NEK

Technical Specification

AUTOMATIC VOLTAGE AND REACTIVE POWER REGULATION ON STEP-UP POWER TRANSFORMERS

KRŠKO NUCLEAR POWER PLANT

SP-E3054

November 2024

Revision 0

AUGMENTED QUALITY

Dejan Skrivalnik	Originator	13.11.2024 Date
Boštjan Podgoršek	Reviewer	13. 11. 2024 Date
Siniša Đurđek	Reviewer	13 11 2024 Date
Damijan Gregorič	Reviewer (QA)	13. 11. 2024 Date
Peter Jan	Engineering and Design Change Superintendent	18/11/2024 Date

RECORD OF REVISION

No.	Date	Reason for revision and revision summary	Affected pages
0	13.11.2024	Initial issue	---

TABLE OF CONTENTS

1 SCOPE 1
1.1 Scope of Work 1
1.2 Equipment, Material, and Services to be Furnished by the SUPPLIER 1
1.3 Equipment, Material, and Services to be Furnished by OTHERS 2
2 DEFINITIONS 3
3 CODES, STANDARDS AND REGULATORY REQUIREMENTS 4
4 SUPPLEMENTAL DATA 5
5 DOCUMENT SUBMITTAL 6
5.1 General 6
5.2 Information Required with the Proposal 6
5.3 Documentation Required after Contract Award 7
5.4 Final Documentation 8
6 DESIGN REQUIREMENTS AND DESIGN INPUTS 9
6.1 General Requirements 9
6.1.1 System Sensors 17
6.1.2 Hardware 18
6.1.3 Installation and Commissioning 19
6.2 Environmental Conditions 19
6.3 Foundation Requirements 20
6.4 Electrical Requirements 20
6.4.1 Electrical Power 20
6.4.2 Cabinet Internal Wiring 20
6.4.3 External Wiring 20
6.4.4 Grounding 20
6.5 Preliminary Equipment List 20
6.6 Preliminary Equipment Selection 20
6.7 Location and Mounting 20
6.8 Ventilation Requirements 20
7 PERFORMANCE REQUIREMENTS 21
7.1 General 21
7.2 Fire Resistance 21
7.3 Qualification 21

7.4 Separation 21
7.5 Calibration 21
8 MATERIALS AND DETAILS OF CONSTRUCTION 22
9 FABRICATION AND ASSEMBLY 23
10 INSPECTIONS AND TESTS 24
10.1 Test Responsibility 24
10.2 Visual Inspection 24
10.3 Performance Tests 24
11 ITEM QUALIFICATION 26
11.1 Nuclear Grade Classification 26
11.2 Environmental Qualification 26
11.3 Seismic Qualification 26
12 CLEANING 27
13 CORROSION PROTECTION AND COATING 28
14 MARKING AND IDENTIFICATION 29
15 PACKAGING, HANDLING AND STORAGE 30
16 NONCONFORMING MATERIALS 31
17 RECORDS 32
18 OTHER REQUIREMENTS 33
18.1 SUPPLIER’s Responsibilities 33
18.2 PURCHASER’s Responsibilities 33
19 RIGHT OF ACCESS 34
20 QA PROGRAM REQUIREMENTS 35
20.1 SUPPLIER's QA Program 35
20.2 SUPPLIER’s Responsibility for Subcontractors 35
20.3 Certificate of Compliance 35
20.4 Manufacturing and Inspection Plans 36
21 SPECIAL HANDLING 37
22 SHELF LIFE 38
23 10CFR21 REPORTING 39
24 COMMERCIAL GRADE ITEM DEDICATION 40
25 SUPPLIER DOCUMENTATION REQUIREMENTS 41
26 PURCHASER PROPRIETARY DATA 42
27 NONCONFORMANCE REPORTS 43

28 REPAIR RECORDS 44
29 SOURCE INSPECTION/SURVEILLANCE NOTIFICATION 45
30 SHIPPING REQUIREMENTS 46
31 DELIVERY SCHEDULE 47
32 WITNESS AND HOLD POINTS 48
33 VENDOR TECHNICAL MANUAL AND REGISTERED UPDATES 49
34 TRAINING 50
35 ATTACHMENTS 51
Attachment 1: BIDDER'S Equipment Specification Exceptions form (1 page)
Attachment 2: QS-610, Rev.2, Generic Quality Assurance Program Requirements
Attachment 3: SP-3, Rev.5, Cyber Security Program

1 SCOPE

1.1 Scope of Work

This Specification defines essential requirements for modernization and upgrade of existing Automatic Voltage Regulators (AVR) on parallel connected Main Transformers GT1 & GT2 i.e. step-up transformers, 21/400 kV, in the KRŠKO Nuclear Power Plant (NEK). A major upgrade of the AVR is implementation of reactive power regulation.

