**Technical Specification – AT 330/220/35 kV 250MVA.**

| No | Technical Data | | Unit | Required by the Purchaser | Guaranteed by the Supplier |
| --- | --- | --- | --- | --- | --- |
|  | Technical Data in conformity with the requirements of the standard | |  | IEC, DSTU EN, DSTU IEC standards |  |
|  | Manufacturers designation | |  | \* |  |
|  | Manufacturer and Country of Origin of the transformer | |  | \* |  |
|  | Transformer type | |  | three-phase autotransformer, oil-filled, with ONAF cooling, three-winding, with OLTC, 250000 kVA rated power and voltage classes HV-MV – 330/220 kV, for moderate climate region, outdoor installation |  |
|  | Rated Voltage | | kV | 330/230/38.5 |  |
|  | System Nominal Voltage | | kV | 330/220/35 |  |
|  | Climatic Version and Location Category in conformity with GOST 15150-69 | |  | U1 (for the region with moderate climate, to be outdoor located) |  |
|  | Maximum Installation Altitude, m | | m | Up to 1000 |  |
|  | Area's Seismic Stability, not less, DSTU B V.1.1-28:2010 | | Points | 7 |  |
|  | **Rated Parameters and Technical Data** | |  |  |  |
|  | Rated Winding Voltage | HV | kV | 330 |  |
| MV | kV | 230 |  |
| LV | kV | 38,5 |  |
|  | Highest Voltage for Equipment (according to Ukrenergo Standard, GOST 1516.3-96) | HV | kV | 363 |  |
| MV | kV | 252 |  |
| LV | kV | 40.5 |  |
|  | Rated Power | | MVА | 250 |  |
|  | Rated Power of LV winding | | MVА | 100 |  |
|  | Rated Frequency | | Hz | 50 |  |
|  | Winding Connection Diagram & Group | |  | YNa0d11 |  |
|  | Full Wave Lightning Impulse (LI) 330 kV winding | | kV | 950 |  |
|  | Full Wave Lightning Impulse (LI) 220 kV winding | | kV | 750 |  |
|  | Full Wave Lightning Impulse (LI) 35 kV winding | | kV | 190 |  |
|  | Chopped Wave Lightning Impulse (LIC) 330 kV winding | | kV | 1050 |  |
|  | Chopped Wave Lightning Impulse (LIC) 220 kV winding | | kV | 835 |  |
|  | Chopped Wave Lightning Impulse (LIC) 35 kV winding | | kV | 220 |  |
|  | Applied Voltage or Line Terminal AC withstand (AV)(LTAC) 330 kV winding | | kV | 395/525 |  |
|  | Applied Voltage or Line Terminal AC withstand (AV)(LTAC) 220 kV winding | | kV | 325/395 |  |
|  | Applied Voltage or Line Terminal AC withstand (AV)(LTAC) 35 kV winding | | KV | 85 |  |
|  | Neutral mode | |  | solid earthing |  |
|  | Short-Circuit Voltage on main tap position, %   * HV-MV * HV-LV * MV-LV | | % | 10,5 (tolerance ±10%) 90 (tolerance ±15%) 72 (tolerance ±15%) |  |
|  | No-load Current (max) | | % | 0.15  (tolerance +30% as per IEC 60076-1) |  |
|  | No load Losses at Rated Voltage, (max.) | | kW | 60  (tolerance +15% as per IEC 60076-1 provided that the tolerance for total losses do not exceed +10%) |  |
|  | Load losses at rated power in HV-MV mode at middle tap-changer position, (max.) | | kW | 580  (tolerance +15% as per IEC 60076-1 provided that the tolerance for total losses do not exceed +10%) |  |
|  | Load losses at rated power in MV-LV mode at middle tap-changer position, (max.) | | kW | 320 (tolerance +15%) |  |
|  | Load losses at rated power in HV-LV mode at middle tap-changer position, (max.) | | kW | 305 (tolerance +15%) |  |
|  | **Design Requirements** | |  |  |  |
|  | The Transformer is to be Manufactured:   * + with Cable Leads-in;   + with Bushings;   + for Connection to SF6 Equipment | |  | With Bushings |  |
|  | Transformer Oil according to Table 4 - SOU-N EE 43-101: 2009 (as amended by 13.02.2018), availability of certificate (passport, protocol) | |  | Yes |  |
|  | Oil Preservation System | |  | Elastic membranes  air-bag type |  |
|  | Inner insulation of the transformer: Check of core and frame insulation.  In accordance to IEC 60076-1. Earthing connection point to be brought outside | |  | Yes |  |
|  | The transformer shall be equipped with fittings / for technological systems’ signals and sensors, to allow for connection of the condition monitoring system in the future  Transformer shall be provided with HV bushing insulation monitoring device to monitor the insulation condition at the operating voltage | |  | Yes  Yes |  |
|  | Pressure Relief Valve (With contacts for actuation signalling) | |  | Yes |  |
|  | Cooler Bank Shut-off valves.  Inlet and outlet valves, each with separate contacts to provide remote signalling of open/close position and with a visual position indicator. | |  | Yes |  |
|  | Gas relay (main tank)  Installed on the pipe between the main tank / tap changer and the conservator ascending towards the conservator by 0° to 5°  Two-float design, with separate contacts providing ‘alarm’ and ‘trip’ settings.  Provision to be made for gas extraction at ground level. | |  | Yes |  |
