**SECTION 5 Schedule of Requirements**

SPECIFICATIONS on procurement of equipment

АТ 330/110 kV

**Project for emergency recovery of critical infrastructure facilities of Ukraine:**

Power transformers for the SS-330 Lviv Pivdenna and SS-330 Zhytomyrska

1. **Background**

The ongoing war in Ukraine has already resulted in significant loss of life, devastating destruction of infrastructure and unprecedented displacement internally and towards neighboring countries.

Due to the massive attacks on facilities of critical infrastructure, in particular, the transmission and distribution systems and generation, nearly 50% of the Ukrainian integrated power system is damaged or destroyed. Ukrenergo’s specialists work 24/7 to stabilize the system and restore the power supply.

As of today, the main challenge for Ukrainian energetics remains the shortage of specific high-voltage equipment for transmission and distribution systems reconstruction carrying out emergency restoration works at power grid facilities.

As the Russian attacks were primarily focused on autotransformers (AT) it is crucial that Ukrenergo must replenish its AT fleet ASAP to successfully pass through the winter period.

Objectives of the assignment

The main aim of the assignment is to support establishment of an effective mechanism for mobilizing and processing financial assistance from the international partners for the emergency recovery of Ukraine's critical infrastructure facilities damaged or destroyed because of the armed aggression of the Russian Federation.

This project is a prerequisite for larger cooperation with international organizations to rebuild Ukraine's infrastructure destroyed by Russian aggression.

Key project objectives are

1. To ensure the reliability of electricity supply to subscribers of the SS-330 Lviv Pivdenna and SS-330 Zhytomyrska;
2. To enable development of power supply systems in the region.