The modernization and upgrade of the AVR consists of:

- Upgrade of the system to newest hard- and firmware, both in modular design
- Separation of voltage regulation and monitoring features into two separate devices
- Implementation of additional safety feature – preventing reactive power to exceed limits in automatic voltage regulation mode.
- Further modification of parallel operation to synchronous operation of both motor drive units
- Implementation of reactive power regulation and selection between automatic voltage regulation and reactive power regulation
- Implementation of a desired value memory feature. This feature always saves the last active desired voltage or reactive power value and uses this value in case of loss of supply voltage after voltage recovery.
- Implementation of additional parameters for reactive power limits and hysteresis
- Total reactive power measurement
- Out-of-Step alarm in bypass operation mode

1.2 Equipment, Material, and Services to be Furnished by the SUPPLIER

The equipment, material, accessories, and services to be furnished by the SUPPLIER shall include, but are not necessarily limited to, the following:

1. Four (4) sets of AVR devices and OLTC monitoring devices. The first two sets of devices shall be suitable for Main Transformer GT1 regulation and monitoring feature. The second two sets of devices shall be suitable for Main Transformer GT2 regulation and monitoring feature. One set of devices for each transformer will be installed/used on GT1/GT2 regulating board, and the second set of devices for each transformer will be spare. For detail system specification see item 6 DESIGN REQUIREMENTS AND DESIGN INPUTS.
2. Two (2) potentiometers for setting the NEK desired/reference voltage value on HV side of step-up transformers. One of two potentiometers shall be a spare.
3. Two (2) potentiometers for setting the NEK desired/reference reactive power value, received/delivered to/from the plant. One of two potentiometers shall be a spare.
4. Performance of all necessary factory acceptance tests.
5. Packaging and shipment.
6. Final supervision of installation and the system commissioning on site including defining and setting the AVR parameters and setpoints.
7. On-site training.

1.3 Equipment, Material, and Services to be Furnished by OTHERS

The following equipment, material, and services are not a part of this Contract and will be furnished by OTHERS:

1. LED displays for NEK reference values indication of voltage and reactive power (AVR's feedback indication), mounted on the ECB.
2. Voltage regulation – reactive power regulation selector switch for selection of regulation type/mode, mounted on the ECB.
3. ELES – NEK selector switch for selection who will set reference values of voltage and reactive power, mounted on the ECB.
4. LED displays for ELES reference values indication of voltage and reactive power, mounted on the ECB.
5. External cables and Conduit connections to the cabinets.
6. Calculation/study that will on the base of simulations of different conditions on the HV network determine the setpoints of the AVR (voltage dead time, reactive power dead time, delays, etc.).

2 DEFINITIONS

AC	Alternate current
AQ	Augmented Quality
AVR	Automatic Voltage Regulator
BIDDER	An entity, which offers supply of products and/or services and has submitted a bid within a public tendering procedure
ECB	Electrical Control Board
ELES	Electric power transmission system operator, public company
FAT	Factory Acceptance Test
FME	Foreign Material Exclusion
HV	High Voltage
MCR	Main Control Room
MECL	Master Equipment Component List
NCN	Nonconformance Notice
NEK	Nuclear Power Plant Krško
OLTC	On-Load Tap Changer
OTHERS	NEK or other company(ies) subcontracted by NEK
PURCHASER	Nuclear Power Plant Krško
RTP	Distribution transformer substation
QA	Quality Assurance
SAT	Site Acceptance Test
SUPPLIER	An entity, which supplies equipment and/or services to NEK per this Specification

3 CODES, STANDARDS AND REGULATORY REQUIREMENTS

Devices shall be designed, manufactured, tested, and certified in accordance with the latest applicable portions of the following codes and standards:

1. International Electrotechnical Commission (IEC)
    a. IEC 61000, Electromagnetic Compatibility (EMC), Part 4 – Testing and Measurement Techniques
    b. IEC 61010, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 2
    c. IEC 60950-1, Information Technology Equipment - Safety
    d. IEC 60255-21, Vibration Electrical Relay Testing
2. European Directives
    a. Electromagnetic Compatibility (EMC) Directive 2004/108/CE
    b. Low-Voltage (Safety) Directive 2006/95/CE
3. NEK SP-3 Cyber Security Program rev.5 (in attachment)

Unless stated otherwise by the PURCHASER, the SUPPLIER shall use the appropriate codes and a standard listed in this section in effect at the time of Purchase Order issued by the PURCHASER.

