

Kozloduy NPP EAD

TERMS OF REFERENCE

No. 23.EII-2.T3.1226

For design and construction of a building and/or design, supply, installation and commissioning

SUBJECT: Design, manufacture and supply of spare parts and materials analogous to the original ones, necessary for the implementation of the repairs on the 9,10GQ turbine generators and 9,10GE excitation generators operated at Kozloduy NPP Units 5 and 6.

This Terms of reference shall contain a technical specification in accordance with the Public Procurement Act.

1. Brief description of the Terms of reference

The purpose of this Terms of reference is: design, manufacture and supply of spare parts, gaskets and repair materials similar to the original ones, for 9,10GQ turbine generators, type: TBB-1000-4Y3 and the rotary rectifiers to excitation generators (exciters) 9,10GE, type: ББД-4600-1500AY3, operated at Kozloduy NPP Units 5 and 6. The quantities, characteristics and types of parts to be supplied are divided into two lots, presented as follows:

Appendix 1 - Lot 1. Main spare parts, gaskets and materials for turbine generator, type: TBB-1000-4Y3;

Appendix 2 - Lot 2. Main spare parts for rotary rectifier of exciter, ББД 4600-1500AY3 type.

2. Design requirement

Justification for the design preparation. Lack of design and technical documentation necessary for the manufacture of spare parts, gaskets and selection of materials used for repairs of turbine generators TBB-1000-4Y3 and ББД-4600-1500AY3 exciters.

Main design functions:

- design of spare parts, gaskets and selection of materials required for repair of TBB-1000-4Y3 turbine generators and ББД-4600-1500AY3 exciters - with qualities and characteristics analogous to the original ones, and when information is available - covering the minimum of the given indicators taken from the relevant Russian standards or technical conditions;

- Preparation of a justification for the selected design solution for each of the new items (spare parts, gaskets and materials), justifying the selection of the alternative spare part with the replacement of the corresponding original one. The justification shall be consistent with:

- the specific installation location of the new spare part, to the relevant assembly of the power electrical machines quoted;
- a conformity assessment of the original spare part for a specific item, according to ГОСТ or TY standards whose technical requirements are aligned with equivalent European standards;
- the requirements referred to in paragraph 3 of this Terms of reference.

General technical design requirements for new (alternative) spare parts.

- the design of the spare parts shall comply with the operating conditions and technical characteristics of the equipment presented in Appendix 3 to the Terms of reference;

- during the design and selection of materials, for the preparation of alternative spare parts, as well as the selection of commercially available spare parts:

- take into account the specific installation location of each of the new spare parts (including: gasket or repair material), to the respective assemblies of the power electrical machines quoted;
- take into account, as a minimum, the known requirements of Kozloduy NPP for the supply of the equipment and the characteristics of the materials referred to in paragraph 3 below;
- assess the conformity of the original spare part for a specific item according to a ГОСТ or TY standard, the technical requirements of which are aligned with equivalent European standards;

- all materials selected for the design of the individual spare parts, gaskets and the materials selected for the repair replacing the original ones shall not originate from the Russian Federation;
- where necessary and in agreement with the Customer, new design solutions may be developed concerning:
 - electrical insulation of the electrical connections between the ends of the stator windings and the conductor bus bars of the terminals;
 - electrical insulation of the exposed sections to the bus bars of the leads - inside the generator;
 - protection of the visible areas of the surfaces of the rubber gaskets to the terminals - inside the generator;
 - electrical insulation of the nipple threaded connections to the flexible hoses connecting the hydraulic branches of the stator coil;
 - the sealing of the stator winding bus bars in the stator pack channels;
 - electrical insulation and strengthening of the stator winding bus bar heads in the output sections of the stator pack channels;
 - development of a new construction of end terminals with a cooling loop, overall and connection dimensions - similar to the original ones in place.
 - the specific requirements (known to Kozloduy NPP) under ГОСТ and ТУ standards claimed for the respective original spare parts shall be aligned to equivalent European standards and included in the design of the new (alternative) parts.

Design phases. The design shall be developed in one phase and includes the development of:

- technical documentation for the design/selection of spare parts and materials similar to the original ones;
- technological documentation for manufacturing;
- justification of their suitability for use under the particular conditions, the necessary tests to prove operability and specific requirements during installation/insertion.

Classification of the premise in which electrical machines are operated. In terms of explosion and fire safety, the premise in which the equipment is operated, for which the spare parts are intended, is Ф5Д category according to Regulation No. Із-1971 of 29.10.2009 on civil and technical rules and regulations to ensure fire safety.

Technical information of the equipment for which spare parts, gaskets and materials will be designed (ТБВ-1000-4У3 turbine generators and БВД- 4600-1500АУ3 exciters). Appendix 3 gives general information and basic technical characteristics of the equipment for which spare parts need to be designed.

2.1. Description of the requirements for the different parts of the design

Considering the specificity of the design, the analogous spare parts shall be developed only in one design part - "Development of technical documentation for the design/selection of spare parts and materials analogous to the original ones, manufacturing documentation, justification for their feasibility for use under the specific conditions, the necessary tests to prove their operability, as well as specific requirements during their installation/assembly".

This part shall contain an explanatory note, a calculation note and graphic materials (drawings) with specification to them, the requirements for which are specified in clause 2.3.

2.2. The design parts related to technology are:

2.2.1 Architectural

n/a

2.2.2 Constructive

n/a

2.2.3 Electrical

n/a

2.2.4 I&C

n/a

2.2.5 Water supply and sewerage

n/a

2.2.6 HVAC (Heating, Ventilation and Air Conditioning)

n/a

2.2.7 Energy efficiency

n/a

2.2.8 Geodetic (tracing plan and vertical layout)

n/a

2.2.9 Mechanical and technological

n/a

2.2.10 Traffic organisation and safety

n/a

2.2.11 Fire Safety

n/a

2.2.12 Health and Safety Plan

n/a

2.2.13 Construction Waste Management Plan

n/a

2.2.14 Radiation protection

n/a

2.2.15 SAR (Safety Analysis Report)

n/a

2.2.16 Software

n/a

2.2.17 Other design parts

The design part: "Development of technical documentation for the design/selection of spare parts and materials analogous to the original ones, manufacturing documentation, justification for their feasibility for use under the specific conditions, the necessary tests to prove their operability, as well as specific requirements during their installation/assembly".

