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TECHNICAL SPECIFICATION

Switchgear for OSC

KRŠKO NUCLEAR POWER PLANT

SP-E3043

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AUGMENTED QUALITY

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1.0 PURPOSE and SCOPE

1.1 Purpose

This technical specification defines requirements for design, manufacture, testing, packing, and shipping of Switchgear (EE104SWGL122) for Operating Support Center building (OSC).

SWG shall be qualified as seismic category I equipment.

The Supplier shall be responsible for compliance with all requirements from this specification. The Supplier shall also define and perform all additional analyses, tests, inspections, and other activities which may be necessary to ensure that design, material and workmanship are appropriate for the service intended, or as may be required by common practice.

1.2 Scope of Supply

The scope of supply shall include, but not be limited to the following:

[1] One complete, fully assembled, 400V SWG (Equipment Tag No.: EE104SWGL122). The 400 VAC switchgear shall be supplied with all outgoings, as well as auxiliary equipment, fully in compliance with 400 VAC System One-Line Diagram (Attachment 1) and Electrical Elementary Diagram (Attachment 2).

[2] The Supplier shall include all materials, internal wiring, and components needed for complete installation, operation and functionality of equipment within the scope of this specification, and required service conditions.
Bolts, nuts, links, cable lugs, and other installation hardware shall be supplied in sufficient quantities, in order to assemble equipment on site.

[3] Set of mutually agreed spare parts for SWG

[4] Adapter bracket for CBK lifting

[5] Packing and shipment to NEK site

[6] Any special tools needed for operating, handling or maintenance purposes

[7] Seismic qualification

[8] All documentation required by this Technical specification

[9] Prototype SWG[1], as applicable

[10] Training

Supplier is fully responsible for proper sizing, design, performance, materials selection, quality assurance, testing, packing, shipping and full technical support during design finalization, production, installation, and commissioning.

Any deviation from the Specification or repair of equipment, even when accepted in writing by the NEK, shall not relieve the Vendor from its responsibility for proper equipment design, manufacturing, or performance.

The final equipment selection shall be approved by NEK prior to supplier procurement.

[1] In case that seismic qualification will be performed on the prototype

2.0 DEFINITIONS AND ABBREVIATIONS

E&DC	Engineering and Design Change
ESD	Engineering Service Division
FAT	Factory acceptance test
NEK	Nuklearna elektrarna Krško (Nuclear Power Plant Krško)
OBE	Operating Basis Earthquake
OEM	Original Equipment Manufacturer
OSC	Operating Safety Centre
SSE	Safety Shutdown Earthquake
SWG	Switchgear
VRLA	Vented Relief Lead Acid (Battery)

3.0 CODES STANDARDS AND REGULATORY REQUIREMENTS

The equipment and components to be supplied shall be designed, manufactured, and tested according to standards listed below.

In case of any conflict between codes, or this Technical Specification and any code, the more stringent requirements shall apply unless otherwise mutually agreed.

3.1 Institute of Electrical and Electronics Engineers (IEEE)

[1] IEEE 1050-2004 Instrumentation and Control Equipment Grounding in Generating Stations
[2] IEEE C37.98-2013 IEEE Standard for Seismic Qualification Testing of Protective Relays and Auxiliaries for Nuclear Facilities
[3] IEEE 344-2004 Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations

3.2 International Electro technical Commission (IEC)

[1] IEC 60529 - 1989 Degrees of protection provided by enclosures (IP Code)

3.3 National Electrical Manufacturers Association (NEMA)

[1] ICS-6-1993 (or UL 508) Industrial Control and Systems: Enclosures
[2] ICS-250-2014 (or UL 845) Enclosures for Electrical Equipment (1,000 V Maximum)
[3] ICS 1-2000 (or UL 508) Industrial Control and Systems. General Requirements
[4] ICS 2-2000 (or UL 508) Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts

3.4 American National Standards Institute (ANSI)

[1] ANSI IEEE C37.13-2008 IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures
[2] ANSI IEEE C37.16-2009 IEEE Standard for Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers
[3] ANSI IEEE C37.17-2012 IEEE Standard for Trip Systems for Low-Voltage (1000 V and below) AC and General Purpose (1500 V and below) DC Power Circuit Breakers
[4] ANSI IEEE C37.20.1 -2015 IEEE Approved Draft Standard for Metal-Enclosed Low Voltage (1000VAC and Below, 3200 VDC and Below) Power Circuit Breaker Switchgear

[5] ANSI IEEE C37.20.7-2007 IEEE Guide for Testing Metal-Enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults
[6] ANSI C37.50-2012 Low-Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures
[7] ANSI NEMA C37.51-2015 For switchgear - Metal-enclosed low-voltage ac power circuit breaker switchgear assemblies - Conformance test procedures
[8] ANSI IEEE C37.81-1989 IEEE Guide for Seismic Qualification of Class 1E Metal-Enclosed Power Switchgear Assemblies
[9] ANSI IEEE C37.90-2005 Relays and Relay Systems Associated with Electric Power Apparatus.
[10] ANSI IEEE C62.41-1991 IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
[11] ANSI IEEE C62.45-1992 IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits
[12] ANSI IEEE C57.13-2009 Instrument Transformers

3.5 Underwriters Laboratories (UL)

[1] UL 1332-2005 Standard for Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment
[2] UL 1558-2016 Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear3.6

4.0 SUPPLEMENTAL DATA

Items listed below are hereby made a part of this Specification. Where a conflict exists between supplemental data and this Specification, this Specification shall take precedence.

Supplemental data items:

[1] QS-610, Rev. 1, Generic Quality Assurance Program Requirements
[2] SP-S702, Rev. 10, Seismic Analysis, Testing and Documentation

NOTE: The specification SP-S702 is provided without Appendices with floor response spectra figures. Applicable floor response spectra figures are provided in the Attachment 3 of this specification.

5.0

5.0 DOCUMENT SUBMITTAL

The Contractor shall submit complete documentation for equipment, as specified in 25.0.

Drawings shall be submitted in NEK approved formats, as applicable, i.e. B-208, E-207, D-206, B-810, 816, SS-224…

All documents (including drawings, graphs, specifications, etc…) submitted shall be in the form of hard copies and electronic media. Acceptable document format sizes shall be A2 or smaller, A3 and A4 should be used whenever possible.

Preferred format for electronic correspondence is Adobe Acrobat Reader (pdf). Other acceptable formats shall be:

Word Processing: Microsoft WORD (doc, docx);
Spreadsheet: Microsoft EXCEL (xls, xlsx); and
Computer Aided Drafting: AutoCAD (dwg).

All documents in electronic media shall be provided in original format, as well as directly converted to pdf format (not scanned, if possible).

5.1 Information Required with the Proposal

The Supplier shall submit complete data for the equipment offered along with his proposal, including:

[1] List of deviations/exceptions to this specification.