**3. Technical Specifications**

АТ 330/110 kV technical requirements

| № | Description | Required |
| --- | --- | --- |
|  | Design | three-phase |
|  | Standard technical conditions | IEC 60076  (DSTU 2103-92  DSTU 3463-96) |
|  | Installation, (internal, external) | external |
|  | Neutral mode | Solid earth |
|  | Rated voltage winding kV  – HV  – MV  – LV | 330  115  38.5 |
|  | Maximum working voltage, kV  – HV  – MV  – LV | 363  126  40.5 |
|  | The rated capacity of the transformer, kVA | 200000 |
|  | Rated power of LV winding,  kV ∙ A | 80000 |
|  | Frequency, Hz | 50 |
|  | Diagram and connection group of windings | YNa0d11 |
|  | Maximum allowable current in the common winding, A | 800 |
|  | Number of phases | 3 |
|  | No-load current on the main branch, %, no more than | 0.45 |
|  | Power short circuit in the main branch, %   * 1. HV-MV   2. HV-LV   3. MV-LV | 10.5  38.0  25.0 |
|  | No-load losses at the main branch, kW, not more | 103 |
|  | Loss of short-circuit at the main branch, kW, not more | 410 |
|  | The allowable temperature rises of individual elements of the transformer on the ambient temperature, ОС, not more | IEC 60076 |
|  | Resistance to short-circuit currents, kA:  - Thermal (HV, LV)  - Dynamic (HV, LV) | IEC 60076  (State Standard 11677-85) |
|  | The type and range of voltage regulation | On-load changing in AV line  115±6х2% from Uсн |
|  |
|  | On-load tap changing with one drive for three phases | Yes |
|  | On-load tap changing with vacuum contactors | Yes |
|  | A pointer of On-load tap changing | Yes |
|  | Power supply of on-load tap changing   * 1. engines   2. The control circuits   3. alarm circuits | ~380 V, 50 Hz  ~220 V, 50 Hz  =220 V |
|  | The presence of the control unit voltage regulator with the possibility of connection to Computer process control system (communication protocol - IEC 61850), type | Yes |
|  | Number of switching cycles before the first revision, not less | 70000 |
|  | Mechanical endurance of the contactors, the number of switches, at least | 800,000.00 |
|  | The wear resistance of the contacts with the (0.7 - 1.0) Ie, the number of connections, not less | 400,000.00 |
|  | Technical support type on the territory of Ukraine | Bidder offers the possibility |
|  |
|  | Type of cooling system (M / D / DC) | ONAN/ONAF1/ONAF2 |
|  | The arrangement of the coolers | mounted |
|  | Manual operation of the cooling system possibility | Yes |
|  | Rated supply voltage of control circuit of the cooling system, V | ~220, 50Hz |
|  | Power supply of signaling circuits, V | =220 |
|  | Rated supply voltage of engines of the cooling system, V | ~380, 50Hz |
|  | The installed power of cooling system engines, kW, not more | 12.6 |
|  | Requirements for dielectric strength of main circuits | IEC 60076  (State Standard 1516.3-96) |
|  |
|  | On the HV side:  - Rated primary current, A  - Rated secondary current, A  - Rated Burden, V ∙ A  - The number of secondary windings, pcs.  - accuracy class  Accuracy class (0.2) for the connection of the AKM device and monitoring systems specified by the manufacturer | 1000-750-600-400  1  10  4+1    0,2+0,2/10Р/10Р/10Р |
|  | On the MV side:  - Rated primary current, A  - Rated secondary current, A  - Rated Burden, V ∙ A  - The number of secondary windings, pcs.  - accuracy class  Accuracy class (0.2) for the connection of the monitoring systems specified by the manufacturer | 2000-1500-1000  1  10  4    0,2/10Р/10Р/10Р |
|  | On the LV side:  - Rated primary current, A  - Rated secondary current, A  - Rated Burden, V ∙ A  - The number of secondary windings, pcs.  - accuracy class | 1000-750-600-400  5  30  4    0,5/10Р/10Р/10Р |
|  | On the withdrawal of the total winding:  - Rated primary current, A  - Rated secondary current, A  - Rated Burden, V ∙ A  - The number of secondary windings, pcs.  - accuracy class | 1000  5  30  2    10Р/10Р |
|  | The neutral:  - Rated primary current, A  - Rated secondary current, A  - Rated Burden, V ∙ A  - The number of secondary windings, pcs.  - accuracy class | 1000  5  30  2    0,5/10Р |
|  |
|  | Climatic version (U, HL) and allocation category according to state standard 15150-69 | N1 |
|  | Height above sea level, m, not more | 1000 |
|  | Seismic area, on a scale Earthquake Intensity Scale-64` | 6 |
|  | Pollution degree (PD) of the atmosphere in accordance with 1. IЕС/TS 60815-1 | C |
|  | Specific normalized creepage distance for 35 kV bushings, in accordance with 1. IЕС/TS 60815-1, cm/kV, not less | 4.1 |
|  | Specific normalized creepage distance for 110 kV and 330 kV bushings, in accordance with 1. IЕС/TS 60815-1, cm/kV, not less | 3.47 |
|  |
|  | The level of the tank connector | lower |
|  | Gas relays of AT with a device for the selection of the gas without pulling on the AT | Yes |
|  | The number of contacts of Gas relay of AT pcs., Not less:  - signal  - Actions to disable | 3  3 |
|  | Jet on-load tap changing relay with three contacts | Yes |
|  | Grounding the active part | outside the bottom of the tank |
|  | Protection of transformer oil | Film |
|  | Oil level in the expander is dial type with a scale, with the possibility of remote control, with two pairs of signal contacts - maximum and minimum oil level. | Yes |
|  | Oil level in the Tap changer expander is with two pairs of contacts (maximum, minimum oil level below the critical level). | Yes |
|  | The presence of air system drainage | Yes |
