|  | According standard IEC 60076 | Confirm |  |  |  |
|  | EU Commission Regulation Nr. 1783/2019 | Confirm |  |  |  |
| **Documentation** | | |  |  |  |
|  | **Documentation which must be submitted with the Tender** | LV or EN |  |  |  |
|  | An image of the product that meets the following requirements has been submitted:   * .jpg or .jpeg format * resolution of at least 2Mpix; * the complete product can be seen and all the inscriptions on it can be read;   the image does not contain any advertisement | Confirm |  |  |  |
|  | List of special equipment and tools necessary for transformer aggregates mounting (for example: oil pump, vacuum treatment etc.) | Yes |  |  |  |
|  | Transformer dimensions drawings with all aggregates location on tank. Indicating also specification of weights: oil weight, active part weight, weight of fully assembled transformer and tanked with oil | Yes |  |  |  |
|  | Drawings of transformer on applicable transport (truck with trailer, railway etc.) with dimensions and transformer transportation weight | Yes |  |  |  |
|  | Test program (transformer and oil) after assembling of parts before energizing | Yes |  |  |  |
|  | Type test certificate, acc. IEC 60076-5, 2006, the short circuit withstand tests for transformers of category II with voltage level 110 kV (acc. to IEC 6076-5 point 3.2.2). Test must be made within last ten years. | Yes |  |  |  |
|  | Ir tipa tests un/vai produkta sertifikāta kopija. Tipa testu un/vai produkta sertifikātu izsniegusi laboratorija vai sertificēšanas institūcija, kas akreditēta saskaņā ar ES pieņemto akreditācijas kārtību (laboratoriju/institūciju akreditējis viens no Eiropas Akreditācijas kooperācijas (EA) dalībniekiem (<http://www.european-accreditation.org/>) un atbilst ISO/IEC 17025/17065 standartu prasībām./ Copy of type test and/or product certificate. Type test and/or product certificate issued by laboratory or certification body accredited in accordance with the accepted EU accreditation procedure (laoratory/certification body have been accredited by a member of the European Co-operation for Accreditation (EA) (<http://www.european-accreditation.org/>) and compliant with the requirements of ISO/IEC 17025/17065 standard. | Specify |  |  |  |
|  | **Documentation which must be submitted after signing of the Contract** |  |  |  |  |
|  | Transformer drawings with all transformers dimensions, aggregates, bushings location on tank, protection relays, measuring devices and secondary equipment for plant design with all connection to tank and another transformer parts. Indicating also specification of weights: oil weight, active part weight, transport weight and weight of fully assembled transformers to the Purchaser’s for approval. Transformer tank bottom detail drawing. One copy of printed documentation and in an electronic form\*. | Within 60 days after signing of Contract |  |  |  |
|  | Secondary wiring diagrams, terminals diagrams, circuit diagrams of relay protection, cooling system, OLTC driver to the Purchaser’s approval. One copy of printed documentation and in an electronic form\*. | Within 60 days after signing of Contract |  |  |  |
|  | If there are necessary to make corrections then corrected drawings for approval with Purchaser be made. | Within 14 days after corrections made by the Purchaser |  |  |  |
|  | Final transformer drawings with: all transformers dimensions, aggregates, bushings location on tank, protection relays, measuring devices and secondary equipment for plant design with all connection to tank and another transformer parts. Indicating also specification of weights: oil weight, active part weight, transport weight and weight of fully assembled transformers Transformer tank bottom detail drawing. Two purchasers's approved copies of printed documentation and in an electronic form\*. | Within 90 days after signing of Contract |  |  |  |
|  | Final secondary wiring diagrams, terminals diagrams, circuit diagrams of relay protection, OLTC driver, cooling system~~.~~ Two purchasers' approved copies of printed documentation and in an electronic form\*. | Within 90 days after signing of Contract |  |  |  |
|  | Full documentation, all drawings necessary for plant design. Two copies of printed documentation and in an electronic form\*. | 30 days before transformer delivery |  |  |  |
|  | Operation and maintenance instructions – two copies of printed documentation and in an electronic form in the Latvian and English language. Two copies of printed documentation and in an electronic form\*. | 30 days before transformer delivery |  |  |  |
|  | Certificate on delivered transformer oil | On delivery |  |  |  |