The Supplier shall certify and sign that the Proposal is fully in compliance with this specification, except when specially outlined in the list of deviations or exceptions. All exceptions shall be included in the above-mentioned list, as well as their justification, with the reference to the corresponding section of the specification. Exceptions not included in the "List of Exceptions" shall not have contractual validity.
All requirements listed in this specification which are not according to Supplier's standard practice, shall be clearly stated. Solutions shall be suggested.

[2] Supplier's Quality Assurance (QA) and Quality Control (QC) Programme.
[3] Preliminary dimension drawings, showing front views, layout of buckets.
[4] Duly completed SWG datasheets
[5] Bill of Material (BOM)
[6] Detailed production and delivery schedule.
[7] List of documents to be submitted
[8] List of accessories, spare parts (suggested) and special tools.

5.2 Documentation Required after Contract Award

	Fulfill (F) Approval (A[1]) Certified (C) Record (R)	**Maximum delivery period after contract award**
List of documents	F/A	2 weeks
Equipment/parts catalogues	R	2 weeks
Detailed Quality Plan with approved R (record), W (witness) and H (hold) points	F/A	3 weeks
Certified datasheets	A/C	2 weeks
Certified drawings of the general arrangement and dimensions, including: a) Outline drawing, showing weight, cable openings details, minimum clearances at the front, top, rear and sides b) General arrangement, showing location and position of all components. c) Outline details of buckets and breakers d) Details of anchoring, showing static and dynamic support reaction forces e) Connection and mounting details f) Shipping dimensions and weights g) Structural drawing (weights, centre of gravity, dimensions of the frame, etc)	A/C	8 weeks
Nameplates and rating plates of main equipment.	A	12 weeks
Complete, itemized Bill of Material. BOM shall be detailed to the smallest parts level, indicating the OEM descriptions and part numbers. The design/qualified life and maintenance	A	10 weeks

[1] Fabrication prior to approval of drawings marked "A" shall be at the Supplier's own risk.

	Fulfill (F) Approval (A[1]) Certified (C) Record (R)	Maximum delivery period after contract award
replacement interval shall be specified for each item. BOM shall be submitted in the form of a spreadsheet		
One-line diagrams.	A	8 weeks
Internal schematic wiring diagrams and interconnection diagrams.	A	8 weeks
Breaker settings, time curves' characteristics and coordination tables.	A	8 weeks
Test procedures and protocols.	F/A	10 weeks
Final test protocols and reports (after FAT).	A	One week after FAT is finished
Instructions manuals (storage, installation, test & commissioning, maintenance and operation), including: a) Instructions for handling and storage prior to being put into service b) Installation instructions and spreadsheets with torque requirements for all electrical and mechanical bolted connections c) Activities which will allow use of parts during the complete design/qualified life of parts. d) Detailed maintenance program, including troubleshooting e) In Storage Maintenance (ISM) Instructions f) Spare parts list	R	16 weeks
List of spare parts, which must be periodically replaced in order to meet qualified life criteria, in accordance with section 11 herein. The design/qualified life and maintenance replacement interval of each item shall be specified.	R	One week after FAT is finished
All equipment data required for plant Master Equipment Component List	R	One week after FAT is finished
Certificate of Conformance (CoC) certifying that all the requirements of this Technical Specification and purchase order have been met and that the qualification is in accordance with specified standards.	R	One week after FAT is finished
Seismic qualification documentation package in accordance with reference standards. It shall comprise the qualification plan, description of items to be tested, detail test procedures and acceptance criteria.	A	4 weeks prior to qualification tests
Qualification reports, including results of the seismic qualification tests.	A	3 weeks prior to shipment 2 weeks (if no new qualification test is necessary)

6.0 DESIGN REQUIREMENTS AND DESIGN INPUTS

SWG shall be front accessible, low voltage drawout type with up to 42-inch deep sections.

The low voltage switchgear shall consist of a stationary structure containing two feed lines (main and emergency diesel generator), one load line to power the MCC EE103MCC914, and instrumentation (see Attachment 1).

Access to circuit breakers, busbars, cable connections, and all necessary components shall be from the front of SWG.

The low voltage section shall be rated for operation at 400/230 volts, 50 Hz, 3-phase, 4-wire, solidly grounded neutral.

The control power for breaker closing, tripping, and indication shall be provided from the DC/DC converter (see 6.6[1]).

All power and control wiring shall be connected to terminals with cable lugs.

All instrumentation shown in one line diagram and electrical elementary diagrams shall be supplied with the switchgear.

All equipment shall be suitable for indoor installation. Temperature controlled space heaters shall be provided in each compartment.

Adequate cabinet ventilation shall be provided, to ensure proper operation of all equipment within the ambient condition, by natural circulation.

The secondary unit substation shall be designed and manufactured in accordance with the standards listed in 3.0.

6.1 Structural requirements

The SWG structure shall consist of rigid, welded, and bolted mild steel frames, completely metal enclosed with smooth and level sheets, free from flaws and provided with suitable braces to withstand all stresses incidental to shipping, installation, and operation without permanent deformation or other damage. Cubicles of welded steel frames shall be bolted together to form a continuous line-up.

The unit substation, including the enclosure and the base frame, shall be designed to meet the seismic design requirements, as defined in 11.2.

The unit substation base frame shall be designed for anchoring to the floor. Static and dynamic support reaction forces shall be calculated and shown on the appropriate drawing.

Anchor bolts shall be defined and provided with SWG. Appropriate access provisions shall be provided for field installation. Leveling and anchoring instructions shall be provided in appropriate form.

SWG structure shall be segregated by metal sheets into the following compartments (as applicable):

a) Circuit breaker(s)
b) Main bus
c) Cable compartment
d) Control & instrumentation compartment

Hinged doors shall have handles with cylinder lock to limit access to circuit breaker assemblies. Closing and latching the doors shall be possible in all breakers' operation position, including test position.

Instruments, selector switches, push buttons, indicating lamps, and equipment other than auxiliary devices shall be mounted on a hinged panel on the front of the switchgear, independent of the access door to the breaker mechanism.

Concealed hinge construction (no hinges visible from the outside when the door is closed) shall be used for unit and wireway doors. All doors shall be constructed and fabricated in such a manner that the weight of the equipment mounted on doors will not cause sagging when they are open.

The enclosures protection shall comply with NEMA 3 (IP 54[1]).

6.2 Switchgear Bus-bars

Completely insulated, high-conducting, flat copper bars with round edges shall be used for bus-bars. Electrical connections shall be silver-plated, and bolted tightly by according to proven methods to ensure maximum conductivity.

Bus and bus connections shall be completely insulated with anti-hygroscopic, track-resisting material with flame retardant properties. In addition, the insulation should not generate noxious and poisonous fumes when heated above the design temperature. Suitable materials, with similar characteristics, shall also be used to insulate bus joints between groups of units of the switchgear assembled in the field.