2.2.17.1. Basic requirements.

When designing alternative spare parts for exciters and generators, including the choice of materials and raw materials for their preparation, take into account the following:

- the main functions and requirements of the design (as per clause 2 of paragraph 2 - "Main functions of the design");
- the general technical requirements to the design (according to clause 3 of paragraph 2 - "General technical requirements for the design of the new (alternative) spare parts");
- the technical characteristics and the operating conditions of the equipment for which the parts are intended, according to the general information provided in Appendix 3;
- the technical requirements (known to Kozloduy NPP) for the alternative spare parts specified in Appendix 1 and Appendix 2;
- the requirements of the technical documentation attached to the present Terms of reference;
- the purpose, function and place of installation of each of the spare parts in the machines.

2.2.17.2. Additional requirements.

It is further assumed in the development of the design:

- in the absence of sufficient information required for the design of a particular spare part in order to procure it, carry out a site survey of the relevant assembly of the equipment where this part is embedded and operated;
- enter new alphanumeric names/abbreviations (identification) of the different types of spare parts in Appendices 1 and 2, as required by the Contractor quality assurance (QA) system.

2.3. Requirements for the content of the design sections

For the design part, the Contractor shall submit:

- **Explanatory note (Description of the design solution)** - describe the adopted design solutions and the functions of the individual part of the design (in this case only the one under clause 2.2.17), with the adopted modes of operation, layout solutions.

- **Interrelationships with the existing design** - the conditional design limits are:

- Selection/design, manufacture of alternative spare parts for 9,10GQ turbine generators and 9,10GE excitation generators operated at Kozloduy NPP Units 5 and 6;

- justification for the incorporation and full adaptation of alternative parts to the specific installation locations on the equipment without the need for its rework:

- recommendation for the lifetime of each of the individual spare parts (the time for which they shall provide reliable and safe operation under normal operating conditions), the lifetime shall be not less than the replacement periods specified by the equipment manufacturer, with the respective inter-overhaul periods of the turbine generators and exciters:

- the spare parts to be replaced in the course of average repair shall have a life cycle of not less than 1 calendar year (from the time of installation);

- spare parts to be replaced during overhaul shall have a life cycle of at least 6 calendar years (from the time of installation).

- possibility of cyclical and uninterrupted replacement of alternative parts during equipment outages.

- **Equipment performance requirements** - after the design implementation shall be kept:

- the technical and operational characteristics of 9,10GQ turbine generators and 9,10GE excitation generators operated at Kozloduy NPP Units 5 and 6 in all their operating modes;

- the periodicity of repair works and equipment scopes. In accordance with this periodicity, the replacement cycles of the alternative inputs shall be accurately and clearly described.

- **Calculation note and calculations** - the calculations justifying the design solutions in terms of reliability, strength, seismic resistance, availability, etc. shall be presented. It shall contain a justification of the functionality of the design under all operating modes and transients. It includes a description of the verification performed to establish technical conformity. In cases where the use of specific calculation and verification methods, model tests, validation and verification tests for safety critical software or other special requirements are required, these shall be explicitly noted.

- **Drawings, schemes and graphic materials** - determine the required graphic representations of the adopted design solutions, according to which the installation works can be performed.

Mechanical design drawings of each of the spare parts shall be included.

Specifications - the specific design shall include a specification of the materials from which the alternative parts are to be manufactured, to this specification shall be included also requirements for the characteristics of the materials, such as : technical characteristics, conformity assessment to standards, dimensions, name, testing and test methods, packaging, marking, labelling, operating procedures, conformity assessment procedures etc.

List of norms and standards - as quoted in clause 4.1 or equivalent(s) related to the subject of the service under the Terms of reference.

3. Requirements for the supply of equipment and materials

The requirements to be considered in the design, manufacture and supply of the alternative spare parts are detailed in the descriptions of Appendix 1 and Appendix 2 of the Terms of reference.

3.1. Equipment qualification

The equipment for which spare parts will be designed, manufactured and supplied (TBB-1000-4Y3 turbine generators and rotary rectifiers of ББД-4600-1500AY3 exciters) are elements of the systems not affecting safety.

3.2. Seismic category

The equipment for which the spare parts will be designed, manufactured and supplied (TBB-1000-4Y3 turbine generators and rotary rectifiers of ББД-4600-1500AY3 exciters) has a category of

seismic resistance, which is provided by the current civil standards for industrial facilities in the Republic of Bulgaria, that is the Eurocode system.

3.3. Equipment qualification

3.3.1. The spare parts and materials subject to this Terms of reference are items of major equipment (9,10GQ turbine generators and 9,10GE exciters), the failure of which entails the risk of interruption of electricity generation.

3.3.2. The approximate ambient temperature in the turbine hall at which the equipment for which the spare parts are required, is operated, is as follows:

- during the outage (planned annual maintenance): $18 \pm 2^{\circ}\text{C}$;
- during operation: $50 \pm 5^{\circ}\text{C}$.

3.4. Physical and geometrical characteristics

3.4.1. For Appendix 1 - according to item 2 of the Appendix.

3.4.2. For Appendix 2 - according to item 2 of the Appendix.

3.5. Material characteristics

According to the requirements of item 3 of Appendix 1.

3.6. Chemical, mechanical, metallurgical and/or other properties

According to the requirements of item 4 of Appendix 1.