|  | Transformer Test Reports. Two copies of printed documentation and in an electronic form\*. | 10 days before transformer delivery |  |  |  |
|  | Reports of performed tests and commissioning  Note: Take over deed about performed tests and commissioning will be signed by the Purchaser only after receipt of the reports. | Yes |  |  |  |
|  | \*Electronic form means – CD or Flash memory card | Specify |  |  |  |
| **Technical information** | | |  |  |  |
|  | **Electrical requirements** |  |  |  |  |
|  | Rated power (windings: HV/LV), MVA | 6,3/6,3 |  |  |  |
|  | Voltage ratio (windings: HV/LV), kV | 115 / 21 |  |  |  |
|  | Rated current HV, A | Specify |  |  |  |
|  | Rated current LV, A | Specify |  |  |  |
|  | Highest voltage for equipment HV side, kV | 123 |  |  |  |
|  | Highest voltage for equipment LV side, KV | 24 |  |  |  |
|  | Over-excitation ability not less than U rated x 1,1 (of U rated) | Specify |  |  |  |
|  | Rated frequency, HZ | 50 |  |  |  |
|  | Vector group | YN/d11 |  |  |  |
|  | **Insulation level** |  |  |  |  |
|  | HV phases A-B-C-N insulation level, (kV)  (HV neutral point N will be effectively earthed). | LI 550 / AC 230 |  |  |  |
|  | LV phases Am-Bm-Cm insulation level, (kV) | LI 125/AC 50 |  |  |  |
|  | **Secondary voltages:** |  |  |  |  |
|  | Control voltage for relay protection (except tap changer drive) | 110 V DC |  |  |  |
|  | Auxiliary supply voltage for operating mechanisms | 400 V AC |  |  |  |
|  | Auxiliary supply voltage for heating | 230 V AC |  |  |  |
|  | **Electric losses** |  |  |  |  |
|  | Minimum value of Peak Efficiency Index (PEI).  Considering guaranteed loss values. | According to EU Commission Regulation |  |  |  |
|  | No-Load-Losses Po\*, kW | Specify |  |  |  |
|  | No-Load-Losses current Io (% of I rated) | Specify |  |  |  |
|  | Load-Losses Pk HV-LV\*(value on the principal tap), kW | Specify |  |  |  |
|  | Note: Manner of the evaluation of No-Load-Losses costs and of Load-Losses costs see in tender documentation. | Noted |  |  |  |
|  | \*No positive tolerance shall be allowed on the indicated maximum losses |  |  |  |  |
|  | **Impedance voltages (HV-LV)** |  |  |  |  |
|  | Please indicate impedance voltage at first tap, at 6,3 MVA power and winding temperature 75°. | The first tap-highest  plus position ≤11,5% |  |  |  |
|  | Impedance voltage at principal tap, at 6,3 MVA power and winding temperature 75°; tolerance ±7,5 % | 10,5% |  |  |  |
|  | Please indicate impedance voltage at last tap, at 6,3 MVA power and winding temperature 75°. | The last tap-lowest minus position ≥9,5% |  |  |  |
|  | Impedance voltage of HV-LV at OLTC first tap must be more, than impedance voltage of HV-LV at OLTC last tap. | Yes |  |  |  |
|  | **Earthing and short-circuit strength** |  |  |  |  |
|  | HV neutral point N shall be effectively earthed. | Yes |  |  |  |
|  | Summary short-circuit strength |  |  |  |  |
|  | The transformer shall withstand full short circuit incident | Yes |  |  |  |
|  | Maximum inrush current and decay constant, A-sec. | Specify |  |  |  |
|  | Offered type of transformer is tested with full short-circuit current | Yes / no |  |  |  |
|  | All transformer windings shall withstand 3-phase short-circuit current on LV terminals for the duration of 3 seconds at any OLTC tap assuming that the short-circuit apparent power of 115 kV system is 8000 MVA.  Minimum required short-circuit currents that transformer has to withstand shall be calculated according to item 4.1.2 of IEC 60076-5:2006. For the first (highest plus) tap position system voltage equal to 123 kV shall be used in equation (1) of item 4.1.2 of IEC 60076-5:2006. For the last (lowest minus) tap position system voltage equal to 110 kV shall be used in equation (1) of item 4.1.2 of IEC 60076-5:2006. Manufacturer shall provide written description of the circuit's calculation method. Moreover, the validity of the used method should be proved by tests made to similar constructions and at same stress levels used in the design. | Please attach |  |  |  |
|  | **HV** |  |  |  |  |
|  | Please indicate phase (1) **and** line (2) values on the first tap-highest plus position, kA/3 sec. | Specify |  |  |  |
|  | Please indicate phase (1) **and** line (2) values on the principal tap, kA/3 sec. | Specify |  |  |  |
|  | Please indicate phase (1) **and** line (2) values on the last tap-lowest minus position, kA/3 sec. | Specify |  |  |  |
|  | **LV** |  |  |  |  |
|  | Please indicate phase (1) **and** line (2) values on the first tap-highest plus position, kA/3 sec. | Specify |  |  |  |
|  | Please indicate phase (1) **and** line (2) values on the principal tap, kA/3 sec. | Specify |  |  |  |
|  | Please indicate phase (1) **and** line (2) values on the last tap-lowest minus position, kA/3 sec. | Specify |  |  |  |