A neutral bus, electrically insulated from the frame, shall be provided throughout the whole length of the switchgear. Termination points for neutral cables shall be provided.

A grounding bus shall be provided throughout the whole length of the switchgear.

6.3 Circuit Breakers

Circuit breakers shall be three-pole, stored energy operated, fully withdrawable with commonly recognized safety interlocks and with adequate thermal, mechanical, and electrical capability for the required service.

Breakers shall have primary and secondary disconnecting devices, auxiliary switches, electrically & manually operated mechanism and compression-type cable terminals. All control wires shall be terminated by ring tongue lugs on both ends.

Each circuit breaker shall have inter-phase barriers, arc quenchers, mechanical or electrical trips, closing mechanism, position indicator, and operation counter.

Circuit breakers shall have mechanically interlock to prevent insertion or withdrawal when in closed position. Any charged mechanism must be automatically discharged before the breaker can be removed.

Provisions shall be available to solidly ground the circuit breaker frame automatically while in service. The ground connection shall be made before the primary disconnecting contacts engage during insertion and shall be broken after these contacts break during withdrawal.

The following conditions must be fulfilled when breaker is in Service, Test or Withdrawn (isolated) position:

a) Service – the main and auxiliary disconnecting contacts shall be in the "plugged-in" state.
b) Test – the main disconnecting contacts shall be open and the auxiliary contacts shall remain closed to permit normal breaker operations for the control circuit test.
c) Withdrawn - both the main and auxiliary disconnecting contacts shall be open.

[1] According to IEC 60529 Degrees of protection provided by enclosures (IP Code)

Circuit breakers of the same current rating shall be electrically and mechanically interchangeable within the housing, however it shall be effectively prevented to insert breaker of different current rating to such unit.

Breakers shall have digital protection units (see 6.4).

Protection units, as well as, control and auxiliary switch wiring and any other removable breaker component of the same size and rating shall be electrically and mechanically interchangeable.

Provisions shall be included for padlocking breakers in the "test" and "disconnect" positions, with the door open or closed, to permit safe work on the circuit equipment. The padlocking shall prevent the breaker from being inserted into the operating position.

Interlocks shall not prevent opening of the door when the circuit breaker is closed.

The construction of the draw-out mechanism shall be such that proper alignment of primary and secondary disconnecting devices is assured throughout all positions and movement. The mechanism shall operate smoothly in and out of each position.

The contact surfaces of all disconnecting contacts shall be silver plated. In addition, the primary disconnecting contacts shall be self-aligning with ample current-carrying capacity.

The circuit breakers shall be able to operate at 120 VDC, provided from DC/DC converter (see 6.6[1]), with operating limits from 90 VDC to 140 VDC, except for tripping and alarm functions which shall operate satisfactorily from 70 VDC to 140 VDC.

The close and trip circuits shall have two-pole protective devices.

Circuit breaker control circuits shall be designed to provide anti-pump and anti-flip features (rated for continuous operation).

Breaker operating status shall be available on the breaker front plate and by the LED indicating lights; red, green and white lights shall be provided (see section 1.1[6]). These lights shall be operable when breaker is either in service or test position.

Breakers shall be mechanically operated and locally electrically operated (close, open); however, the main feed line breaker will be controlled also by emergency diesel generator and operated remotely.

Remote trip and close interlocks shall be effective when the breaker is in service or in test position.

External signals and spare contacts shall be wired and connected to terminal blocks. Terminal blocks shall be labeled according to Electrical Elementary Diagrams (Attachment 2 hereto).

6.4 Protection units

All breakers shall have protection units rated according to switchgear datasheets. They shall be properly configured for loads and power supplies per Attachment 1.

Protection unit shall prevent closing of the circuit breaker, provide local trip signal (white light) and contacts for remote signaling in case of under voltage and over current conditions. The over-current trip unit reset shall be available locally from the front of each protection unit circuit breaker.

Power supplies for protection units shall be provided within the breaker itself.

Protection units shall provide measuring of basic electrical parameters.

The Supplier shall calculate appropriate setting for all breakers protection units based on one line diagram (Attachment 1). Protection units shall be finally set up prior to shipment.

Main feed line breaker (CBK02) shall be suitably set up for reverse feeding during emergency diesel generator testing.

6.5 Connections and Cable Terminations

Provisions shall be made for power cable entries through the top of the 400 VAC switchgear. Provisions shall have bolted blank cover plates, to be drilled on-site during installation, for power and control cable entrance.

All power and control cable connections will be through rigid metal continuous conduits.

Power cable terminal connections (terminal lugs) shall be of tinned solderless Burndy Type YA, long barrel, double indent, or equivalent type of terminal.

Control wiring terminal connections (terminal lugs) shall be of ring-tongue type wire terminal lugs with insulated ferrules or equivalent.

The crimping tool used shall be of the "ratchet type" to prevent partial compression (the crimping tool shall be approved by the terminal lug manufacturer).

Bus connections shall be tightly bolted by approved methods using Bellevile washers and a minimum of two bolts to ensure continuous maximum conductivity.

Provisions and cable lugs shall be provided for connection of the following external cables:

a) Cable size 2 x 4-1-500 MCM (from AC main power source)
b) Cable size 2 x 4-1-500 MCM (from Emergency diesel generator)
c) Cable size 3 x 4-1-500 MCM (to MCC)

It shall be possible to connect the external cables without excessive bending.

Special cable termination compartments shall be provided where necessary. Details of these compartments shall be submitted with the Proposal.

The physical wire location on the terminal blocks shall be harmonized with elementary diagrams (Attachment 2).

6.6 Instrumentation, control and secondary circuits

[1] DC/DC converter

DC/DC converter shall be provided for SWG control voltage. The power supply for the converter will be VRLA battery, consisted of 30-36 battery blocks of 12 VDC each. The final battery output voltage will determined upon the UPS selection. The converter output voltage shall be 120 V DC.

[2] Instruments

Voltmeter shall be analogue, semi-flush mounted, approximately 4 inches square with a 250° linearized white scale and black markings, 2% accuracy. Antiglare glass shall be provided.

[3] Fuses

Fuses for secondary and control circuits shall be readily accessible from the front of the switchgear when the hinged door are opened.
The removal of a bolted cover plate shall not be required for access fuses or breakers.
It shall be possible to safely replace any fuse without de-energizing SWG.

[4] Switches

Selector switch for Vm shall be type W-2.
Positions and contacts of the selector switch shall be in accordance with the electrical elementary diagrams (Attachment 2)

[5] Pushbuttons

Pushbuttons shall be Type OT2 flush operators - full shroud.

[6] Indicating Lights

Indicating lights shall be of low voltage resistor LED type.
Color caps shall be as follows:

- Green - To indicate that the circuit breaker is open.
- Red - To indicate that the circuit breaker is closed.
- White – To indicate that the breaker protection has activated.