|  | Shut-off valve with two pairs of contacts with the valve position indicator (standard shut-off valve «SERGI» manufacturing) | Yes |
|  | Two safety valves (on opposite sides) with contacts for the alarm trigger. | Yes |
|  | Max. overload of AT according to Ukrainian national standardization system 3463-96 | Yes |
|  | Control monitoring system for AKM (output signal) | 4-20 mА |
|  | Connecting of monitoring system for the gas content in transformer oil:  transformer tank / cooling system -  cooling system (lower collector) | Yes |
|  | Available devices for the breakout of active part in a tank from the bias  - During transportation  - During operation | Yes  Yes |
|  | Has thermosyphon filter | Yes |
|  | Durability, years, at least | 30 |
|  | No need for additional winding and magnetic conductor seals for the entire life time | Yes |
|  | Brand type and manufacturers of components:  - Transformer oil  - Wire windings  - Electrocardboard  - Paint | Defining by the bidder and gives in the bidding proposition |
|  | Color of transformer paint | gray (RAL 7038) |
|  | Color of porcelain tire bushings LV | brown |
|  | The movement of the transformer | longitudinal-cross |
|  | Installation of autotransformer is horizontal (without tilting) | Yes |
|  | Track, mm    - longitudinal  - cross  (distance between the tracks 5140) | 1524  2х2000 |
|  | Shape of wheels | flanged |
|  | Bushing types:   * + 330 kV (with a solid RIP insulation, external silicone insulation HTV category   + 110 kV (with a solid RIP insulation, external silicone insulation HTV category   + 35 kV (bushings) | Yes          Yes          Yes |
|  | 330/110 kV bushings monitoring; | Yes |
|  | Bushings have to withstand the test console loads for 1 minute (according to State Standard 10693), N, not less than:   * 1. 330 kV   2. 110 kV | 2500  2000 |
|  | The permissible 50 Hz network overvoltage for a duration t, and the number of overvoltage cases for the year n (in relative terms with respect to the maximum operating voltage) | IEC 60076  (State Standard 1516.3-96) |
|  | Bushings 330 kV must have contact terminals for connection of two flexible cables of 330 kV busbar | Yes |
|  | Overall dimensions, mm:  -length  - width  -height | DSTU 2103-92  Defining by the bidder and gives in the bidding proposition |
|  | Overall transportation dimensions, mm:  -length  - width  - heigh | DSTU 2103-92    Defining by the bidder and gives in the bidding proposition |
|  | Weight, t:  - Transport (without oil)  - full  - oil | DSTU 2103-92  Defining by the bidder and gives in the bidding proposition |
|  |
|  | Service life to first overhaul, years, not less than | 30 |
|  | Durability, years, at least | 30 (without overhaul and revision of the active part) |
|  | The frequency and maintenance requirements | Defining by the bidder and gives in the bidding proposition |
|  | Fail safe performance probability | IEC 60076  (State Standard 11677-85) |
|  | Shelf life up to commissioning, months, not less | 12 |
|  |
|  | The warranty period from the date of commissioning, years, not less | 5 |
|  |
|  | Number and date of security certificates | Yes |
|  | Security requirements, including fire | GOST 12.2.007.0-75  GOST 12.2.007.2-75  GOST 12.1.004-91 |
|  | The permissible noise levels | State Standard 12.2.024-87 |
|  |
|  | Voltage interference (VI), measured at 1.1 of Maximum operating voltage, mV, not more | 2500 |
|  | Autotransformers three-phase, complete | Yes |
|  | Oil and silica gel to the extent necessary for the introduction of the transformer to the work process and the oil needs to be refilled during the operation; Mineral oil is compatible with the type of GK oil | Yes |
|  | Additional oil sampler at the top of the tank, available for service with a stationary platform autotransformer | Yes |
|  | On-load tap changer device with a microprocessor-automatic control | Yes |
|  | Protection system (explosion and fire) SERGI configuration ТР HDS SOGST or equivalent | Yes |
|  | The automatic control cabinet | Yes |
|  | Additional winding and oil temperature control devices | Yes |
|  | Monitoring system for the gas content in transformer oil: | Yes |
|  | Automated monitoring system of AT as part of the monitoring unit and the Remote display and signaling to transmit information to the Computer-aided process control (optical ethernet) | Yes |
|  | Spare parts and accessories according to the delivery note | Yes |
|  | Set of tools for service | Yes |
|  | Bill of equipment | Yes |
|  | Certificates  - compliance  - origin | Yes |
|  | Overall and installation drawings and schemes of the control cabinet, drive circuit and the regulator tap changer, number of copies | 2 |
|  | Technical passport, number of copies | 2 |
|  | Operating Instructions in Ukrainian language, the number of copies | 2 |
|  | Instructions for transport, unloading, storage, installation and commissioning in the Ukrainian language, the number of copies | 2 |
|  | Table of short-term overload accidents | Yes |
|  | Scheme grounding of the active part | Yes |
|  | The protocols (acts) acceptance testing | Yes |
|  | Program and methods of control testing | Yes |
|  | Marking, packing and storage in accordance with IEC 60076 (State standard 14192‑96, State standard 23216‑78, State standard15150‑69) | Yes |
| 1. ` | The presence of shock indicators for monitoring transport conditions | Yes |
|  | Terms of transportation (with oil, oil-free) | without oil, filled with dry nitrogen |