|  | Note. Short-circuit strength calculations shall be based on the impedances of the transformer, considering all tappings and impedance tolerances. | Noted |  |  |  |
|  | **General requirements** |  |  |  |  |
|  | Out-door installation | Yes |  |  |  |
|  | Ambient air temperature range | -40 °C up to +40 °C |  |  |  |
|  | Maximum atmospheric humidity | 100 % |  |  |  |
|  | Maximum wind speed (up to 12 m from ground) | 40 m/s |  |  |  |
|  | Degree of protection for all equipment | ≥IP54 |  |  |  |
|  | Sound pressure level at rated voltage (Measured by IEC 60076-10). Measuring distance 0,3/2 m. | ONAN  70 dB (A) |  |  |  |
|  | Minimum creepage distance of insulators between phase and earth. | 43,3 mm/kV |  |  |  |
|  | HV neutral point N shall be effectively earthed. | Yes |  |  |  |
|  | **Transformer dimensions and design** |  |  |  |  |
|  | Transformer dimensions (Height / Width / Depth), mm | Specify |  |  |  |
|  | Weight of active part, t | Specify |  |  |  |
|  | Transformer transportation weight, t | Specify |  |  |  |
|  | Volume of oil, m3 | Specify |  |  |  |
|  | Total weight | Specify |  |  |  |
|  | The bottom part of transformer’s tank must be equipped with a special construction, according with picture 1. | Yes |  |  |  |
|  | Transformer without rollers | Yes |  |  |  |
|  | The transformer must be installed on the new foundation. | Yes |  |  |  |
|  | The transformer must be fixed to foundation using special fasteners. | Yes |  |  |  |
|  | Location of HV, LV and N bushings on transformer’s cover please see the picture.2. | Yes |  |  |  |
|  | Minimum clearance between HV (115 kV) live parts phase-to-phase - 1000 mm | Yes |  |  |  |
|  | Minimum clearance between HV (115 kV) live parts phase-to-earth - 900 mm | Yes |  |  |  |
|  | Minimum clearance for 20 kV phase-to-phase should be not less than 330 mm and between phase-to-earth 300 mm. | Yes |  |  |  |
|  | It is necessary to install the additional suitable console construction for support insulators should be installed on the top of transformer tank cover to allow 20 kV terminals with busbar bridges (see Picture 1). Console design for support insulars should be hot dip galvanized. The console must be mounted to the transformer using bolted connections only. The customer agrees the weight load of the console with the transformer manufacturer at the stage of approval of the transformer drawings in accordance with the part ,,Documentation which has to be submitted after signing of the Contract " of this specification (see below) | Yes |  |  |  |
|  | Jacking pads for hydraulic jacks | Yes |  |  |  |
|  | Lifting lugs for lifting of the complete transformer | Yes |  |  |  |
|  | Lifting lugs on the tank cover for lifting of the active part | Yes |  |  |  |
|  | Transformer tank cover designed to prevent the accumulation of gasses inside and water deposits on the top. | Yes |  |  |  |
|  | HV bushings should be placed in order to carry out those mounting without oil draining below upper part of core. | Yes |  |  |  |
|  | Valves for vacuum treatment, vacuum pump connection and oil draining should be located of the transformer tank. | Yes |  |  |  |
|  | Diameter of valve for oil draining (filtering) from tank. | ≥50 mm |  |  |  |
|  | Valves in top, middle and bottom level of the tank for oil sampling with possibility to connect flexible hose. Ball valve type. The valves should be brought down to be accessible at ground level. | Yes |  |  |  |
|  | All valves must be ball type (except butterfly valves for cooling radiators) | Yes |  |  |  |
|  | Flexible hose for DGA sampling taking from valves in top, middle and bottom level of the tank. | Yes |  |  |  |
|  | Separate pockets with insulation paper samples-on the tank cover | Yes |  |  |  |
|  | Valves for oil filling and drainage. Valves should be completed with blanking plates. Draining valve should be connected to vent the tank as closed as possible to the junction of the tank wall and the base, so that no more than a few mm of oil will remain tank when empty. | Yes |  |  |  |
|  | Two elbow valves, complete with a blanking plate for filling connections, should be provided on the tank cover and located at diagonally opposite corners. | Yes |  |  |  |
|  | A valve fitted with blanking plate and located on the tank cover in line with the bottom sampling valve should be provided for attaching a vacuum gauge, a pressure gauge or an oil level indicator when vacuum filling. | Yes |  |  |  |
|  | Transformer tank, conservator and valves shall withstand full vacuum | Yes |  |  |  |
|  | Transformer and all parts should be completely oil-tight | Yes |  |  |  |