The SUPPLIER shall submit criteria for the design and fabrication of equipment not covered by codes given above to PURCHASER for review and approval.

4 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. 2, Generic Quality Assurance Program Requirements
2. SP-3, Rev.5, Cyber Security Program

5 DOCUMENT SUBMITTAL

5.1 General

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 Portable Document Format (pdf). Other acceptable formats shall be:

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

All SUPPLIER's documents shall bear at least the following information:

- SUPPLIER's Name;
- Date of issue;
- Document status;
- Document number;
- Revision number;
- Construction Code or Standard;
- Other organizations participating in the manufacturing;
- NEK Purchase Order number; and
- NEK Specification number.

5.2 Information Required with the Proposal

The BIDDER shall submit complete operating data and description of the equipment offered with the Proposal. This data shall include the following:

1. General description of proposed equipment with operating characteristics of components (instruments, relays, switches, indicating lights, alarm panels, internal wiring etc…).
2. Preliminary outline drawings of the device, clearly marked with the unit tag number and showing all principal dimensions, weights of the unit and major items, operational and maintenance clearance dimensions, material specifications and typical cross section views. The BIDDER may provide standard submittal drawings for this purpose.
3. Supplier's Quality Assurance (QA) and Quality Control (QC) Program Manuals.
4. Description of factory acceptance tests (FAT) and site acceptance test (SAT).
5. Completion and feedback of the Equipment Specification Exceptions form with a description of any deviations or exceptions to this Specification.

The BIDDER shall indicate additional documentation he proposes to supply.

5.3 Documentation Required after Contract Award

The documentation of the AVR and OLTC monitoring device shall include the following information as a minimum:

1. Certified outline drawings of the AVR assemblies, clearly marked with the unit tag number and showing all principal dimensions, weights of the unit and major items, operational and maintenance clearance dimensions, material specifications and typical cross section views. These drawings shall be specifically for the supplied equipment involved. Standard submittal drawings are not acceptable unless clearly marked or modified to indicate the concerned equipment.
2. Detailed drawings of components, sub-components or accessories. If these items are shown on separate drawings appropriate cross references shall be used.
3. Wiring diagrams and electrical bill of material.
4. Structural design information including forces and moments at every external equipment support interface, support hardware and bracket details, required anchor bolt sizes, anchor bolt locations, required anchor bolt materials, and specific anchor bolt torqueing requirements. (Where there are no specific torqueing requirements, the SUPPLIER shall state so). The SUPPLIER shall make provisions for transmitting any tension or shear loads to the anchor bolts.
5. List of used materials with ASTM designations.
6. Description of required factory and site acceptance tests to be performed including acceptance criteria.
7. Equipment start-up procedure
8. Setting the device detection setpoint (alarm) procedure description
9. Software user guide with instructions for updating.

The manufacturing documentation shall comprise the following as a minimum:

1. Documentation index;
2. Submittal schedule;
3. Manufacturing and inspection plan;
4. Design and manufacturing documentation;
5. All certificates required with material;
6. Deviation, nonconformance and repair reports;
7. Test procedures;
8. Test reports showing conformance to all testing procedures;
9. Cleaning procedures;
10. Packaging, handling and storage procedures;
11. Vendor technical manual;
12. List of recommended spare parts;
13. Statement of shelf life and operational life of the units;

14. Certificate of conformance with the requirements of this Specification.

5.4 Final Documentation

The SUPPLIER shall submit the original and one (1) electronic copy (CD, DVD, flash memory media) of the final technical documentation.

6 DESIGN REQUIREMENTS AND DESIGN INPUTS

6.1 General Requirements

The SUPPLIER shall provide four (4) sets of AVR devices and OLTC monitoring devices with customer specific features. The first two sets of devices shall be suitable for Main Transformer GT1 regulation and monitoring feature. The second two sets of devices shall be suitable for Main Transformer GT2 regulation and monitoring feature. One set of devices for each transformer will be installed/used on GT1/GT2 regulating board, and the second set of devices for each transformer will be spare.