Section 5b: Other Related Requirements

Further to the Schedule of Requirements in the preceding Table, Bidders are requested to take note of the following additional requirements, conditions, and related services pertaining to the fulfillment of the requirements:

|  |  |
| --- | --- |
| Delivery Term [[INCOTERMS 2020](https://home.kuehne-nagel.com/-/knowledge/incoterms)]  *(Pls. link this to price schedule)* | DPU port of Constanza, Romania or Gdansk Poland |
| Exact Address of Delivery/Installation Location | Delivery:  port of Constanza, Romania or Gdansk Poland |
| Mode of Transport Preferred |  |
| UNDP Preferred Freight Forwarder, if any[[1]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en%2DUS&rs=en%2DUS&wopisrc=https%3A%2F%2Fundp-my.sharepoint.com%2Fpersonal%2Fmaryna_anokhina_undp_org%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F723ad5d1d55d4bbe92d58ee508b56f97&wdenableroaming=1&mscc=1&wdodb=1&hid=C35B7DA0-2097-5000-AFF4-A0611E473EA3&wdorigin=ItemsView&wdhostclicktime=1669728064852&jsapi=1&jsapiver=v1&newsession=1&corrid=42cbe208-2411-4046-9277-41e464f35d2c&usid=42cbe208-2411-4046-9277-41e464f35d2c&sftc=1&cac=1&mtf=1&sfp=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush&rct=Medium&ctp=LeastProtected#_ftn1) |  |
| Distribution of shipping documents  *(if using freight forwarder)* |  |
| Customs, if required, clearing shall be done by: |  |
| Ex-factory / Pre-shipment inspection | N/A |
| Inspection upon delivery | Final Inspection and acceptance test will be performed in accordance with TOR/specification |
| Installation Requirements | Required online support and overview during installation as specified above |
| Testing Requirements | Final Inspection and acceptance test will be performed in accordance with TOR/specification. |
| Scope of Training on Operation and Maintenance | N/A |
| Commissioning | N/A |
| Warranty Period | Warranty period is defined in the Specification of each item.  Availability of an official service in Ukraine is an asset. The Supplier is obliged to indicate the addresses of the Warranty Service Station that can provide immediate support (on-line is also acceptable). |
| Local Service Support | Local services support is an asset. |
| Technical Support Requirements | N/A |
| After-sale services Requirements | ☒ Warranty on Parts and Labor for minimum period defined in the specification of each item.  ☒ Technical Support on site or on-line  ☐ Provision of Service Unit when pulled out for maintenance /repair  ☒ Others: please suggest most appropriate option |
| Payment Terms | 100% of the total amount of the contract will be paid after signing the acceptance of goods. |
| Conditions for Release of Payment | ☐ Pre-shipment inspection  ☒ Inspection upon arrival at destination  ☐ Installation  ☐ Testing  ☐ Training on Operation and Maintenance  ☐ Others *[pls. specify]*  ☒ Acceptance by UNDP and submission of originals of invoice, act of acceptance and tax invoice (if applicable). |
| All documentations, including catalogues, instructions and operating manuals, shall be in this language | English and Ukrainian |

[*[1]*](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en%2DUS&rs=en%2DUS&wopisrc=https%3A%2F%2Fundp-my.sharepoint.com%2Fpersonal%2Fmaryna_anokhina_undp_org%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F723ad5d1d55d4bbe92d58ee508b56f97&wdenableroaming=1&mscc=1&wdodb=1&hid=C35B7DA0-2097-5000-AFF4-A0611E473EA3&wdorigin=ItemsView&wdhostclicktime=1669728064852&jsapi=1&jsapiver=v1&newsession=1&corrid=42cbe208-2411-4046-9277-41e464f35d2c&usid=42cbe208-2411-4046-9277-41e464f35d2c&sftc=1&cac=1&mtf=1&sfp=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush&rct=Medium&ctp=LeastProtected#_ftnref1)*A factor of the* [*Incoterms*](https://www.kn-portal.com/incoterms_2020/) *stipulated in the ITB.*