|  | Transformer shall be fitted with necessary manholes and handholes holes. Manholes and handholes should be provided as appropriate in tank cover and walls to permit unhindered access to inspect, repair or remove tap-changer components, winding connections and other devices that may require routine or emergency maintenance.  A manhole should be not less than 500 mmm diameter or 500 mmx500 mm to allow free entry. Handholes should be approximately 400 mm diameter or 300 mmx600 mm. All manholes, handholes and bushing openings on the cover should have a flange to prevent water from entering the opening when individual covers are removed.  At least two manholes should be provided on tank cover for access to the interior without lowering the oil below the top of the core. | Yes |  |  |  |
|  | Ladder screwed to the transformer’s tank for access to tank cover for maintenance while transformer is not energised. While transformer is energised, ladder should be covered with lockable plate.  Ladder construction inclination must be not less than 15 ° to the tank . Ladder should be equipped with handrails on both sides. | Yes |  |  |  |
|  | Connection tube with valve on transformer tank for Hydran gas analyzer system(which will be installed in the future). | Yes |  |  |  |
|  | **Requirements for earthing** |  |  |  |  |
|  | Earthing of the magnetic circuit sections and insulated bolts should be conducted to one hand hole point where their insulation can be measured without lowering of transformer oil level. | Yes |  |  |  |
|  | At least two suitable earthing terminals on the main tank. One earthing terminal should be located, for instance, towards the extreme right hand end of the low voltage side and the other diagonally opposite on the high voltage side. | Yes |  |  |  |
|  | Earthing of all transformer parts:  -oil conservator;  - cabinets;  - cooling radiators;  -OLTC tap changer motordriver;  -all flanges on the tank if there are rubbers between them and main tank. Gasket flange joints should be electrically bridged;  -another transformer parts should be made. All elements must be grounded with single wire or another insulated conductor. The connection between the grounding conductors must be cleansed from the paint and during installation should be treated with contact grease. | Yes |  |  |  |
|  | Earthting terminals marked with the appropriate graphical symbols | Yes |  |  |  |
|  | The tank should be designed or incorporate measures to minimise the losses caused by circulating and eddy-currents and avoid onerous temperatures at any part of the tank surface and flanges between parts of the tank and its components especially at gasket sealed joints. | Yes |  |  |  |
|  | **Requirements for painting** |  |  |  |  |
|  | Transformer tank and other weather-exposed parts shall be reliably protected against corrosion | Yes |  |  |  |
|  | Internal and external corrosion protection of the tank and conservator | Yes |  |  |  |
|  | Inside of the transformer tank must also be painted with a suitable paint for this purpose | Yes |  |  |  |
|  | External surfaces shall be painted with two component polyurethane paint | Yes / RAL 7033 |  |  |  |
|  | The topcoat thickness | ≥100 m |  |  |  |
|  | **Oil in tank and main conservator** |  |  |  |  |
|  | Transformer oil according to IEC 60296, table 2, (I) - inhibited oil | Yes |  |  |  |
|  | Transformer oil according to IEC 61619 Part1 without PCB (content ≤ 1 mg/kg) | Yes |  |  |  |
|  | Manufacturer of transformer oil | Specify |  |  |  |
|  | Type No. (name) of transformer oil | Specify |  |  |  |
|  | **Manner of transformer oil transportation** |  |  |  |  |
|  | transformer will be transported fully tanked with oil | Yes / no |  |  |  |
|  | separate delivery of oil by tank car vehicle | Yes / no |  |  |  |
|  | separate delivery of oil in barrels / please specify also volume and number of barrels | Yes / no;  Litres / number |  |  |  |
|  | other manner of oil transportation | Please describe |  |  |  |
|  | **Conservator** |  |  |  |  |
|  | Manufacturer, type | Specify |  |  |  |
|  | Main oil conservator mounted on a support construction, connected to the transformer tank and located at the opposite side of neutral-point N bushing | Yes |  |  |  |
|  | Appropriate dimensioned silica gel dehydrating breather with heating system (maintenance free) in a convenient floor height. The structure of the device shall be made of metallic material (plastic is not accepted) and the connection with the transformer pipe must be via flange. Each silica gel breather shall be equipped with LED status indication (green, yellow and red).  The device shall have contacts to indicate errors and regeneration process. The control box shall have a resistance in order to avoid condensation.  A stainless steel filter at the bottom shall protect the silica gel chamber against external environment influences and, the filter system must have a heating to avoid water freezing.  Identical shall be also for OLTC. | Yes |  |  |  |