NEK can regulate the voltage or reactive power by switching the OLTC stages of the GT1/GT2 transformers, i.e. 21/400 kV step-up transformers. OLTC motor drives on GT1/GT2 transformers are controlled by corresponding two AVRs. On existing AVRs only voltage regulation is implemented. AVRs operate in two different voltage regulation modes:

- 400 kV automatic voltage regulation during normal operation of NEK (generator switch is closed and generator supplies 400 kV and 6.3 kV network)
- 6.3 kV automatic voltage regulation during NEK outage (generator switch is open)

New AVRs, as well as existing, shall operate with Master/Follower parallel operation algorithm. During 400 kV voltage regulation, AVR which operates transformer GT1 OLTC motor drive, is master AVR, which regulates voltage. During 6.3 kV voltage regulation, AVR which operates transformer GT2 OLTC motor drive, is master AVR, which regulates voltage. In each voltage regulation mode the other AVR is follower AVR, which follows the master AVR. To minimize the time period in which the transformers have different tap positions, both, master AVR and follower AVR, shall send the Raise/Lower impulses synchronously to the appropriate OLTC motor drive. Master and follower AVR shall exchange the information about their tap position via appropriate Controller Area Network (CAN) communication bus.

On new AVRs reactive power (flowing between generator and 400 kV grid) regulation shall also be implemented. This regulation shall be performed on AVR which operates transformer GT1 OLTC motor drive. In this mode of operation the transformer GT1 AVR shall be master AVR, and GT2 AVR shall be follower AVR. The total reactive power shall be measured by GT1 AVR, consequently additional sum current (GT1 + GT2 current on HV side) input on AVR shall be available.

The deficiency of the existing voltage regulation (which should be corrected by new regulation configuration) is that if the reactive power exceeds the plant threshold between -250 MVAr and +150 MVAr, the AVR stops the regulation (goes into blockade) and does not perform automatic actions (switching of GT1/GT2 OLTCs) to bring the reactive power back within the allowed range.

The new AVRs require a software upgrade to add the following functions to the existing ones:

a) In voltage regulation mode, AVR shall do not perform a switchover of the OLTC stage when this would lead to an overshoot of the reactive power at the plant

threshold. For this purpose, the AVR needs to know how much change in reactive power is caused by the switching of one of the OLTC stages of the GT1/GT2 transformers.

b) In voltage regulation mode, AVR or associated monitoring device shall monitor the reactive power at the plant threshold and, in the event of a spontaneous deviation outside the permissible reactive power range of -250 MVAr to +150 MVAr, shall ensure that the reactive power automatically returns to the permissible range of -250 MVAr to +150 MVAr by shifting the OLTC stages, irrespective of the fact that the desired/reference voltage value cannot be achieved.

c) In reactive power regulation mode, AVR shall not perform a switchover of the OLTC stage when this would result in an overshoot of the reactive power at the plant threshold. For this purpose, the AVR must know how much change in reactive power is caused by the switching of one stage of the OLTCs of the GT1/GT2 transformers. ELES will ensure that they do not send desired reference values of reactive power that would be outside the allowed range between -250 MVAr and +150 MVAr.

New AVRs configuration shall preserve remote selection (by selector switch) between automatic regulation/control and manual control of the OLTCs, where AVRs are bypassed. In manual control mode AVRs shall supervise out-of-step condition (more than one step difference) of OLTCs and trigger alarm if out-of-step condition appears. In automatic mode of regulation operators in the MCR should continue to be allowed to remotely set the voltage desired/reference value on the AVR and to see the set value on LED display (feedback indicator). For these reasons the following equipment, installed on the ECB in the MCR, should be connected also to the new AVRs:

a) Potentiometer for setting the NEK desired/reference voltage value on HV side of step-up transformers (400 kV grid). Reference voltage should be adjustable in the range 360-440 kV.

b) LED display of the NEK voltage desired/reference value (AVR’s feedback indication).

Besides above-mentioned equipment the following equipment shall be added on the ECB and connected to the AVRs for control purposes:

a) Potentiometer for setting the NEK desired/reference reactive power value, received/delivered to/from the plant. Reference reactive power should be adjustable in the range +/- 500 kVAr.

b) LED display of the NEK reactive power desired/reference value (AVR’s feedback indication). Display shall be connected to AVR’s 4-20 mA output.

c) Selector switch to select either voltage regulation or reactive power regulation.

d) Selector switch to select the source - ELES or NEK - to set the voltage or reactive power desired/reference value.

e) LED display of the ELES desired/reference voltage value. Display shall be connected to AVR’s 4-20 mA output.

f) LED display of the ELES reactive power desired/reference value. Display shall be connected to AVR’s 4-20 mA output.