6.7 Wiring and Terminal Blocks

Secondary, control and alarm wiring shall be of a minimum 14 AWG (2.08 mm^2) 7 stranded copper conductors and 600 V, 90ºC flame retardant insulation.

DC control power wiring shall be minimum 12 AWG.

41 strand extra flexible copper wires shall be used, wherever wiring is subject to flexing on hinged panels.

Insulation shall be free of halogens and made from non-combustible materials. Cable with polyvinyl chloride insulation are not allowed.

The crimping tool used shall be of the "ratchet type" to prevent partial compression (the crimping tool shall be approved by the terminal lug manufacturer).

Wiring shall be identified at both ends with permanent markers carrying the same wire marks as shown on the Supplier’s electrical diagrams and drawings.

Wiring shall be pulled in a neat manner and shall be continuous between terminal points.

Terminal blocks shall be provided to terminate all secondary and control wiring. All spare contacts shall be wired to the terminal blocks. At least 20% of spare terminals should be provided.

Terminal blocks shall be suitable for ring type lugs, with barriers between terminals and shall be provided with identification and marker strips.

Terminal blocks for incoming and outgoing wiring shall be accessible for connecting and testing regardless of the breaker position and shall allow safe access without de-energizing SWG. Terminal blocks shall not be located less than 12 inches (30.48 cm) from the floor.

Separate, heavy duty terminal blocks shall be provided for DC control circuits.

The Supplier's wiring shall not have more than two wires connected to any terminal block. Terminals provided for terminating the external wiring shall be arranged for one wire to each terminal point.

The Supplier shall prepare and furnish final elementary diagrams showing complete internal wiring for each compartment.

6.8 Grounding

A copper grounding bus shall extend through the entire length of the SWG assembly.

All metal parts of the SWG structure shall be effectively connected to the ground bus.
The frame of each circuit breaker shall be grounded through an approved ground contact at all times, except when the primary disconnecting devices are separated by a safe distance.

Provisions shall be made for bolted connection of 500MCM copper cable or greater from the top of SWG unit. Means for connecting a portable grounding device to the grounding bus shall be provided.

Grounding of instrumentation and control equipment shall be in accordance with standard IEEE 1050 (2004)

6.9 Spare parts and accessories

A complete list of recommended spare parts shall be provided.

As a minimum, the following spare parts shall be quoted (as an optional scope):

a) One complete set of indicating lamps
b) One set of color caps of each color indicating in addition to a)
c) One protection unit of each breaker type, as applicable
d) One set of extension rails for the switchgear (for the circuit breakers withdrawal mechanism).
e) One complete breaker with protection unit
f) Set of any special tools required for normal maintenance.

Additional parts may be selected from the recommended spare parts list.

7.0 PERFORMANCE REQUIREMENTS

The Supplier shall properly size and select switchgear, based on loading data provided by NEK, for starting and continuous operation.

Supplier shall document sizing and design, based on factory sizing program (simulation). NEK will check the sizing and advise accordingly.

The Supplier shall certify that the equipment covered by this Specification will operate under all design loading combinations based on the design parameters specified herein.

The Bidder shall clearly state in the offer whether the switchgear is arc resistant according to IEEE C37.20.7 (2007) or according to the safety solutions taken in order to deal with arc flash hazard.

7.1 Fire Resistance

Inherent flame-retarding characteristics and properties, in accordance with ASTM D 635, shall be considered in selection, design, and fabrication of components and materials.

7.2 Calibration

Adequate instrument calibration, if applicable, shall be provided, to ensure proper operation or indication of equipment and their accuracy within the designed range. The calibration lists shall be a part of Test reports defined in chapter 10.

All protection units shall be tested and calibrated.

8.0 MATERIAL REQUIREMENTS

The Contractor shall be fully responsible for selection of materials and their procurement specification.

Insulation materials shall be suitable for use at 600V, 90°C. They shall be free of halogens (chloride, etc…) and made of non-combustible, flame retardant materials.

The Supplier shall submit Materials Safety Data Sheets for all hazardous materials delivered or used on NEK site during installation.

Materials used shall be suitable for environmental qualification as specified under item 11.0.

9.0 FABRICATION AND ASSEMBLY

Components, belonging to one functional group, should form a single mechanical and electrical module. Breakers shall be withdrawable and replaceable without disconnecting the SWG from power sources.

Suitable door or barrier shall be provided for protection when breaker is removed.

Only new (not used) components/materials traceable and certified to meet the design requirements shall be utilized in production.

Internal wiring shall follow accepted industry practice and shall be neatly bounded and marked on both ends.

The Foreign Material Exclusions program shall be enforced during the production and assembling of SWG.

10.0 INSPECTION AND TESTS

Supplier shall submit Certified data to present the characteristics of the equipment being supplied and to show that the materials comply with the specified test values. Testing, inspection and acceptance criteria shall conform to applicable codes and standards.

The inspection and test plan shall be sent to NEK for review, completion, and approval , as requested in 5.2.

Only calibrated measuring devices and tools shall be used. Calibration certificates of metering and test equipment (to be used during the FATs) shall be available prior to or during the tests.

The equipment, covered by this specification, shall be completely assembled in the factory prior to final testing.

10.1 Production Tests (Routine Tests) 400 VAC Switchgear

Test shall be in accordance with ANSI C37.20.1 (2015), including:

a) Complete dielectric tests of power and control circuits
b) Proof test of effective grounding
c) Electrical operation and control-wiring test: control wiring continuity, control wiring insulation test, polarity tests, sequence tests
d) Test of all bolted connections of power circuits with 100A minimum
e) Functional tests
f) The circuit breakers shall pass the production tests according to ANSI C37.50 (2012)

Apart from the above testing requirements, at least the following tests shall be performed, if not already part of any of above:

a) Finding minimum CBK tripping voltage
b) Finding minimum CBK closing voltage
c) Primary and secondary testing of breaker protection units
d) Breakers' dielectric test
e) Breakers' main pole contact resistance measurement

10.2 FAT

Factory Acceptance Test of SWG is required.

The Supplier shall prepare test plan for NEK review and approval. Comprehensive test plan shall be prepared to prove that design, production and final components set up were correct, satisfactory and according to the Purchaser requirements in every mechanical and electrical aspect.

10.3 Acceptance Criteria

The Purchaser will accept only materials and equipment, which meet this specification and the supplementary specifications, codes, and standards specified herein.

The equipment shall operate fully of this specification. Any material or equipment, which fails within the warranty period, shall be replaced immediately by the Supplier at no additional cost to the Purchaser for material, equipment, services, labor or transportation.

The acceptance of test results and satisfactory completion of inspection by the Purchaser shall not relieve the Supplier of the responsibility of furnishing the equipment complete and correct in all respects, including all necessary devices, for satisfactory operation.

The equipment subjected to design tests or seismic qualification tests shall not be part of the supply.

10.4 Site Acceptance Test

Supplier shall prepare SAT program for NEK review and approval.