|  | Separate expansion space in the main oil conservator for the diverter and selector switches compartments of OLTC. | Yes |  |  |  |
|  | Main oil conservator and expansion space for OLTC shall be fitted with filling openings and draining valves and with connection pipes to eyesight level. | Yes |  |  |  |
|  | **Cooling system** |  |  |  |  |
|  | Type of cooling | ONAN 100% |  |  |  |
|  | Temperature rise of oil / windings | 60 / 65 °C |  |  |  |
|  | Transformer’s hot-spot temperature at ambient temperature of +40°C | +120 °C |  |  |  |
|  | Hot dip galvanized radiators, (but not painted) with shut off valves | Yes |  |  |  |
|  | Cooling radiators shall be flanged to the transformer tank | Yes |  |  |  |
|  | Cooling radiator’s location – location at any side. In case if cooling radiators are located at LV side, they must not disturb the terminals connection with busbar bridge. | Yes |  |  |  |
|  | Valves shall be located as separate part, between radiators and transformers flanges with possibility to change them in case of emergency | Yes |  |  |  |
|  | Alarm / tripping command when oil temperature exceed | Yes |  |  |  |
|  | Alarm / tripping command when temperature of windings exceed | Yes |  |  |  |
|  | Manufacturer, type of oil thermometer | Specify |  |  |  |
|  | Oil thermometer– dial capillary type (bourdon spring system) with a scale range: –20 C up to +130 C, alarm and tripping contacts (no mercury), accuracy of alarm and tripping:  5 C, weatherproof, withstanding vibration of transformer, in a separate pocket. | Yes |  |  |  |
|  | Manufacturer, type of winding thermometer | Specify |  |  |  |
|  | Windings thermometer – on LV side, dial type with a scale range: 0 C up to +150 C type, alarm and tripping contacts (no mercury), accuracy of alarm and tripping:  5 C, weatherproof, withstanding vibration of transformer, in a separate pocket. | Yes |  |  |  |
|  | Temperature sensors on the top cover of the transformer must be protected from mechanical damage and from moisture. | Yes |  |  |  |
|  | Other requirements to winding and oil thermometers:   * The thermometer must be ventilated and remain mist free up to 80% RH; * Contact rating – AC 250V/5A cos φ=1, DC: 250/0,4 (induction free) 110V/0,6 60V/1A, 24V/4A (induction free); * Insulation voltage – AC: 2500V/1 min. * Maximum load ≥750Ω (at Ub=24 VDC) * Accuracy ±1 % of full scale value.   Detection element – installation length of 150 mm and doubled threaded union. | Yes |  |  |  |
|  | Thermometers for oil and windings shall be located inside of control cabinet  of cooling system. | Yes |  |  |  |
|  | Control cabinet should be made of non-corroding cast aluminium or stainless steel box. | yes/please specify |  |  |  |
|  | Cooling system control cabinet shall be equiped with heat elements, termoregulator and portable lamp with a length of wire not less than 0.75 meters. Cabinet lighting is automatically switched on when the door is opened. The cabinet with ventilation and filters prevent insects from entering. | Yes |  |  |  |
|  | Secondary cable entrance in secondary terminal box | Pg type stainless steel cable gland |  |  |  |
|  | Transport gaskets between cooling radiators and tank should be changed to basic gaskets in radiators at assembly | Yes |  |  |  |
|  | **On-load tap changer (OLTC)** |  |  |  |  |
|  | OLTC on HV side according to IEC 60214. Must be provided copies of the tests according IEC 60214-1, part 5.2 | Yes |  |  |  |
|  | Manufacturer , MR or ABB | Specify |  |  |  |
|  | OLTC arrangement: OLTC with selector switch and diverter switch located outside of transformer tank in a separate tank (compartment type) (1) or In-tank type (2) | Specify (1) or (2) |  |  |  |
|  | The on-load tap changer shall use vacuum interrupters | Yes |  |  |  |
|  | Installed in HV line on A, B, C phases | 115 ± 11 × 1% |  |  |  |
|  | The switching operation of the OLTC must be possible till to -25°C of oil temperatures in diverter switch. The OLTC unit has to be designed for switching operation in,, arctic areas”. The switching operation of the OLTC should block at oil temperature bellow -25°C. | Yes |  |  |  |
|  | Protection relay for OLTC: Flow relay (1) (The flow relay housing must be equipped with a transparent inspection window through which the flap valve can be controlled) or Pressure relay (2) | Specify (1) or (2) |  |  |  |