|  | Silica Gel | |  | Yes |  |
|  | Maintenance-free dehydrating breather | |  | Yes |  |
|  | Oil level indicator on conservator.  Dial type with visual scale, providing an analogue output for remote monitoring | |  | Yes |  |
|  | Winding temperature indicator with contacts for cooler control and alarm/trip functions. | |  | Yes |  |
|  | Painting colour | |  | Light-grey (RAL 7038) |  |
|  | Cabinets (control, signalling, terminals) arrangement | |  | Free standing |  |
|  | Stainless steel conduit along the transformer tank to protect the control cables laid from the monitoring, signalling, protection devices, leads-in, the current transformers to the terminal’s cabinets, against mechanical damage and solar radiation | |  | Yes |  |
|  | **Bushings** | |  |  |  |
|  | Bushing Insulation level in accordance to IEC Standards (60076-3, 60137).  Insulation level according to Table 3, IEC 60137 for Highest Voltage for Equipment (Um) below:  HV – 362 kV (Um)  MV – 245 (Um),  LV – 40.5 kV (Um) | |  | Internal insulation - Solid (RIP), external insulation – porcelain or silicon  Pollution severity class acc. IEC/TS 60815- 1:2008 – d (heavy pollution) |  |
|  | Specific Creepage Distance of Bushing External Insulation, (USCD) not less than: | | cm/kV | 4.33 |  |
|  | Completing the leads-in with the clamps for busbar connection | |  | Yes |  |
|  | Rated Current for   * Primary winding bushing * Secondary primary bushing * Tertiary winding bushing | | A | **\***  **\***  **\*** |  |
|  | Allowable mechanical loads on to the bushings, at least:  - 330kV  - 220kV  - 35kV | | N | (Cantilever load testing according IEC 60137)  2500  2000  **\*** |  |
|  | HV bushing insulation monitoring  Outdoor cabinet for bushing insulation monitoring, complete set | |  | Yes  Yes |  |
|  | **Built-in Current Transformers:** | |  |  |  |
|  | CT final Technical Data are to be clarified at the stage of the equipment purchasing by the Supplier | |  | Yes |  |
|  | **At 330 kV HV Bushing:** | |  |  |  |
| Primary Current | | A | 1000\*-750-600-400 |  |
| Secondary Current | | A | 1 |  |
| Rated Burden, V ∙ A | |  | 30 |  |
| The number of secondary windings, pcs. | |  | 4+1(ф.А) |  |
| Accuracy Class | |  | 0,2S+0,2S/10Р/10Р/10Р |  |
|  | **At 220 kV MV Bushing:** | |  |  |  |
| Primary Current | | A | 2000– 1500– 1000-750 |  |
| Secondary Current | | A | 1 |  |
| Rated Burden | | V ∙ A | 30 |  |
| The number of secondary windings, pcs. | |  | 4 |  |
| Accuracy Class | |  | 0,2S/10Р/10Р/10Р |  |
|  | **At 35 kV LV Bushing:** | |  |  |  |
| Primary Current | | A | 3000– 2000–1500- 1000(\*) |  |
| Secondary Current | | A | 5 |  |
| Rated Burden | | V.A | 30 |  |
| The number of secondary windings, pcs. | |  | 4 |  |
| Accuracy Class | |  | 0,2S/10Р/10Р/10Р |  |
|  | **At HV Neutral Terminal:** | |  |  |  |
| Primary Current | | A | 1000– 750– 600– 400(\*) |  |
| Secondary Current | | A | 5 (\*) |  |
| Rated Burden | | V.A | 30 (\*) |  |
| The number of secondary windings, pcs. | |  | 4 (\*) |  |
| Accuracy Class | |  | 0,2S/10Р/10Р/10Р |  |
|  | **Cooling System** | |  |  |  |
|  | Cooling System Type | |  | Combined  ONAN/ONAF1/ONAF2 |  |
|  | The Cooling system automatics cabinet:   * + Automatic maintain the temperature inside the cabinet for normal operation in conformity with climatic manufacture version of the transformer equipment.   + The cabinet protection degree not less than ІР55;   + Current protection of the fan’s electric motors. | |  | Yes  Yes  Yes |  |
|  | The cooling system fans service life, not less than: | | Years | 30 |  |
|  | Coolers Arrangement | |  | Mounted on the Tank |  |
|  | Cooling Devices (Radiators) Design | |  | Plated |  |
|  | Automatic Control in Cooling Systems | |  | Yes |  |
|  | Combined electrical power of all cooling fans | | kW | \* |  |
|  | Rated supply voltage for cooling system | | V | ~400, 50Hz |  |
|  | **Voltage Control Device** | |  |  |  |
|  | Manufacturer | |  | \* |  |
|  | Type of OLTC | |  | Vacuum diverter switch |  |
|  | Rated through current | | A | \* |  |
|  | Rated step capacity | | kVA | \* |  |
|  | Capability of 3-type control:   * + local – from the drive key (buttons);   + remote –from the control board;   + automatic – from the automatic control unit   + local – using a manually-operated switch of tap-changer position | |  | Yes |  |
|  | Tap Changer range & (number of steps) | |  | 252±6х2% of Umv |  |
|  | Way of control and Tapping Winding | |  | OLTC on the MV line |  |