11.0 ITEM QUALIFICATION

11.1 Environmental Qualification

SWG will be installed indoor in a room without ambient control. The expected environmental conditions are as follows:

Ambient temperature: 5°C to 40ºC
Maximum relative humidity: 95 % (without condensate)
The altitude does not exceed 200 m.

Outdoor air temperature (design input): -35°C to 46°C

11.2 Seismic performance requirements

Seismic qualification shall be performed in accordance with the requirements of IEEE 323, IEEE 344 and specification SP-S702. SWG structural integrity may be justified based on analytical method (analysis). Complex electrical components (breakers, contactors, etc…) installed in MCC shall be qualified by tests (generic test are acceptable).

Floor response spectra are shown in Attachment 3 (tabular data is also available upon request).

Vibration damping mounting devices, such as shock absorbers, shall not be used.

11.3 Radiological qualification

400 VAC Switchgear and its essential auxiliary equipment shall be resistant to radiological exposure for 30 days and retain 100% operability.

The anticipated radiological exposure of equipment is below 10Gy, which is limit for radiologically harsh environment; therefore, no special protective measures are required for equipment.

11.4 Design life

The equipment shall have a design life of 40 years, with routine parts replacement, as identified by the Supplier.
A list of all components that cannot meet the above requirement shall be provided. A complete service plan, for any such component shall be provided, including replacement parts, shelf life of the such spare parts, frequency of change-out, etc…

12.0 CLEANING

The FME program shall be followed and enforced through production, assembling and packing shop activities.

All parts shall be shipped free from dirt, corrosion, and unwanted grease.

13.0 CORROSION PROTECTION / COATING

Corrosion and oxidation protection shall be applied on all surfaces per manufacturer's internal painting procedures.

Painting of the cabinets shall be finished with light grey conforming UL 1332 (2005). The final exterior surface shall be bonded, smooth, and free of bubbles, ripples or other flaws. Steel parts shall be thoroughly cleaned to remove dirt, scale and grease, fully in compliance with Supplier's painting procedures, prior to painting. This shall be followed immediately by an application of a priming coat of rust-resistant paint and the necessary finish coats. Steel surfaces shall have a minimum of two finish coats. Paint shall be suitable for the operating temperatures of the equipment. Paint coating shall be free of sags, runs and incomplete coverage.

14.0 MARKING AND IDENTIFICATION

Identification labels shall be provided for all components to uniquely identify each item.

All devices (terminal blocks, fuses, circuit breakers, etc) and wiring shall be properly identified and marked according to designations on the wiring diagrams. Cables and wires shall be marked on both ends.

All devices mounted inside of the SWG shall be clearly permanently identified either by identification plates or by printed or stenciled inscriptions.

Devices located or accessible on the front plate shall also be clearly identified and marked with temporary identifier tag.

All nameplates and any other identifications shall be approved by NEK prior to application. Appropriate drawings or sketches shall be provided for approval.

The nameplate for 400 VAC switchgear shall be in compliance with applicable standards and shall show, at least, the following information:

a) The manufacturer's name and address
b) Type and designation of the switchgear
c) Identification reference and serial number
d) NEK Purchase Order
e) Rated voltage, rated current, rated frequency
f) Rated short-time current and rated short-circuit current
g) Insulation voltage and impulse withstand voltage

Circuit breakers shall have rating plates, in accordance with applicable standards. Each ACB shall be marked with SN on the breaker frame and on the breaker front name plate (rating table). Name plate shall also have determined type and size of protection unit, electrical figure number, NEK Purchase Order, etc.

All components shall be clearly identified and, where necessary, match marked in such a way as to eliminate any question or confusion at subsequent assemblies or repairs.

The Supplier shall establish and maintain a system for the identification of materials, parts and components according to NEK instructions. If the Supplier offers its own identification system, it shall be approved by NEK. These measures shall ensure that the lot number, serial number or other appropriate means, either on the item or on records, maintain identification of items traceable to the item throughout fabrication, testing, shipment and use of them.

These identification and control measures shall be designed to prevent the use of incorrect or defective materials, parts and components as well as to provide a permanent record to assist in the future evaluation of in-service degradation of parts.

15.0 PACKAGING, HANDLING AND STORAGE

Packing or crating shall ensure the satisfactory transportation, handling, and delivery of the equipment at its destination in undamaged condition.

Breakers shall be packed in wooden transportation crates or better type of packaging.

ShockWatch and TipNTell indicators (ULINE or equivalent) shall be installed on the equipment housing and each shipping crate in all three axes prior shipment. Clear receiving inspection acceptance criteria shall be identified by the Contractor before shipment

The Supplier shall inform NEK of any special storage, handling, controls and preventive maintenance requirements, as necessary to adequately maintain and preserve the item before installation. The Supplier shall inform sufficiently in advance of shipping for necessary preparation.

16.0 NONCONFORMING MATERIALS, EQUIPMENT AND SERVICES

Any deviations or design changes, not fully in accordance with the technical or quality assurance requirements of the procurement documents, and which the Supplier desires to accept, shall be approved by NEK. Any such deviation request shall be made in writing prior to disposition by means of the Deviation/Change Request Form submitted to NEK for approval prior to continuing work.

Non-conformance with specification requirements and applicable codes and standards invoked by this specification will not be accepted until approved by NEK.

Those non-conformances which cannot be brought within specification requirements by rework or replacement shall be reported to NEK and put on hold until approval. When such a condition exists, the Supplier shall initiate a non-conformance report (NCR) using the Supplier's standard non-conformance document, which identifies the non-conformance, Supplier's proposed disposition and NEK disposition approval.

The Supplier shall:

a) Tag and segregate the non-conformance item to prevent any further processing which may result in a change of the non-conformance as identified
b) Make the NCR available to the responsible NEK inspector for review to ensure the non-conformance is completely identified and accurately stated
c) Transmit the NCR with non-conformance disposition to NEK in an expeditious manner. The Supplier shall provide technical justification for the recommended dispositions.

The requirements of the specification are binding; no exceptions are acceptable without the prior consent of NEK.

The NCR shall provide the method by which the Supplier shall obtain a documented response and approval from NEK when non-conformances are identified. The use of NCRs will pertain to the work at the Supplier and/or Sub-Supplier's.

Once the item is identified with an NCR, the NCR shall remain assigned to that item permanently and NEK shall be advised of the originating NCR.

17.0 RECORDS

17.1 Record system

A record system shall be established and maintained by the contractor to provide documentary evidence of the quality of items and activities affecting quality. Quality assurance records shall include results of reviews, inspections, test, audits, monitoring of work performance and material analysis. Records shall at minimum identify Contractor's name, order number, inspection, and data recorder, data inspection that was performed, type of observation, procedures used, results, acceptability, and action taken with deficiencies noted. Record of inspection shall also include identity of drawings and procedures utilized along with the revision level.

All quality verification records, procedures, and qualifications shall be identifiable to the item or activity involved. All this record shall be send to NEK.