|  | Shaft between the motor drive and tap-changer shall be completely covered by a metallic sheath (if necessary) | Yes |  |  |  |
|  | Separate oil conservator for OLTC, if it is located in different tank out of transformer main tank (1) or separate expansion space in the main oil conservator (2) | Specify (1) or (2) |  |  |  |
|  | Tank of the diverter and selector switch compartments shall be fitted with filling openings and draining valves | Yes |  |  |  |
|  | Valves for oil sampling from diverter switch should be located in bottom part of transformer apr. on eyesight level. | Yes |  |  |  |
|  | **Tap changer motor drive** |  |  |  |  |
|  | Manufacturer | Specify |  |  |  |
|  | Type | Specify |  |  |  |
|  | Secondary voltages and degree of housing protection see above. | Yes |  |  |  |
|  | Tap-position indicator by resistors. | Yes |  |  |  |
|  | Tap position transmitter with contacts to arrange parallel operation of tap-changer’s motor drives. | Yes |  |  |  |
|  | Tap position measurement by the regulator. | 4-20 mA |  |  |  |
|  | Operation counters for the motor drive mechanism. | Yes |  |  |  |
|  | The motor drive unit must have a swing frame in which electrical components  are installed. | Yes |  |  |  |
|  | Swing-frames being installed in the cabinet the hinges of the outer doors shall be  arranged on the side opposite to those of the swing-frames. | Yes |  |  |  |
|  | After the doors of the motor drive unit are opened, no voltage-carrying  components must be able to be touched. | Yes |  |  |  |
|  | Remote alarm signal in case when motor drive works is blocked | Yes |  |  |  |
|  | Control voltage | 230 AC |  |  |  |
|  | OLTC motor-drive box shall be equipped with heat elements, termoregulator and portable lamp with a length of wire not less than 0.75 meters. Box lighting is automatically switched on when the door is opened. The box with ventilation and filters prevent insects from entering. | Yes |  |  |  |
|  | Motor drive with limit switch for emergency hand operation | Yes |  |  |  |
|  | The transmission gear shall be of belt-type drive. | Yes |  |  |  |
|  | With necessary crank handles | Yes |  |  |  |
|  | Location of motor drive mechanism and control cabinet (if any) acc. to drawing (picture please see below). | Yes |  |  |  |
|  | A solid cover made from non-corrosive aluminium must be used as the protection against accidental touch of the drive shaft arrangement between motor drive unit and OLTC. | Yes |  |  |  |
|  | Motor drive mechanism box should be made of non-corroding cast aluminium or stainless steel. | yes/please specify |  |  |  |
|  | Secondary cable entrance in motordrive box | Pg type stainless steel cable gland |  |  |  |
|  | **Bushings** |  |  |  |  |
|  | **HV 110 kV bushings according to IEC 60137** | Yes |  |  |  |
|  | Manufacturer, ABB, Trench, MGC, Micafil or HSP | Specify |  |  |  |
|  | Type No. | Please specify No. |  |  |  |
|  | Type of insulation design | Dry type |  |  |  |
|  | RIP-technology insulation | Yes |  |  |  |
|  | Polymer or porcelain insulator | Please specify |  |  |  |
|  | Specify the maximum duration permitted mechanical load on the bushing top-terminal . | Please indicate |  |  |  |
|  | Flat primary terminals of tinned plated copper alloy with 4 drill holes | Yes |  |  |  |
|  | Distance between hole centres according to IEC 518 | 45 × 45 mm |  |  |  |
|  | Without arcing horns | Yes |  |  |  |
|  | **Neutral bushing according to IEC 60137** | Yes |  |  |  |
|  | Manufacturer, ABB, Trench, MGC, Micafil or HSP | Specify |  |  |  |
|  | Type No. | Please specify No. |  |  |  |
|  | Type of insulation design | Dry type |  |  |  |
|  | RIP-technology insulation | Yes |  |  |  |
|  | Polymer insulator or porcelain insulator | Specify |  |  |  |
|  | Flat primary terminals of tinned plated copper alloy with 4 drill holes | Yes |  |  |  |
|  | Distance between hole centres according to IEC 518 | 45 × 45 mm |  |  |  |
|  | **LV bushings according to IEC 60137** | Yes |  |  |  |
|  | Manufacturer | Specify |  |  |  |
|  | Type No. | Please specify No. |  |  |  |
|  | Porcelain insulator | Yes |  |  |  |
|  | Colour of insulator | Specify |  |  |  |
|  | Flat primary terminals of tinned plated copper alloy | Yes |  |  |  |
|  | Distance between hole centres according to IEC 518 | 45 × 45 mm |  |  |  |
|  | Transport gaskets between transport cover and 110 kV bushings adapter should be changed to basic gaskets at the bushings assembly | Yes |  |  |  |
|  | **110kV phases with built in 3 core( or 3 single core) current transformers** | Yes |  |  |  |
|  | Manufacturer | Specify |  |  |  |
|  | Accuracy class, | 5P30 |  |  |  |
|  | Rated power output, VA | 25 |  |  |  |
|  | Rated primary/ secondary current, A | 150/1 |  |  |  |