Today at NEK installed AVR’s have been delivered with customer specific Master/Follower parallel operation algorithm according to MR-specification Nr. DSE-

91/2005, dated 29.03.2005. All these customer specific features regarding Master/Follower parallel operation algorithm shall be implemented in the new AVR devices as well. In order to avoid circulation currents in parallel mode in Master-Follower mode the tap position shall be supervised. Master and slave/follower exchange the information about their tap position via CANBUS.

Synchronized Master-Follower parallel mode (customer specific feature) shall be implemented also in the new AVRs devices. Both, master AVR and follower AVR, send the Raise/Lower impulses synchronously to the appropriate motor drive. This is to minimize the time period in which the transformer has different tap positions.

In automatic voltage regulation mode the generator switch is closed; the generator supplies the 6.3 kV and 400 kV network. Main Transformers GT1 and GT2 are in parallel, with GT1 AVR (400kV) acting as Master and GT2 AVR (6,3 kV) as follower. GT1 AVR regulates the 400 kV voltage. The desired voltage value can be set in range 360-440 kV by NEK using potentiometer, installed in the MCR, or by ELES sending the desired voltage value (IEC 61850). The connection of potentiometer in the MCR to the AVR shall be the same as at the existing AVR (3–wire connection – potentiometer as voltage divider). NEK desired/reference voltage value (set by potentiometer) shall be reported by a feedback indicator connected to the AVR 4-20 mA output. ELES desired/reference voltage value (IEC 61850) shall also be reported by a feedback indicator connected to the AVR 4-20 mA output. The Follower GT2 AVR shall follow the GT1 AVR. If reactive power is out of the range -250 Mvar +150 Mvar in this voltage regulation mode, auto commands should be activated to automatically come into reactive power allowed range (automatic runback function).

The following setting parameters shall be implemented at blocking in positive power sector 0 to +150 MVAr (generator supplies to 400 kV) in voltage or reactive power mode:

Setting parameter	Limit value	Default value	Setting range	Function
1 step		70 MVAr	0 MVAr to 150 MVAr	
Par +ON	Positive blocking ON	150 MVAr	0 - 500 MVAr	Blocking before step if (Qactual+1step)>150 MVAr
Par +OFF	Positive blocking OFF			Blocking in positive MVAr direction deactivated

The following setting parameters shall be implemented at runback in positive power sector 0 to +150 MVAr (generator supplies to 400 kV) in voltage or reactive power mode:

Setting parameter	Limit value	Default value	Setting range	Function
Par +ON	Runback ON	+150 MVAr	0 to +500 MVAr	Runback activated
Par +OFF	Runback OFF	+150 MVAr	0 to +500 MVAr	Runback deactivated

The following setting parameters shall be implemented at blocking in negative power sector 0 to -250 MVAr (generator supplies to 400 kV) in voltage or reactive power mode:

Setting parameter	Limit value	Default value	Setting range	Function
1 step		70 Mvar	0 MVAr to 150 MVAr	
Par +ON	Negative blocking ON	-250 MVAr	0 - 500 MVAr	Blocking before step if Qactual-1step<-250 MVAr
Par +OFF	Negative blocking OFF			Blocking in positive MVAr direction deactivated

The following setting parameters shall be implemented at runback in positive power sector -250 MVAr to 0 MVAr (generator supplies to 400 kV) in voltage or reactive power mode:

Setting parameter	Limit value	Default value	Setting range	Function
Par +ON	Runback ON	-250 Mvar	0 to -500 MVAr	Runback activated
Par +OFF	Runback OFF	-250 Mvar	0 to -500 MVAr	Runback deactivated

The setting of the four new parameters (Par ON/OFF) from above tables shall be reported by IEC61850 to ELES. ELES will receive only “read-only right” to those parameter settings. The “write & change-rights” of the four new parameters (Par ON/OFF) shall have NEK only. Setting is possible as follows:

- on the AVR's display
- locally via PC connected via RJ45 service port on the AVR's front
- from remote on the web browser of a PC connected to the AVR via LAN/RJ45 connection

After loss of power supply, voltage recovery and a reset of devices the last valid value of desired/reference voltage (or of desired reactive power) shall be re-used. This feature is independent of origin of the value (NEK setting or ELES setting via IEC 61850 protocol).

The desired reactive power value shall be set in range -500 MVAr …0…+500 MVAr by NEK using potentiometer, installed in the MCR. AVR shall have an input for this potentiometer. The connection of potentiometer to AVR shall be the same as for the potentiometer for voltage value setting (3–wire connection – potentiometer as voltage divider). NEK desired/reference reactor power value (set by potentiometer) shall be reported by a feedback indicator connected to the AVR 4-20 mA output. ELES desired/reference reactor power voltage value (IEC 61850) shall also be reported by a feedback indicator connected to the AVR 4-20 mA output.