17.2 Fabrication records

Additionally to the requirements for manufacturing data, the Contractor shall prepare and provide all fabrication records related to NEK equipment.

18.0 OTHER REQUIREMENTS

Any additional requirements and/or exceptions imposed beyond this specification requirements during biding, negotiating and contracting process shall be identified as change to this specification and brought to the attention of the NEK ESD – Design and Modification Superintendent for resolution concurrence and/or approval.

19.0 RIGHT OF ACCESS

Access shall be granted to NEK representative(s) to all Supplier's and/or Sub-contractor's premises where design, fabrication and assembly of equipment specified in this Specification will take place in order to survey production, assembling, testing, and QA Program implementation i.e. review of generated QA related documentation. Such premises shall include, but not be limited to: shops, working areas, and engineering offices.

Such survey shall take place at any time upon NEK request, periodically according to the PQP or on the task basis during the course of work.

NEK representatives shall have the right to request Supplier to stop the work, if major contractual deviations are discovered during the manufacturing, purchasing, control, or any other process/production activities.

NEK QA surveys shall not relieve the Supplier's and/or his Sub-contractors from responsibility to perform all inspections and tests required.

20.0 QA PROGRAM REQUIREMENTS

20.1 SUPPLIER's QA Program

The SUPPLIER shall maintain QA Program which comply with standard ISO 9001 or comparable standard and conforms to relevant PURCHASER QA requirements, specified in specification QS-610 Generic Quality Assurance Program Requirements. QA Program shall apply to all activities affecting the quality of supplied equipment, materials and services.

The SUPPLIER shall submit with Proposal one controlled copy of its Quality Manual to the PURCHASER for review and acceptance. All portion of the QA program that have been revised during the period under this specification must be accepted by PURCHASER.

20.2 SUPPLIER's responsibility for Subcontractors

The SUPPLIER shall ensure that its subcontractors meet applicable requirements of this Specification.

The Specification requirements shall apply to subsuppliers for works and services not performed by the SUPPLIER.

The SUPPLIER shall be fully responsible for all actions of his subcontractors in relation to the PURCHASER.

20.3 Certificate of Compliance

The SUPPLIER and its subcontractors shall provide a Certificate of Compliance stating that all provided equipment and services meet requirements of this Specification.

20.4 Manufacturing and Inspection Plans

The SUPPLIER shall provide the Manufacturing and Inspection Plans with record (R), witness (W) and hold (H) points to the PURCHASER for review and approval prior to start of manufacturing.

The Manufacturing and Inspection Plans shall cover at least all relevant inspection requirements and shall outline the manufacturing and production sequence and specific inspections that are required to be performed.

The SUPPLIER shall update the Manufacturing and Inspection Plan and submit copies thereof to the PURCHASER when changes are approved by the PURCHASER.

21.0 SPECIAL HANDLING

The Supplier shall specify special handling requirements during transportation and storage.
A detailed special handling procedure shall be provided to NEK in such case.

The Supplier shall also specify any special requirements necessary to maintain equipment warranties.

22.0 SHELF LIFE

The SUPPLIER shall not ship any item that has less than 90% of remaining shelf life at time of shipment.

The SUPPLIER shall provide shelf life data as follows:

a) Expiration date,
b) Cure date or manufacturing date, and
c) Material composition.

If the above requirements are not met the item will be shipped back to the SUPPLIER at the SUPPLIER's expenses.

23.0 10CFR21 REPORTING (For US supplied equipment only)

Not applicable.

24.0 COMMERCIAL GRADE DEDICATION

Not applicable.

25.0 SUPPLIER DOCUMENTATION REQUIREMENTS

Documents shall be submitted as requested in sections 5.0 and 33.0 herein.

Vendor shall submit the final revision of all documentation in electronic and printed form.

Documentation shall be delivered as follows:

[1] Documents requested in section 5.1 shall be submitted with the proposal.

[1] Documents requested in section 5.2 shall be submitted in before FAT.
[2] Documents requested in section 0 (Inspections and Tests) shall be submitted upon FAT completion.
[3] Seismic qualification report as requested in 11.2 shall be submitted in before FAT.
[4] Complete quality assurance package as requested in 0 shall be submitted upon shipment (factory release)
[5] Certificate of Compliance;
A Certificate of Conformance/Compliance shall be submitted by the Supplier stating that the equipment is in conformance with the requirements of this specification. The Supplier and its Sub-Suppliers shall provide the Purchasers Quality Assurance personnel in writing that all referenced standards, codes and procedures have been compiled with.
[6] Formal statement that equipment is designed and selected for 40 years of service
[7] MCC & major equipment manuals as requested in 33.0 shall be submitted before FAT

[8] Final QA package with all non-conformance reports, repair records etc…
[9] Spare part list

26.0 NEK PROPRIETY DATA

NEK has a proprietary interest in all drawings, designs, specifications, documents' information or know-how which may be furnished pursuant contract execution and in any know-how improvement, discovery or invention which may be made, developed or conceived in the performance of work hereunder or which may arise or result therefrom (hereinafter collectively referred to as the "Information"). All such information shall be considered proprietary of the NEK. The right to use of all such Information shall be transmitted to the contractor only for its personal use and shall be entirely restricted to the performance of the contract and subject to the confidentially provision.

27.0 NON-CONFORMANCE REPORTS

The Supplier shall issue a nonconformance report for any deviation that violates environmental qualification, interchangeability, design, operating parameters, or any other request per this specification during procurement, manufacturing, testing, and commissioning of equipment per this specification. Such report shall have technical justification for nonconformance resolution dispositions and be submitted to NEK for approval prior to continuation of activities.

Any disposition, which cannot be returned to acceptable conditions, specified in approved drawing or specification, shall be specifically approved and accepted by NEK, prior to the shipment of equipment.

28.0 REPAIR RECORDS

Production repair records shall be included in the final quality release documentation. As a minimum, following information shall be provided in each of those:

a) Summary of repair/refurbishment work that has been performed on the equipment
b) Brief root cause analysis
c) Details about any "special process" used during repairs
d) A list of replacement parts installed in the repaired equipment

29.0 SOURCE INSPECTION / SURVEILLANCE NOTIFICATION

The contractor shall provide access to Contractor's plant facilities and records pertaining to the purchase order for the purpose of planning and performing source inspection/surveillance activities.

Inspections or examinations performed by NEK representatives or designated representatives do not relieve the Contractor of its responsibility to meet the requirements of this specification and purchase order.

30.0 SHIPPING REQUIREMENTS

Vendor shall be responsible for packaging and shipping of equipment to NPP Krško site.

Appropriate means shall be provided for safe transportation and lifting of equipment.

31.0 DELIVERY SCHEDULE

Items shall be delivered within five months upon signing the contract.

32.0 HOLD POINTS

NEK shall have the right to establish hold points, which will be designated in the final PQP, as defined.