|  | Current transformer core resistance, Ω | Ri ≤ 8.0 |  |  |  |
|  | Built-in current transformers shall be provided with link boxes on the top of transformer cover and wired to transformer main link box. | Yes |  |  |  |
|  | Changing built in current transformers without lifting transformer cover and active part | Yes |  |  |  |
|  | **Protection, measuring devices and secondary equipment** |  |  |  |  |
|  | Pressure relief device with tripping contacts and oil flow pipe down to ground | Yes |  |  |  |
|  | All wires and cables on the top cover of transformer must not have physical contact with the level surface of the transformer and must be protected from mechanical damage. | Yes |  |  |  |
|  | All markings on the wires and cables must be moisture-proof at temperatures range from -40° to + 70° C | Yes |  |  |  |
|  | “Shock-indicator” installed on transformer at the time of delivery | Yes |  |  |  |
|  | Built-in current transformers for WTI - winding temperature indication | Yes |  |  |  |
|  | Secondary terminal box with heating | Yes |  |  |  |
|  | Secondary terminal box shall be located to transformer tank on bottom part (approximately on eyesight level). | Yes |  |  |  |
|  | All necessary internal and secondary wiring should be made  All secondary cables shall be marked at both ends. If marking is located outside from the box, marking material shall be made from stainless material and resistant to sun heat (UV safe). Indication shall be engraved.  Analog signal terminals shall be disconnectable with visible termination of the circuit. For protection signalling disconnectable terminals shall be used.  Marking of secondary wires shall be made the following way: indication shall show the **remote** address of the wire;  cable number, remote box or equipment and number of wire in cable shall be shown on the wire indication. | Yes |  |  |  |
|  | For wiring weatherproof cables should be used | Yes |  |  |  |
|  | All internal and secondary wiring and cables should be marked with the appropriate symbols. | Yes |  |  |  |
|  | Oil level gauges for the main tank and OLTC with alarm contacts (max / min level exceed) and with dial marks indicating: max / min oil level, correct average expected oil level at the following temperatures: “min”, –35°C,  -200C, 0 °C, +45°C, “max”. Scale diameter no less than 25 cm. | Yes |  |  |  |
|  | Contact insulation level for all transformer protection relays and terminals | ≥ 500 V DC |  |  |  |
|  | Secondary cable entrance in secondary control box | Pg type stainless steel cable gland |  |  |  |
|  | Control cabinet should be made of non-corroding cast aluminium or stainless steel box. | Yes |  |  |  |
|  | Pressure relief device (devices) with tripping contacts and oil flow pipe down to ground | Yes |  |  |  |
|  | **Buchholz-relay** |  |  |  |  |
|  | Buchholz-relay installed under angle 2 - 40 against main tank cover (1) or main tank installed under angle 2 – 40 against ground level to conservator side (2). | Please indicate (1) or (2) |  |  |  |
|  | Double-float Buchholz-relay including the below mentioned devices and accessorises: | Yes |  |  |  |
|  | -one alarm and two tripping contacts; | Yes |  |  |  |
|  | -checking device; | Yes |  |  |  |
|  | -valve between relay and tank; | Yes |  |  |  |
|  | -valve between relay and conservator; | Yes |  |  |  |
|  | -gas sampling device; | Yes |  |  |  |
|  | -hose from Buchholz-relay down to eyesight level. | Yes |  |  |  |
|  | Temperature of the insulation liquid -400C to +1150C | Yes |  |  |  |
|  | Resistance against vibration:   * Vibration 2-200 Hz, 1 g   Shock: 10 g, 11 ms | Yes |  |  |  |
|  | Resistance to pressure – 0.25 MPa | Yes |  |  |  |
|  | Resistance to vacuum - < 2.5 kPa | Yes |  |  |  |
|  | Insensitivity to magnetic field – 25 mT | Yes |  |  |  |
|  | Contacts load capacity:   * AC 5V – max 250 V, 0,01 – max 6 A, cos φ≥ 0,5   DC 5V – max 250 V, 0,01 – max 6 A τ=L/R< 40 ms | Yes |  |  |  |
|  | **Rating, diagram and instruction plates** |  |  |  |  |
|  | The plates located on eyesight level, at HV side of the tank | Yes |  |  |  |
|  | The plates shall be made according to IEC | Yes |  |  |  |
|  | **Information on the plates** |  |  |  |  |
|  | Type of transformer | Yes |  |  |  |
|  | Serial number | Yes |  |  |  |
|  | Rated power of windings: HV/LV | Yes |  |  |  |
|  | Rated current on first principal and last tap- position. | Yes |  |  |  |
|  | Rated voltage on first principal and last tap- position. | Yes |  |  |  |
|  | Vector group | Yes |  |  |  |
|  | Colling type | Yes |  |  |  |
|  | Year of manufacture | Yes |  |  |  |
|  | Oil type | Yes |  |  |  |
|  | Insulation level | Yes |  |  |  |