Total reactive power measurement shall be implemented as customer specific feature. The total reactive power shall be measured by GT1 AVR only. Total reactive power shall be measured by GT1 AVR with additional sum current measurement (GT1+GT2 current on HV side). A separate current input for separate sum current input on AVR shall be available.

Selection of operating modes and setting ranges shall be implemented on AVR. The following selection of operating modes via binary inputs on AVR shall be implemented:

	Operating mode of GT1 AVR (Master)							
AVR binary input No.	*Reactive power regulation by ELES*	*Reactive power regulation by NEK*	*Voltage regulation by ELES*	*Voltage regulation by NEK*	*Not allowed commands => AVR blocked*			
1	*X*	*X*	*1*	*0*	*X*	*X*	*X*	*X*
2	*X*	*0*	*1*	*1*	*X*	*X*	*0*	*1*
3	*X*	*1*	*0*	*0*	*X*	*X*	*0*	*1*
4	*0*	*1*	*1*	*1*	*0*	*1*	*1*	*1*
5	*1*	*0*	*0*	*0*	*0*	*1*	*0*	*0*

Notes on the table above:

- "X" stands for any logical value ("0" or "1")
- GT1 AVR binary input 1 is used for activating / deactivating reactive power blocking in NEK voltage regulation mode (0 – blocking is active, 1 – blocking is inactive)

- GT1 AVR binary inputs 2 & 3 are used to switch between voltage regulation and reactive power regulation, both by NEK; two inputs (double bit information) are used for additional security (valid combinations are 01 and 10, combinations 00 and 11 are invalid)
- GT1 AVR binary inputs 4 & 5 are used to switch between reactive power regulation by ELES and reactive power or voltage regulation by NEK; two inputs (double bit information) are used for additional security (valid combinations are 01 and 10, combinations 00 and 11 are invalid)

Settings and operating ranges shall be as follows:

	Operating mode of GT1 AVR (Master)	
	Regulation by ELES	*Regulation by NEK*
Setting of desired voltage	*via IEC 61850; setting range: 360 kV……440 kV minimum step: 1 kV*	*via potentiometer; setting range: 360 kV……440 kV minimum step: 1 kV*
Setting of desired reactive power	*via IEC 61850; setting range: –500MVAr…0…+500 MVAr; minimum step: 1 MVAr*	*via potentiometer; setting range: –250MVAr…0…+150 MVAr (default); –500MVAr…0…+500 MVAr (setting)*

Note on the table above:

In “reactive power regulation by ELES - mode” or “voltage regulation by ELES - mode” AVR shall allow ELES to change the value of the desired reactive power value or voltage value via IEC61850 communication protocol, but only if this mode is activated via the corresponding binary input. The change of operating mode via binary inputs shall include “1-second-suppresion filter”. This is to avoid possible error events caused by temporary invalid values on binary inputs while the switching operation of the existing change-over switches is in progress. The activated operating mode shall be reported to NEK by output relays. Each change from one to another operating mode must be recorded by an event with time and date stamp.

A summary of the operating modes of voltage and reactive power regulation is as follows:

a) Normal operation, voltage regulation at 400 kV
   - NEK is synchronized with the 400 kV network
   - generator load switch is closed
   - Main Transformers GT1 and GT2 are operated in parallel mode
   - automatic voltage regulator GT1 AVR regulates the 400 kV voltage level according to the desired voltage which it receives via from variable potentiometer (NEK)
   - GT1 AVR is Master, GT2 AVR is Follower; GT2 AVR follows GT1 AVR

b) Normal operation, reactive power regulation mode at 400 kV
   - generator load switch is closed
   - GT1 AVR regulates the reactive power flowing between generator and 400 kV network
   - GT1 AVR is Master, GT2 AVR is Follower; GT2 AVR follows GT1 AVR

c) Station Voltage (6,3 kV) regulation
   - generator load switch is open
   - GT2 AVR regulates the 6,3 kV voltage (station supply)
   - GT2 AVR is Master, GT1 AVR is Follower; GT1 AVR follows GT2 AVR

d) Bypass operation
   - AVR in Manual Mode, operator sends control signals to Main Transformers GT1 and GT2 manually, AVR is bypassed
   - if AVR is switched on and recognizes out-of-step condition (more than 1 tap difference between GT1 and GT2) it reports alarms to operator via binary outputs.