|  | Supply of OLTC control microprocessor-based device | |  | Yes |  |
|  | Requirements to OLTC:   * + Mechanical endurance of OLTC with no electric load, quantity of switching-over, at least;   + Electrical endurance of contacts of the OLTC contactors, commutating the switching-over current, at least;   + OLTC switch vacuum compartment monitoring system   + Technical support (servicing) in Ukraine | |  | 500 000  300 000  Yes  Yes |  |
|  | OLTC: number of operations until exchange of diverter switch unit | |  | minimum 1.2 million |  |
|  | Requirements to the OLTC drive:   * + provision of two transformers parallel operation;   + signalling in case of edge positions;   + availability of remote signalling position transducer;   + discrete signalling of the OLTC each position;   + inhibition for switching-over at low temperatures;   + OLTC actuation quantity meter;   + availability of heaters of the drive;   + signalling of the heaters state;   + mechanical indicator of the OLTC position on the cabinet of the drive;   + possibility of connection to PACS in future   + outdoor cabinet of the OLTC remote control at the AIS, set;   + OLTC single drive for three phases;   + Mechanical indicator of the OLTC position in the drive, clearly identified and accessible for reading by operating personnel;   + Operation in the following modes: local control, remote control and automatic control;   + Capability of local manual mechanical operation, with override of electrical control;   + Ensuring of safe completion of switching operation in the event of loss of control current. | |  | Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes  Yes |  |
|  | Voltage of OLTC Power Supply   * Electric Motors * Control Circuits * Signalling Circuits | | V ac  V ac  V dc | ~400, 50 Hz (3phases+N)  ~230, 50 Hz (1phase+N)  =220 |  |
|  | **Reliability Requirements** | |  |  |  |
|  | Mean-Time-Between-Failures, not less | | Hours | 25000 |  |
|  | Operation Service Life, not less | | Years | 30 |  |
|  | Guarantee time period:  Warranty period for the entire supplied equipment shall be   * + from the date of commissioning, or   + from the date of its receipt at the Employer’s storage location   Whichever comes first | | Years | 5  5,5 |  |
|  | **Transportation** | |  |  |  |
|  | * + Movement on site should be possible on rails   + Fully assembled of transformer during movement to service plinth | |  | Yes  No |  |
|  | Transformer movement | |  | longitudinal transverse |  |
|  | Form of rollers | |  | With ribs |  |
|  | Width of rail as per GOST 11677-85:   * + longitudinal movement;   + transverse movement | | mm | 1524  2000 |  |
|  | «Impact-indicators» on the transportation packing for movement conditions monitoring within the supply time period | |  | Yes |  |
|  | **Complete set, supply support** | |  |  |  |
|  | * + Complete set of air-drying system;   + The cooling system automatics cabinet in complete set;   + The control cables complete set with protection for the cables to be laid along the tank;   + Nitrogen gas in the amount required during temporary storage at site and for replenish   + Spares in conformity with the Supply Complete Set Data Sheet, set   Transformer oil:   * + In the amount required for complete filling-in;   + For process operations and replenishing during installation works | |  | Yes  Yes  Yes  Yes  Yes  Yes  10% of the amount of complete filling-in |  |
|  | Delivery  - with no oil, it has to be filled with nitrogen gas during the transportation (the complete set includes the transformer oil in the amount, required for filling-in, process operations during the erection and oil additional filling-in up to the operation oil level). | |  | Yes |  |
|  | Technical support of supply (acceptance of the state and complete set together with the Manufacturer and the Supplier, installation supervision) | |  | Yes |  |
|  | **Documentation to be submitted at the supply** | |  |  |  |
|  | Complete Set Data Sheet | |  | Yes |  |
|  | Quality Certificate | |  | Yes |  |
|  | Origin Certificate | |  | Yes |  |
|  | Certificates for transformers and completing parts (products) of the system | |  | Yes |  |
|  | Technical Description and Operation Manuals or Operation Guidelines (which include the planned repair documentation) for the transformer, completing parts and systems | |  | Yes |  |
|  | Control diagrams of the Cooling Systems and OLTC | |  | Yes |  |
|  | Transfer-Acceptance Tests Protocols (Certificates) | |  | Yes |  |

**\*** **to be determined by the transformer manufacturer**