|  | Winding connection diagram | Yes |  |  |  |
|  | The measured percentile short-circuit impedances (the reference power shall be indicated) for all winding pairs on the principal and extreme tappings | Yes |  |  |  |
|  | The measured percentile zero-sequence impedances | Yes |  |  |  |
|  | The measured percentile short-circuit resistances (+75 ºC, on the 10 MVA basis) for all winding pairs on the principal and extreme tappings | Yes |  |  |  |
|  | The measured no-load loss, and the percentile no-load current or apparent no-load power at rated voltage | Yes |  |  |  |
|  | Maximum Load-Losses HV-LV value on the first tap-highest plus position | Yes |  |  |  |
|  | Maximum Load-Losses HV-LV value on the principal tap | Yes |  |  |  |
|  | Maximum Load-Losses HV-LV value on last tap-lowest minus position | Yes |  |  |  |
|  | The short-circuit strength, for each winding separately | Yes |  |  |  |
|  | The vacuum strength of the transformer tank | Yes |  |  |  |
|  | The transport weight with and without oil | Yes |  |  |  |
|  | Oil weight | Yes |  |  |  |
|  | Active part weight | Yes |  |  |  |
|  | Transformer full weight | Yes |  |  |  |
|  | Furthermore fittings of the transformer shall have their own protection and oil piping diagram according to the pertinent Standard (including  valves, etc.). At least the above mentioned data shall be marked on the separate protection and oil piping diagram of the transformer | Yes |  |  |  |
|  | Valve location plate. The position of each valve in normal service should be shown, i.e. Normally Open (N.O) or Normally Closed (N.C) | Yes |  |  |  |
|  | Diagram plates indicating location of all protection devices and valves | Yes |  |  |  |
|  | Marking of terminals (bushings) on HV side | N –A-B-C |  |  |  |
|  | Marking of terminals (bushings) on LV side | a-b-c |  |  |  |
|  | Curves for oil filling to conservator and OLTC part (oil column height in conservator (mm) depending on the oil temperatureC0). | Yes |  |  |  |
|  | Final Peak Efficiency Index (PEI) according to final loss values | Yes |  |  |  |
|  | The plates shall be in the Latvian, approved by the Purchaser | Yes |  |  |  |
|  | Testing according to IEC 60076 | See below |  |  |  |
|  | **Routine tests:**  - Measurement of winding resistance;  -Measurement of voltage ratio and check vector group;  -Measurement of short-circuit impedance and load losses (on the principal and extreme taps positions);  -Measurement of no-load losses and current; Test of on-loud tap-changer;  -Leak testing with pressure for liquid-immersed transformers tighteness test);   * Measurement of losses at reference temperature; * Dielectric tests;   -Check of core and frame insulation for liquid immersed transformers with core or frame insulation;  -Test to indicate correct functioning of control equipment. | Yes |  |  |  |
|  | **Special tests(**Special measurement definition acc. to IEC 60076-1 point. 3.11.3)**:**  - Measurement of zero sequence impedance (at principal, highest plus and lowerst minus tap);  - Measurement of sound level acc. IEC 6076-10;  -Temperature rise test (for one unit);  - PD measurements.  - Frequency response analysis (FRA) | Yes |  |  |  |
|  | **Another tests:**  Measurement of no-load losses at 400 V and 50 Hz  Check of auxiliary equipment  Oil leakage test.  Degree of insulations paper polymerization  Over excitation curve  Time constant for oil  Time constant to windings | Yes |  |  |  |
|  | **Tests after assembling of parts before energizing:**  -All accessories functional test  -OLTC functional test. | Yes |  |  |  |
|  | Transformers should be tested with same aggregates (110 kV bushings, cooling system elements etc.) which will be assembled on the transformer at substation. | Yes |  |  |  |
|  | DGA should be performed before and after transformers testing | Yes |  |  |  |
|  | **Special requirements** |  |  |  |  |
|  | After delivery and installation of the transformer on the site, the Supplier must  ensure that the DGA of the transformer's oil compliance with the values in Table below:   |  |  | | --- | --- | | **Gas** | **Value [ppm]** | | H2 | ≤5 | | CH4 | ≤3 | | C2H4 | ≤6 | | C2H6 | ≤2 | | C2H2 | ≤0.5 | | Yes |  |  |  |
|  | 1 Contractor’s transformer design engineer participation in the site visit to Latvia in order to collect and take into account during transformer design special requirements according to site conditions: 1 w/days | Yes |  |  |  |
|  | Transformer’s assembling time after delivery, days | Specify |  |  |  |

Picture No.1



Picture No.2





A

A

~ 1324 mm

~2270 mm

Foundation withuot rails

1. An accurate source presenting the technical information (title and page of the instruction) [↑](#footnote-ref-2)