3.7. Working conditions in an ionizing radiation environment

n/a

3.8. Shelf life and life cycle requirements

3.8.1. For the spare parts in Appendix 1, made of rubber compounds, a shelf life (during storage) of not less than 24 months shall be established, from the date of acceptance of the delivery by the Customer on the territory of Kozloduy NPP.

3.8.2. For all spare parts in Appendix 1 and Appendix 2, a warranty period of not less than 24 months shall be established from the date of acceptance of delivery by the Customer on the territory of Kozloduy NPP.

3.8.3. The life cycles of the individual spare parts (the time for which they shall provide reliable and safe operation under normal operating conditions) shall not be less than the periods specified by the equipment manufacturer for their replacement, with the corresponding inter-overhaul periods of the turbine generators and exciters:

- the spare parts to be replaced in the course of average repair shall have a life cycle of not less than 1 calendar year (from the time of installation);
- spare parts to be replaced during overhaul shall have a life cycle of at least 6 calendar years (from the time of installation).

3.8.4. For the alternative repair materials in item 11 of Table II-1 to Appendix 1 (varnishes, putties, hardeners, pastes, specific rubber banding), a shelf life of not less than 12 months from the date of manufacture shall be established.

3.8.5. When making a delivery on the territory of Kozloduy NPP, the spare parts and repair materials supplied shall not have passed more than 10% of their shelf life from their date of manufacture.

3.9. Additional features

According to the requirements of item 5 of Appendix 1.

3.10. Delivery and packaging requirements

3.10.1. Delivery requirements

The spare parts and materials subject to this Terms of Reference shall be delivered to the intended storage location on the Kozloduy NPP site at the Contractor expense.

3.10.2. Packaging requirements

3.10.2.1. Spare parts and materials shall be preserved and supplied in packaging, meeting the storage requirements of the manufacturer, as specified in a storage instruction, ensuring their preservation until put into use, without the need for re-preservation and not allowing direct access to light.

3.10.2.2. As a minimum, the following information shall be displayed on the packaging of chemical materials:

- name, intended use, method of use, hazard symbols if applicable;
- date of manufacture and expiry date (information shall be consistent with that in the documents or safety data sheets accompanying the products);

3.10.2.3. The packaging of spare parts shall be provided with durable labels or name plates in accordance with Appendices 1 and 2.

3.10.2.4. All rubber and silicone gaskets shall be packaged with durable labels or name plates, bearing, in addition to the information specified in 3.10.2.3, additional information: conditional designation of the material from which the gaskets are made; general dimensional characteristics (diameter, length, width etc.), date of manufacture.

3.10.2.5. The clamping aids with which the rolls of cords or other rubber articles are clamped shall be so constructed as not to cause deformation to the surfaces of the cords or rubbers they clamp.

3.10.2.6. On the transport packaging (crates) of spare parts, on at least two sides, indelible permanent marking shall be available (with paint or tin plates) including as a minimum:

- name of contractor,
- contract No.,
- manufacturer,
- weight - gross/net,
- recipient,
- marking with the attachment points for lifting.

3.10.2.7. The rolls with the flat rubber sheets from item 4 of Table II1-1 is recommended to be located on euro pallets, which will facilitate inspection when performing the receiving inspection.

3.10.2.8. Each transport package must be equipped with a mechanical indicator for tilting and a mechanical indicator for shocks and deformations, which will confirm the safe (without hidden damage from shocks, dangerous slopes) transport of the package to the site of Kozloduy NPP EAD.

3.11. Loading and unloading activities

3.11.1. The necessary loading and unloading activities on the territory of Kozloduy NPP will be carried out by the Customer personnel using a stationary overhead crane in a storage room on the UNITS 5 AND 6 site or a front loader (forklift truck). The strapping of the loads will be carried out with textile belts or metal ropes adapted to their weights.

3.11.2. If necessary, the Contractor shall provide a diagram or sketch for the installation of the slings to the loading clamps of the respective packages (crates, europallets, etc.).

3.12. Transport

There are no specific requirements regarding the transportation of spare parts. The equipment shall be delivered to a storage facility at the Kozloduy NPP site by covered road vehicle transport. The load shall be properly secured and immobilised against dislocation or falling during transport.

3.13. Storage conditions

The Contractor shall specify the storage conditions and requirements for spare parts.

4. Requirements to manufacture

The Contractor shall be the manufacturer/authorised representative of the manufacturer of the spare parts under this specification and shall ensure the applicability of the consumables to the parts it manufactures, respectively their applicability in TBB-1000-4Y3 turbine generators and ББД-4600-AY3 excitation generators.

The Contractor shall have the authority to coordinate all documents related to the execution of the scope of work for the installation and adaptation of new spare parts on site.

4.1. Rules, standards, regulations for manufacture and testing

When designing and selecting materials for the manufacture of alternative spare parts, the following standards and technical conditions or equivalent international ones shall be taken into account:

- Regulation I3-1971/29.10.2009. Regulation on civil and technical rules and norms for ensuring fire safety.
- IEC 60034-1 (2022) - Rotating electrical machines;
- ГОСТ 270-75 - Rubber. Method of determination of elastic properties in tension;
- ГОСТ 20403-75 - Rubber. Method for determining hardness in international units;
- ГОСТ 9.029-74, Method B-Rubbers. Test methods for resistance to ageing under static compression deformation;
- ГОСТ 263-75 - Rubber. Shore A hardness method;
- ГОСТ 9.026 - One system of protection against corrosion and ageing. Rubber. Methods of accelerated tests for resistance to ozone and thermal light-ozone ageing;
- ТУ 38 1051165-90 - Rubber and rubber cloth materials made of rubbers based on siloxane and fluorosiloxane rubbers for products of electronic, radio-technical and other industries;
- ТУ 38 103321-76 - Rubber compounds based on silicone rubbers. Specifications;
- ТУ 38 105116-81 - Rubber plate for sealing gaskets of vacuum systems. Specifications;
- ГОСТ 7338-90 - Rubber and rubber fabric plates. Specifications;
- ГОСТ 12433-83 - Reference isooctanes. Specifications;
- ГОСТ 5789-78 - Reagents. Toluene. Specifications;
- ГОСТ 9.030-74 - Unified corrosion and ageing protection system. Rubber. Test methods for resistance in unstressed state to liquid aggressive media;
- ГОСТ 9.029-74 - Unified corrosion and ageing protection system. Rubber. Test methods for resistance to ageing under static compression deformation;
- ГОСТ 9833-73- Rubber O-rings for hydraulic and pneumatic devices. Structure and dimensions;
- ГОСТ 18829-2017-Rubber O-rings for hydraulic and pneumatic devices. Specifications;
- ТУ 2500-376-00152106-94 - Technical rubber products;
- EN IEC 61111 - Live working - Electrical insulating matting;
- ТУ 16-89I79.0066.002ТУ - Electrotechnical sheet glass textolite. General technical conditions;
- ТУ 2296-188-05758799-2015- Semi-conductive sheet glass-textolite/Specifications;
- ТУ 3491-070-50157126-2007;
- ГОСТ 2590-2006 - Hot-rolled long-rolled steel round products. Sortiment;
- ГОСТ 4543-71 - Alloy structural steel rolled products. Specifications;
- ТУ 38.105-1760-89 - Rubber compounds for rubber products of aircraft engineering;
- ТУ 2312-025-05758799 - ЭПИМАЛЬ-9111 enamel/Technical conditions;
- ТУ 16-503.030-2007;
- other applicable standards.

4.2. Testing of products and materials during manufacture

4.2.1. Upon completion of manufacture, the following tests shall be performed on the spare parts listed below for confirmation of compliance with the specified characteristics, according to the design documentation, the manufacturer process documentation and the applicable standards and/or technical specifications for the specific type of spare parts:

4.2.1.1. For Lot 1.

4.2.1.1.1 All flexible plumbing hoses with electrical conduit from Item 7 of Table II-1 to Appendix 1, shall be subjected as a minimum to hydraulic strength tests, at a water pressure of 1.37MPa (14kgf/cm²) for 1 hour. The condition for a successful test is that no water leaks are detected.

4.2.1.1.2 Terminals under item 9 of Table II-1 to Appendix 1.

4.2.1.1.2.1 On all insulators under item 9, including those to the terminal sets (clauses 9.2 4 9.5), a high-voltage dielectric strength test shall be performed at a voltage of 70kV, with an industrial frequency of 50Hz, for a period of 60s. The test shall be carried out on a pre-prepared test rig by covering the area towards the outer surface of the insulator, at the face to which the flange ring fits, with a flexible aluminium foil (to be connected to one electrode of the test rig) and installing a solid metal cylinder (to be connected to the other electrode of the test rig) along the entire length towards the surface of the inner circumference of the insulator.

4.2.1.1.2.2 On all sets of terminals from clauses 9.2 to 9.5 shall be carried out the following:

- hydraulic water test of the density and strength of the water chambers of their guide rods at a pressure of 2.45MPa (25kgf/cm²) for 1 hour. The condition for a successful test is that no water leaks are detected;

- in a specially prepared device (test rig) to perform a pneumatic test with air of the gas density of the terminal in the assembled state (kit) - check for the absence of gaps between the rod and the insulator, at a pressure of 0.59MPa (6.0kgf/cm²) for 1 hour. The condition for a successful test is that no air leaks are found.

4.2.1.2. For Lot 2.

4.2.1.2.1. On the diodes under items 1 and 2 of Table II2-1 of Appendix 2 electrical measurements need to be made, for each one, of the following values:

- forward voltage drop, V (it shall be <1.6V);
- pulse current in reverse direction, mA (it shall be < 0.2mA).

The Contractor shall provide additional information on the method of carrying out the electrical measurements.

4.2.1.2.2. On the fusible power fuses of item 3 of Table II2-1, to Appendix 2, electrical measurements of the transient electrical resistance need to be made for each one, and in the cool state (~35°C) it shall be in the range: $148 \div 186 \mu\Omega$.

4.2.1.2.3. On the RC filter blocks of item 4 of Table II2-1, to Appendix 2, it is necessary to carry out electrical measurements of the following parameters for each unit separately:

- the equivalent capacitance of the connected capacitors according to the diagram in Fig. P2-2 (until the unit is poured with resin): $C1 \div C8 = 0,44 \pm 0,044 \mu F$;
- the equivalent electrical resistance of the resistors connected in parallel according to the scheme in Fig. II2-2 (until the unit is poured with resin): $R1 \div R10 = 18 \pm 0,9 \Omega$;
- insulation resistance (after the resin has been poured and dried): $R_{is} \geq 100 M\Omega$;
- insulation electrical strength test (after the resin has been poured and dried) at 1500V, 50Hz for 60s: $R_{is} \geq 100 M\Omega$.

Test results shall be recorded in supporting documentation (report(s)) to be provided to the Customer on delivery.

4.2.2. For each type of rubber cord in item 1 of Table II1-1, to Appendix 1, a technical document with information on the typical and specific (measured) values of the physical and mechanical parameters of the respective batches from which they are prepared for delivery:

- conditional breaking strength;
- relative elongation at break;
- Shore A hardness;
- relative residual deflection (as specified).

4.2.3. For the individual types of rubber sheets from which the gaskets in items 2, 3 and 10.1 of Table 1 are made, the gaskets in items 2, 3 and 10.1 of Table 2 shall be prepared. P1-1 to Appendix 1, a technical document with information on the typical and specific (measured) values of the physical and mechanical characteristics of the respective batches from which they are prepared for delivery:

- conditional tensile strength /break for item 10.1/;
- relative elongation at break;
- Shore A hardness;
- relative residual deflection (as specified);
- change of mass of the rubber material specimen in the respective aggressive environment (depending on the type and purpose of the rubber material).