NEK keeps the right to cancel presence during such activities.

NEK keeps the right to request additional hold points, if found necessary, to ensure resolution of unexpected quality problems or any other technical issue.

Predetermined hold or notification points require receipt of notification at least twenty (20) working days in advance of the scheduled time of performance. The following hold points for which prior notification is required are mandatory:

a) Final equipment assembly
b) Factory Acceptance/Performance Tests
c) Shipping release

33.0 VENDOR TECHNICAL MANUAL AND REGISTERED UPDATES

Specific manual or suitable technical document shall be provided for each component, such as:

a) SWG general operating & maintenance manual
b) Breaker(s) and protection device(s) manual(s)
c) etc…

All manuals shall be provided to the NEK for review and comments before final issue and delivery. Preliminary versions shall be provided in electronic format only.

Final versions shall be furnished in four hard copies and appropriate electronic version.

34.0 TRAINING

The Supplier shall organize training for the Purchaser maintenance personnel (3-4 participants).

Training scope and description shall be provided two months in advance for review and comments.

The Supplier shall prepare complete training documentation for NEK review and concurrence. All training materials shall be provided in electronic media format (pdf, ppt, doc, CAD).

Training shall take place at the manufacturing premises during or after the FAT. The exact dates shall be mutually agreed.

Training shall cover at least the following:

a) Testing
b) Detail Maintenance (breaker, testing of protection device, switchgear)
c) Refurbishment of breaker if needed to achieve of qualified life (separate price under training option).
d) Detail Diagnostics and Troubleshooting
e) Replacement of all parts and components
f) Training for in-storage maintenance for all parts that will be offered and have to be maintained to reach their qualified life.

Each attendee shall receive after successful training certificate of adequate qualification to independently perform covered activities. Activities shall be specified on certificate.

Training quotation shall be specified in the Proposal.

35.0 ATTACHMENTS

Attachment 1 : One Line Diagram

Attachment 2 : Electrical Elementary Diagram

Attachment 3 : FRS for SWG level

Attachment 1: One Line Diagram

DWG E-206-925

Attachment 2: Electrical Elementary Diagram

DWG B-208-052 sh.120

Attachment 3: FRS[1] for SWG level

NOTES:

Names of Floor response spectra on each figure include considered direction (X, Y, Z), state (OBE, SSE), for Level 2 (nivo 2) and value of damping (%).

Considered directions according to “true north” and “plant north”:

Direction X = East – West response,

Direction Y = North – South response,

Direction Z = Vertical response.

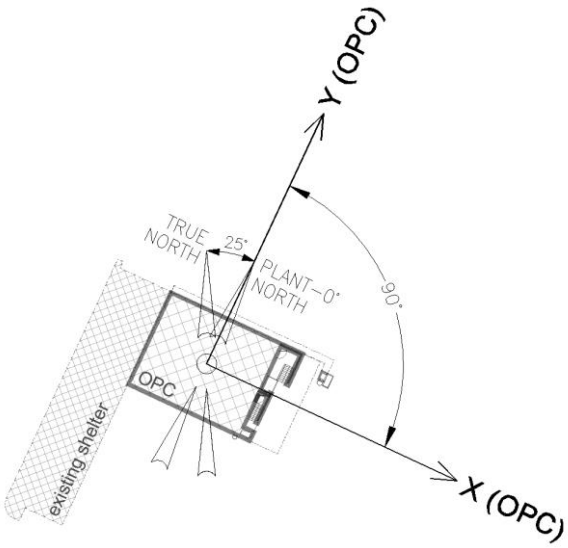


Figure 1: Considered directions of acceleration (X, Y, Z)

Actual levels according to “local zero” (+/-0,00 = altitude +157,85m a.s.l. = NEK altitude 102,650m):

Level 2 = Slab's axial elevation corresponds to (NEK altitude 106,200m);

OPC building is considered as shelter, that is why there is a rule for minimum value of equipment accelerations (shown on each FRS chart as “meja 4g (zaklonišča)”):

For higher levels (levels 1, 2, 3): Sa,min = 4g.

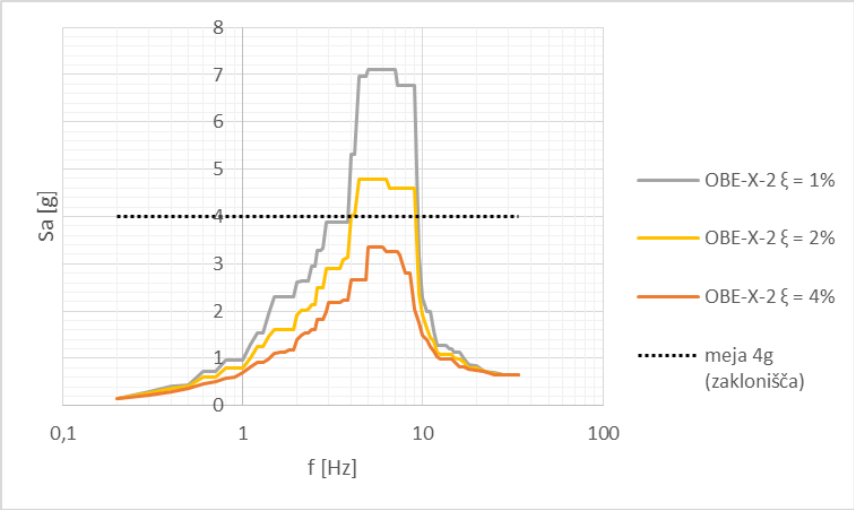
Included floor response spectra:

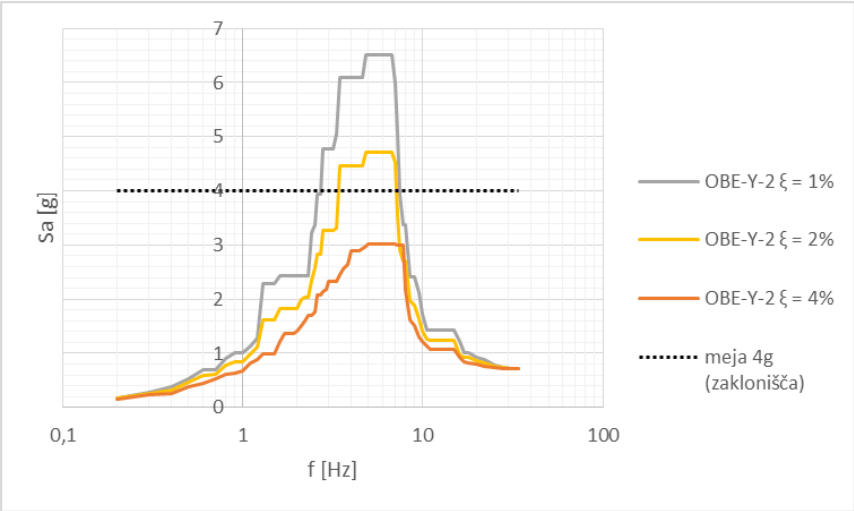
OBE: Level 2 (Etažni spektri – OBE – nivo 2) for all directions and dampings (page 4 of Appendix A of Document OSC Seismic Analysis 1056-NA-L-PZI-3/1-A1);