Time synchronization shall be possible via time server (AVR is connected via switch to time server). Optionally time synchronization of the AVR and OLTC monitoring device should be done via GPS IRIG-B or via GPS.

The AVR and OLTC monitoring device shall operate totally independent of each other. Therefore, malfunctions on one device shall have no influence to operation of the other device. Thus, the AVR and OLTC monitoring device shall have each their own measurement card for current measurement transformer and voltage/potential measurement transformer. GT1 AVR shall have 2 (two) separate current inputs (from GT1 and separately from GT1+GT2) and GT2 AVR shall have one current input (GT2).

In case operator wants to control voltage/reactive power totally manually he will switch the AUTO/MANUAL switch from regular AUTO mode to MANUAL mode. The AVRs shall have this information via digital input. In this case LOWER/RISE signals from NEK control room are bypassing the AVR. As consequence AVR is NOT involved in the regulation but AVR is still active as supervisor (it still gives alarms) in case it is operational and supply voltage is present.

Characteristics of alarms activated by the AVR shall be as follows (refer Tab 1. and Tab 2. below):

Tab 1.

	ALARMS activated by AVR (potential free output relay contacts)		
	*GT1/GT2 OUT OF STEP**	*REACTIVE POWER LIMITS REACHED*	*AVR NOT READY (malfunction or loss of power/AVR switched-off)*
MANUAL operating mode AVR switched to MANUAL MODE *(operator bypassing AVR rise/lower functions)*	*operational only in case "AVR IS READY" – otherwise switched off by default)*	*operational only in case "AVR IS READY" – otherwise switched off by default)*	*operational*
AUTO operation (all modes of operation)	*operational only in case "AVR IS READY" – otherwise switched off by default)*	*operational only in case "AVR IS READY" – otherwise switched off by default)*	*operational*

Out-of-step alarm must not be activated during normal parallel operation. Out-of Step alarm has to be suppressed e.g. by a suppression filter during normal parallel operation.

Tab 2.

	ALARMS activated by AVR (potential free output relay contacts GT1 AVR and GT2 AVR)		
	U>	*U<*	*I>*
MANUAL operating mode = AVR switched to MANUAL MODE *(operator bypassing AVR rise/lower functions)*	*N/A*	*N/A*	*operational only in case "AVR IS READY" – otherwise switched off by default)*
AUTO operation (all modes of operation)	*operational only in case "AVR IS READY" – otherwise switched off by default)*	*operational only in case "AVR IS READY" – otherwise switched off by default)*	*operational only in case "AVR IS READY" – otherwise switched off by default)*

New AVRs must enable communication with ELES by IEC 61850 protocol. By this communication protocol ELES shall receive OLTCs stage information, and

information whether the AVRs are operating in automatic mode or whether the NEK operators are manually controlling the voltage/power regulation. Information of ELES desired/reference voltage and/or reactive power value shall be also sent to the NEK by IEC 61850 protocol.

New AVRs must enable PRP (parallel redundancy protocol) communication with ELES, which allows the connection to the new ELES control system in nearby RTP Krško directly without any intermediate devices. ELES has set up a new control system, which is duplicated and uses dual (redundant) communication at the device level (PRP), therefore such a connection of the new AVRs to the ELES control system is required.

In case of operational problems the AVRs shall trigger alarms to the MCR alarm annunciator. AVRs shall have the following relay channels for remote alarms:

a) GT1/GT2 voltage regulator failure
b) GT1/GT2 voltage regulator blocked
c) GT1/GT2 OLTCs at different stages
d) GT1/GT2 ELES-NEK communication interrupted (IEC 61850 communication protocol failure).

AVRs shall have the following relay channels and/or output analog channels for data transferring to the NEK Process Information System:

a) Information on whether the AVRs operate in automatic regulation mode with NEK reference value setting or in automatic regulation mode with ELES reference value setting or operating in NEK manual mode.
b) Information on whether automatic voltage regulation or automatic reactive power regulation is in function.
c) Information on the reference value of the voltage and the reactive power.
d) Information about the GT1/GT2 OLTCs stages.

6.1.1 System Sensors

The system designed by the SUPPLIER shall use as sensors for the detection of the current and voltage the existing current and voltage measuring transformers.

A current converter card shall be used to record the current values. This card only needs to pass through one of its wires the current signal of the current transformer associated with the measurement.

Current transformers which will be used for current detection on HV side (400 kV) of Main Transformers GT1 & GT2, and connected to the AVRs controlling the OLTC on GT1 and GT2 respectively, have the following characteristic:

- Current ratio: 750/5 A
- Burden rating: 30 VA
- Accuracy class: 1
- Measuring current transformer type.