- operating temperature range.

4.2.4. For the individual types of rubber sheets in item 4 of Table II-1, to Appendix 1, a technical document with information on the typical and specific (measured) values of the physical and mechanical characteristics of the respective batches of which they are prepared for delivery:

- conditional tensile strength;
- relative elongation at break;
- Shore A hardness;
- relative residual deflection (as specified);
- mass change of the rubber material specimen in the respective aggressive environment (depending on the type and purpose of the rubber material);
- operating temperature range.

4.2.5. The measurements of the individual mechanical parameters in 4.2.2, 4.2.3 and 4.2.4 comply with the requirements of the relevant Russian or equivalent standards cited for each indicator. The deviations and norms of the indicators shall be as required by the standard used, but the minimum limit values shall not be worse than the corresponding ones quoted in the sections to clause 3.4 (items 2, 3, 4 and 5 of Appendix 1).

4.2.6. The Contractor shall ensure that, during manufacture, the manufacturer manages non-conformances, with segregation and proper marking of products that are unfit for use or subject to rework, in order to bring them into compliance.

4.2.7. The technological sequence of post-production operations, with the intended testing and control activities (including receiving inspection of materials, testing during manufacture and acceptance testing etc.) are to be presented in the relevant Control and Test Plan(s) (CTP(s)), with the times for control by the manufacturer, Contractor and Customer indicated, and the governing and reporting documents for the individual operations specified. At an appropriate time 20 days prior to the start of the specific manufacture, the relevant CTP (s) shall be submitted to the Customer for agreement on the scope and type of control envisaged.

4.3. Control by Kozloduy NPP EAD during manufacture

4.3.1. The Contractor shall ensure that any non-conformities identified during manufacture and the corrective measures taken are documented and notified to the Customer in a timely manner. Corrective measures regarding spare parts and materials that cannot be replaced shall be subject to agreement with the Customer.

4.3.2. The independent control planned in the CTP during the manufacture and acceptance tests shall be carried out by the designated responsible specialists of the Customer, with the necessary technical and logistical assistance provided by the Contractor.

4.4. Safety measures against contamination with radioactive substances and hazardous products

n/a

4.5. Responsibilities during commissioning

n/a

4.6. Surface conditions and coating application

As required by the manufacturer.

4.7. Safety conditions

n/a

5. Requirements for construction works

n/a

5.1. Control of construction and installation works

n/a

5.2. Conditions and activities to be fulfilled by Kozloduy NPP EAD

n/a

5.3. Conditions and activities to be fulfilled by the Contractor

In case of necessity of a visit of the Contractor representatives, the Contractor admission to the Kozloduy NPP site will be carried out in accordance with the requirements of:

- with regard to the procedure for authorisation and admission to work: "Quality procedure.

Work of external organisations under contract" No.ДБК.КД.ИИ.028;

- regarding the procedures for the pass regime at Kozloduy NPP EAD: "Procedure for the pass regime at Kozloduy NPP" No.10.Ф3.00.ИИ.015.

In order to obtain admission to work at Kozloduy NPP EAD, it is necessary for each representative and/or specialist of the Contractor who is to visit the Kozloduy NPP site to submit documents (as per 10.Ф3.00.ИИ.015) to request permission to work in strategic areas of strategic sites or in areas related to the implementation of strategic activities, in accordance with Article 4, paragraph 4 of the Act of the National Security State Agency and Article 40, paragraph 1, item 2, Article 44 and Article 45 of the Regulations for the Implementation of the Act of the National Security State Agency.

5.3.2. Making available for use, when necessary:

- premises and warehouses owned by Kozloduy NPP EAD;
- cranes, hoists and other equipment of increased danger, owned by Kozloduy NPP EAD - it will be provided, if possible, by drawing up an acceptance protocol.

5.3.3. Kozloduy NPP will provide:

- appropriate working conditions (if necessary for the execution of activities on the UNITS 5 AND 6 site);
- providing access to the equipment and providing input data; coordination and verifying documents for the activities performed under the contract;
- safety and occupational health agreement, and maintenance of housekeeping.

5.4. Conditions and activities to be fulfilled by the Contractor

- design, manufacture and delivery to the Kozloduy NPP site of spare parts analogous to the original ones for the specified type of equipment, in accordance with the requirements of this Terms of reference.

- The Contractor shall ensure preparedness, if required:

- to ensure the presence of the manufacturer representative at the Kozloduy NPP site to monitor/control the correct installation of the spare parts to the respective machine assemblies;
- to participate in the development, correction and coordination of the necessary reporting documents concerning the commissioning of alternative spare parts to government and regulatory authorities.

5.5. Assembly and commissioning

If necessary, Kozloduy NPP reserves the right to invite to the UNITS 5 AND 6 site a representative of the manufacturer who designed and manufactured/provided the alternative spare parts, during their initial assembly (insertion) to the respective locations on the machines.

6. Requirements for other activities necessary for the performance of the contract

n/a

7 . Regulatory and technical documents applicable to construction and assembly works and commissioning

n/a

8 . Documents required for delivery, assembly and commissioning

8.1. Documents and their requirements to be provided upon delivery of spare parts.

The documents accompanying the delivery shall be submitted on paper in 1 copy in English (an exception is made regarding the language only for the documents referred to in clause 8.1.1) and 1 copy in Bulgarian, and this documentation is to be provided on electronic media containing: files in the original document format and pdf files - with all supporting documentation signed and stamped - 1 copy included.

8.1.1. The certificates, protocols and declarations of the delivered spare parts and materials shall be submitted in the original language, accompanied by a translation into Bulgarian. The Contractor is responsible for the accuracy, precision and quality of the translation of the documents.