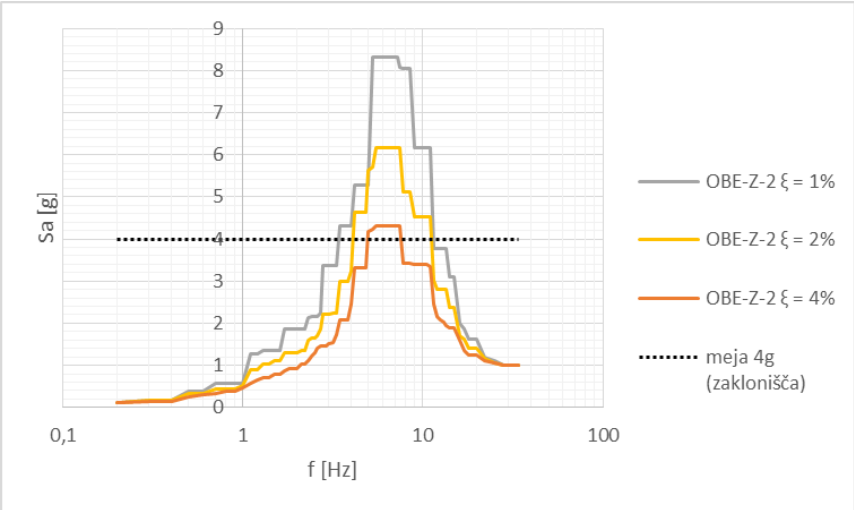
[1] Applicable OBE and SSE Floor Response Spectra Figures are taken from Appendices A and B of the OSC Seismic Analysis 1056-NA-L-PZI-3/1-A1

SSE: Level 2 (Etažni spektri – SSE – nivo 2) for all directions and dampings (page 4 of Appendix B of Document OSC Seismic Analysis 1056-NA-L-PZI-3/1-A1).

OBE: Level 2 (Etažni spektri – OBE – nivo 2)[1]

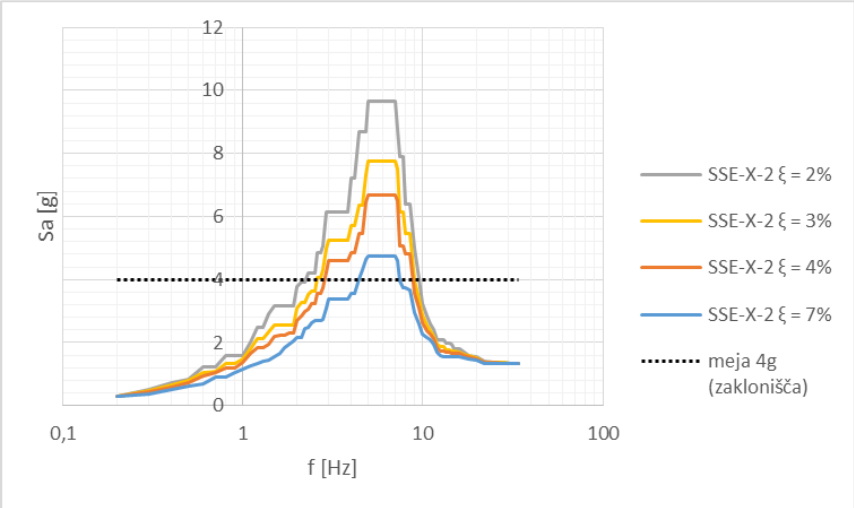


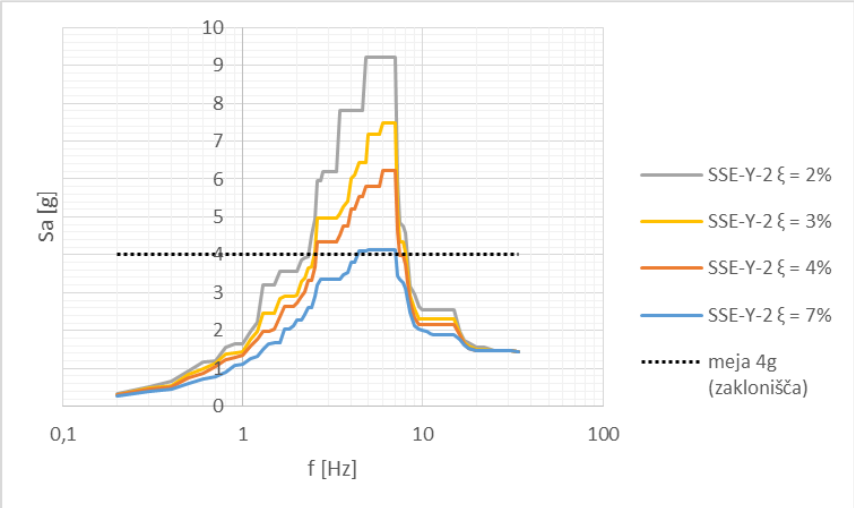


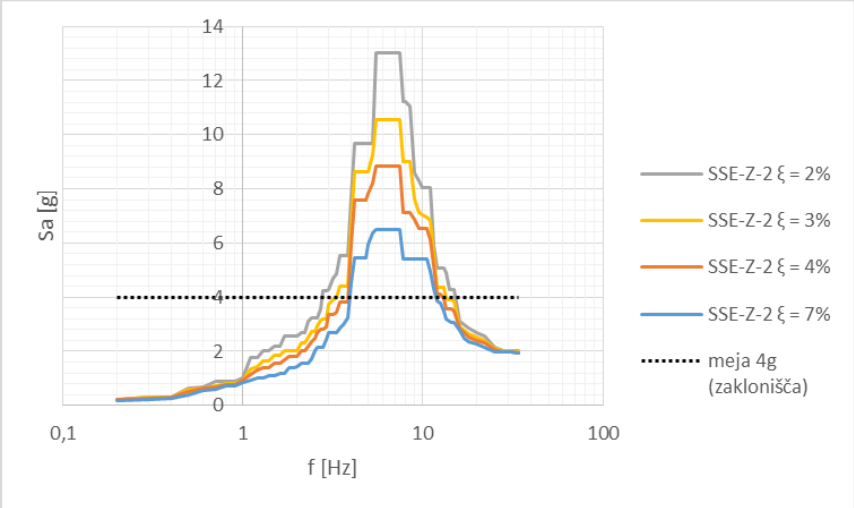


[1]NOTE: " ····· 4g limit (shelters) is not applicable for OSC building

SSE: Level 2 (Etažni spektri – SSE – nivo 2)[1]







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[1] NOTE: " ····· 4g limit (shelters) is not applicable for OSC building