8.2. The documents that shall accompany the delivery are:

- certificate/declaration of origin of the spare parts and materials */indicates where the goods to be delivered to Kozloduy NPP were manufactured - country, manufacturer/;*
- certificate/declaration of conformity of spare parts and repair materials */indicates the conformity of the spare parts with the relevant standard or regulatory document under which they are manufactured/.*
- drawings and technical conditions - where applicable;
- technical documents declaring geometrical characteristics, typical and actual physical and mechanical performance of spare parts made of rubber materials according to Table II-1 (pos. 1.1 ÷ 1.8; rubber material for gaskets according to pos. 2.1 ÷ 2.6, 3.1 ÷ 3.5, 8.2.6; pos. 4.1 ÷ 4.8);
- protocols of factory tests and tests of spare parts on:
 - Table II-1 pos. 7.1 ÷ 7.25; pos. 9.1 ÷ 9.5;
 - Table II-2 pos. 1 ÷ 4;
- document in which they are described: storage conditions and shelf life of repair materials;
- document giving the warranty period of the parts (where applicable);
- instructions for reconditioning (where applicable).

9. Input data

9.1. The Contractor shall prepare and provide a list of his required input data for execution of the activities under this Terms of reference after conclusion of a contract in accordance with the "Quality Procedure. Transmission of input data to external organisations", ДОД.ОК.ИК.1194.

9.2. The necessary requirements and input information required for the design development of the new spare parts will be provided by the Customer NPP Kozloduy through:

- the information available under this Terms of reference;
- access provided to the Contractor (after the contract is signed) to the equipment and original spare parts available to gather the necessary information. The period during which access may be granted, the state of the machinery (repair or operation) and the conditions required will be further specified by formal correspondence;

9.3. The Customer, after checking and evaluating the list, will provide the requested, available input data to the Contractor.

9.4. The input data required for the performance of the activities under this Terms of reference shall be submitted to the Contractor in the form and format in which they are available at Kozloduy NPP.

9.5. The input data shall be transmitted to the Contractor after the conclusion of the contract.

9.6. Necessary input data that are not documentary available, shall be collected by the Contractor, with the assistance of the Customer, by means of walk downs and photographs of the existing situation on site, in compliance with the requirements for access to the Kozloduy NPP site, in accordance with

9.7. In the absence of input data, the Contractor shall develop it at its own expense, with the assistance of the Customer.

10. Receiving inspection

All spare parts and repair materials delivered to the Kozloduy NPP site will be subjected to receiving inspection, which will be performed on the Kozloduy NPP site in accordance with the approved procedure of the "Procedure on Quality Control of Delivered Materials, Raw Materials and Components at Kozloduy NPP", ДОД.КД.ИК.112.

10.1. At the decision of the Acceptance committee, any of the spare parts may be subjected to a specialized receiving inspection, the scope of which is given in clause 10.2. The specialised receiving inspection will also be carried out in accordance with the above-mentioned Procedure ДОД.КД.ИК.112.

10.2. Specialized receiving inspection

If it is decided to perform a specialized receiving inspection, it will be performed on the following spare parts from Tables П1-1 and П2-1 of Appendices 1 and 2:

Table П1-1: pos. 1.1÷1.7; pos. 4.1÷4.8; pos. 9.1÷9.5.

- Table П1-1: pos. 1÷4.

10.2.1. Specialised receiving inspection of the rubber spare parts supplied by pos. 4 1.7, pos. 4.1÷4.8 and pos. 9.1÷9.5 of Table П1-1 will be carried out by taking samples from the received lots and sending them for testing in a specialized independent laboratory, off-site of Kozloduy NPP. The selected samples will be subjected to inspection for compliance of their physical and mechanical characteristics with:

- those quoted in the accompanying documentation for the material concerned;
- the minimum required values of the indicators to be covered, as set out in point 2 of Appendix 1 to this Terms of reference. The test methodology for testing each of the physical and mechanical indicators will be according to the standards quoted. The physical and mechanical parameters to be controlled are:

- conditional tensile/rupture strength;
- relative elongation at break;
- Shore A hardness;
- relative residual deformation /under appropriate conditions/;
- change of the mass of a specimen of oil-resistant rubber material /in the respective environment under the specified conditions/.

In case of non-compliance of the specimens with any of the checked indicators, the delivered goods will be returned to the Contractor (Supplier) in accordance with Procedure ДОД.КД.ИК.112.

10.2.2. The specialised receiving inspection of the spare parts supplied by pos. 1÷4 of Table П2-1 will be carried out by Kozloduy NPP specialists at the UNITS 5 AND 6 site and will include the following electrical measurements:

- measuring the current in the opposite direction of each of the supplied diodes (pos. 1 and 2) according to the methodology of the Customer. Norm: according to clause 4.2.1.2.1;

- measuring the transient resistance of each of the supplied power fuses. Norm: according to clause 4.2.1.2.2;

- capacitance measurement (at 100V, 50Hz) of each of the supplied RC filter blocks. Norm: according to clause 4.2.1.2.3.

11. Output documents resulting from the contract

11.1. At the "Design" stage.

11.1.1. As a result of the execution of the task, the Contractor shall submit to the Customer a design, in the scope and content as required by paragraph 2.

11.1.2. The design shall contain all the data necessary for its implementation, as required in the Terms of reference.

The documents referred to in clause 11.1 shall enter into force after verification and agreement by the Customer.

11.1.3. The project, must contain comparative information on compliance between the newly designed spare parts, together with their nomenclature, and the provided spare parts or drawings, the subject of this assignment.

11.2. At the stage of delivery of spare parts - documentation in accordance with paragraph 8 of the

Terms of reference.

11.3. At the spare parts delivery stage, for all mechanical elements and details, assembly drawings/diagrams containing basic overall and connection dimensions should be provided. The information should be provided on paper and in electronic format - in the format in which PDFs are also prepared

12. Criteria for acceptance of work

12.1. The design activities shall be deemed to be completed after review and acceptance by Kozloduy NPP EAD of the Design without any notes. This stage of the Terms of Reference shall be adopted by a Specialised Technical Committee (STC), for which a Minutes of meeting shall be drawn up. Proceed to the next stage after the approval of the Protocol of Acceptance of the Design without notes. Acceptance of the STC design does not relieve the designer of responsibility, but serves only to determine the appropriateness and acceptability of the design solutions presented.

12.2. The delivery activities shall be considered completed after successful receiving control, in accordance with the established procedure at Kozloduy NPP, in accordance with the "Instruction on Quality Control of the Delivered Raw Materials, Materials and Components at Kozloduy NPP", 10.UD.00.IK.112 and a signed protocol for receiving control without remarks.

13. Quality assurance requirements

13.1. Contractor Management System (CMS)

13.1.1 The Contractor shall implement a certified quality management system according to BSS EN ISO 9001:2015 "Quality management system. Requirements", with a scope covering the activities under this ToR, for which it shall submit a copy of a valid certificate or provide other evidence of equivalent satisfaction of the requirements set out in the ToR.

13.1.2 The Contractor shall notify Kozloduy NPP EAD of any structural changes or changes in the Contractor documentation related to the activities performed under the contract.

13.2. Quality Assurance Programme (QAP)

13.2.1. The Contractor shall prepare a Quality Assurance Programme (QAP).

13.2.2. The QAP shall describe the management system applied in the implementation of the activities. The programme serves to define a detailed schedule, the responsibilities for each of the tasks under the contract and the order of their execution. The QAP may refer to internal documents of the Contractor, copies of which shall be provided to Kozloduy NPP upon request.

13.2.3. The QAP shall be prepared by the Contractor according to the template provided by Kozloduy NPP and shall be submitted by the Contractor to the Safety and Quality Directorate within 20 calendar days after the signing of the contract. The programme is a prerequisite for the start of the activities under the contract, is subject to review and agreement by Kozloduy NPP EAD and shall be prepared on the basis of:

- the terms of reference and the contract;
- the Contractor management system;
- sample content provided by the Customer;
- other standards and regulations relevant to quality assurance depending on the type of work.

13.3. Quality Control Plan (QCP)/ Control and Test Plan (CTP)

13.3.1. The Contractor shall prepare (independently or as an Appendix to the QAP):

- Quality control plan (QCP) covering the design phase of the spare parts;
- Control and Test Plan (CTP) covering the manufacturing stage of the spare parts. The CTP shall include the technological sequence of the operations to be performed, including the relevant design and regulatory documentation for their execution, receiving inspection of materials, measurements, tests, with control points noted by the Contractor and proposals for control by the Customer, as well as relevant reporting documents generated during the execution of the specific operations.

The Contractor shall specify in the CTP the relevant standards and documents regulating the operations (including internal plant documentation) by which each of the measurements/tests shall be

conducted during and after manufacture and the reporting document certifying it (as a minimum, a report or a record). Test methods shall be agreed in advance with the Customer.

For the results of all tests, the appropriate documents, reports and records shall be issued certifying the suitability of the equipment for installation, normal and safe operation.

All testing shall be carried out by the Contractor/Manufacturer, with the participation of the Customer representatives for the relevant points reflected in the CTP.

13.3.2 The QCP and the CTP shall include all activities that are key to the quality of the design and shall specify the Contractor and Customer control points for each of the activities included in the plan.

13.3.3 Upon reaching a control point, the Contractor shall withhold performance of the work pending completion and documentation of its and the NPP planned control activities. Work on the contract continues after a positive control result.

13.3.4 The QCP and the CTP (when it is not annexed to the QAP) shall be submitted for review and agreement by Kozloduy NPP 20 calendar days prior to the readiness for operation of the relevant site.

13.3.5 The QCP and the CTP shall be prepared according to a template provided by Kozloduy NPP.

13.3.6 The QCP and the CTP shall be submitted as an accountable document upon acceptance of service by the Customer.

13.4. Audit by Kozloduy NPP EAD (second party audit)

13.4.1 Kozloduy NPP EAD shall have the right to audit the Contractor before commencement of work under the Contract and during the performance of the Contract.

13.4.2 Kozloduy NPP EAD performs audits in accordance with the procedure established by Procedure on Quality. Organization and conduct of audit of external organizations/second party audit, 10.ОиП.00.ИК.049.

13.5. Non-conformity management

13.5.1. The Contractor shall manage non-conformities in accordance with the requirements of the quality management system it uses, as specifically described in the QAP.

13.5.2. The Contractor is obliged to notify the Customer of any non-conformities that have arisen in the course of performance of the activities within the scope of the Terms of reference and of the subsequent corrective measures taken.

13.5.3. If a non-conformity is found during the manufacture, the Contractor shall prepare a report on the non-conformity found, which shall be reported to the Customer for a decision to be taken on implementing corrective measures on the findings.

13.5.4. The Contractor shall ensure that during the manufacture of spare parts, it manages non-conformities by segregating and properly marking products that are not fit for use or are subject to rework to bring them in line with the requirements of the Terms of reference/specification.

13.5.5. In the event that the requirements of the Terms of reference and the Contract cannot be met, the Contractor shall report to the Customer for a decision on the disposition of the non-conforming deliverable/product and agreement on corrective measures.

13. 6. Professional competence (qualifications) of the Contractor personnel

13.6.1. The manufacturer personnel (or its authorized representative) who will perform the scope of work under this Terms of reference shall have the professional competence and knowledge to:

- design and manufacture turbine generators with >200MW power;
- uprate the generated power of old turbine generators; reverse engineering of turbine generators;
- research, modernization, increasing the generated power of old turbine generators and own developments in the field of turbine generator production (R&D /Research and development/ engineering team);
- performance of testing and inspection activities of turbine generators;
- manufacture and supply of spare parts for turbine generators.

13.6.2. When necessary to carry out activities on the Kozloduy NPP site, the Contractor personnel shall know and apply the requirements for safety culture and receive instructions on the safety consequences of their actions.

13.7. Specific quality assurance requirements

13.7.1. The software and calculation or analysis models used to perform the activities under this Terms of reference shall be verified and validated and documented. The design shall describe the applicability of these software products and models, the limitations of their use and demonstrate their applicability to the specific task.

13.7.2. The completed design shall be independently verified by a designer who was not involved in its preparation. The scope and methods of verification shall be determined by the safety significance of the design and the complexity and uniqueness of the design solutions. The following methods are used for design verification: design analysis, alternative calculations, comparative analyses, qualification tests for technical compliance, independent third-party verification of the design.

13.7.3. The designation of documents prepared by the Contractor in pursuance of the Terms of reference shall contain the Terms of reference index or contract number. Each individual document shall have a unique index assigned by the developer/designer and a revision number.

13.7.4. Corrections to the design documentation shall be introduced by a decision of the STC by issuing a new version or introducing amendments (comments from written opinions) with the current version being maintained. Control over the submission of amendments shall be exercised by the members of the STC designated in an order. The control of amendments shall be documented.

13.7.5. The design shall be submitted on paper in seven copies in Bulgarian and one copy in English, provided it is not in Bulgarian.

13.7.6. The design shall also be submitted on an electronic medium (CD containing: files in the original document format and pdf files of the documents), formatted with the necessary signatures and seals, created using scanning technology.

13.7.7. The design shall contain a list of all design bases used by the designer, clearly identified by the document name, the document paragraph that sets forth the specific requirements, and the requirements set forth in the Terms of reference. Data from documents provided by Kozloduy NPP containing input data are also included in this list.

13.7.8. The design shall include a list of all documents that have been prepared as a result of the design with name, index, date of approval and last revision at the time of submission - at the appropriate stage or final.

13.7.9. The prepared design is accepted by Kozloduy NPP EAD at a specialized Expert Technical Committee (ETC). Acceptance of the design by the ETC does not relieve the designer of responsibility, but serves only to determine the appropriateness and acceptability of the design solutions presented.

13.7.10. The Contractor shall provide author supervision during the design implementation.

13.8. Training of Kozloduy NPP EAD personnel.

n/a

13.9. Required licenses, permits, certificates etc. of the Contractor.

n/a

14. Warranty conditions

14.1. For all spare parts under Appendix 1 and Appendix 2, a warranty period of not less than 24 months from the date of acceptance of delivery by the Customer on the territory of Kozloduy NPP shall be established.

14.2. In the event of any defects in the spare parts, rubber gaskets or repair materials supplied (whether or not incorporated) within the warranty period, the Contractor shall supply a new spare part or material at its own expense within a technically reasonable time, but not more than 1 month from the date of notification of the non-conformity. The newly supplied spare part/material for repair is established the same warranty as for a new delivery.

14.3. In case of subsequent requests from Kozloduy NPP, the Contractor shall declare the possibility of remanufacture and supply of the alternative spare parts already designed under this Terms of Reference for a future period of 10 years.

15. Control by Kozloduy NPP EAD

Kozloduy NPP EAD has the right to carry out inspections and checks of the Contractor. For this

purpose, the Contractor shall provide access to personnel, premises, equipment, tools and documents used by him or his subcontractors.

16. Organisational requirements

If necessary and if invited by the Customer, the Contractor shall provide a representative of the manufacturer who designed and manufactured/provided the alternative spare parts at the UNITS 5 AND 6 site at Kozloduy NPP, to participate during their adaptation/installation (during the outage) to the respective assemblies of the machines for which they are intended (in this case 9,10GQ turbine generators and 9,10GE exciters).

17. Additional requirements

17.1. The Contractor shall have performed activities with a subject identical or similar to the subject of the contract under this Terms of reference for the last 5 (five) years. It shall provide references from other power plants for such activities implemented and realized in full scope.

The term "service/activity similar to the subject matter of the contract under this ToR" shall be understood as a complex service including: reverse engineering, manufacture and supply of spare parts for synchronous generators operated in power plants with an installed capacity of not less than 200 MW per synchronous generator.

17.2. The spare parts and materials subject to the order shall not originate from the Russian Federation.

18. Requirements to the Contractor when using subcontractors/third parties

18.1. All requirements of this Terms of reference shall be specified to the appropriate extent for any subcontractors under the contract. The main contractor shall, as a minimum, define requirements for a subcontractor/manufacturer management system, applicable codes and standards, non-conformity management procedures, scope of documentation to accompany delivery, testing and acceptance checks of equipment, packaging, transportation and storage requirements.

18.2. In case of use of subcontractors/third parties, the main Contractor under the contract:

bears responsibility for the fulfilment of the requirements of the ToR by subcontractors/third parties for the activities performed by them, as well as for the quality of their work;

- defines the lines of communication and interaction with its subcontractors/third parties and the means of control over the activities assigned to them and the persons responsible for exercising such control;

- determines appropriately and to the extent necessary, the applicable requirements of the ToR for subcontractors/third parties to the contract, depending on the activities they perform;

- define as a minimum its requirements for subcontractors/third parties: need for QAP, applicable norms and standards, procedure for managing non-conformities, scope of documentation, tests and inspections etc.;

- agrees the QAP of the subcontractors/third parties and submit the agreed QAP to Kozloduy NPP for information;

- includes all of the requirements identified above in the subcontract/third party contract documentation.

APPENDICES:

- Appendix 1 - Lot 1 - Main spare parts and materials for TBB-1000-4Y3 turbine generators:
- Appendix 2 - Lot 2 - Main spare parts for ББД 4600 1500 AY3 rotary rectifier:
- Appendix 3 - Technical characteristics of the equipment for which the spare parts will be supplied.