Current transformer which will be used for total reactive power measuring on the AVR which controlling the OLTC on Main Transformer GT1 have the following characteristic:

- Current ratio: 1600/1 A
- Burden rating: 10 VA
- Accuracy class: 0.2S
- Accuracy limit factor: FS10
- Measuring current transformer type.

To record voltage values, a converter card shall be used with its input protected by a circuit breaker to prevent short circuits at the measuring point from degrading the functionality of the associated voltage transformer.

Voltage transformers which will be used for voltage detection on 400 kV system and connected to AVR which operates the OLTC on Main Transformer GT1 have the following characteristic:

- Voltage ratio: 400/0.1/√3 kV
- Accuracy power: 15 VA
- Accuracy class: 0.2
- Measuring voltage transformer type.

Voltage transformer which will be used for voltage detection on 6.3 kV buses M1/M2 and connected to AVR which controlling the OLTC on Main Transformer GT2 have the following characteristic:

- Voltage ratio: 6.3/0.12 kV
- Measuring voltage transformer type.

6.1.2 Hardware

The SUPPLIER shall supply hardware consisting of a grouping of cards governed by a controller unit. Associated to this controller unit shall be at least:

- Voltage measurement module,
- Current measurement module,
- Digital Input/Output module,
- Analog Input/Output module,
- IEC 61850 and PRP communication module,
- Power supply unit.

The set shall be grouped in a 19" rack cabinet.

The AVRs and OLTC monitoring system shall have the following minimum specifications:

- 3 input voltage channels,
- 2 input current channels,
- 1 input data (4-20 mA) channels,
- 4 output data (4-20 mA) channels,
- 2 input potentiometer channels (3–wire connection – potentiometer as voltage divider),
- 10 relay channels for remote indications and alarms,
- 2 optical communication IEC61850 protocol channels (PRP),
- 1 CANBUS communication channel for communication between AVRs,
- Power supply 100-240V @50Hz/60Hz,
- Controller unit memory/processing capacity.

Contractor shall supply hardware with a one (1) year warranty and the option to extend to five (5) years.

6.1.3 Installation and Commissioning

The SUPPLIER shall provide completed four (4) sets of AVR devices and OLTC monitoring devices with installed, configurated and tested (FAT performed) equipment. The equipment shall be in 19-inch racks enclosures. Two of four sets will be spare.

The SUPPLIER shall provide four (4) potentiometers for setting the NEK desired/reference voltage value on HV side of step-up transformers and for setting reactive power value, received/delivered to/from the plant. Two of four potentiometers shall be spare.

The PURCHASER will provide erection of the racks on site, as well external cables connections to the cabinets.

The SUPPLIER shall provide final supervision of installation and the system commissioning on site (at least 1 qualified person shall be provided by CONTRACTOR).

6.2 Environmental Conditions

AVRs will be installed inside Electrical Equipment Room (Turbine Building). The following data shall be used as design input:

- Minimum temperature: 15 °C,
- Maximum temperature: 46 °C,
- Relative humidity: 10-90 % (without condensate).

6.3 Foundation Requirements

AVR equipment should be dimensioned for mounting in 19-inch racks enclosure suitable to be fastened to the rack frame in existing GT1 & GT2 OLTC regulating cabinet/board with screws or bolts.

6.4 Electrical Requirements

6.4.1 Electrical Power

Available power input for the equipment in existing regulating board/cabinet is 230 VAC.

6.4.2 Cabinet Internal Wiring

The PURCHASER will provide all necessary internal wiring in GT1 & GT2 OLTC regulating board (connection to terminals, auxiliary relays, switches etc.) where purchased equipment will be installed.

6.4.3 External Wiring

The PURCHASER will provide all necessary external wiring (connection to measuring transformers, power supply, alarms).

6.4.4 Grounding

Equipment racks housing shall be equipped with grounding screws so that the housing can be connected (by purchaser) to grounding bar in the cabinet.

6.5 Preliminary Equipment List

The SUPPLIER shall assemble and provide complete component list (BOM) for NEK review and concurrence prior to procurement.

6.6 Preliminary Equipment Selection

To indicate operating statuses and events devices shall have graphics displays and LEDs. For local settings and control, the devices shall be equipped with buttons/keys and rotary knobs.

6.7 Location and Mounting

Devices for voltage and reactive power regulation and OLTC monitoring on Main Transformers GT1 and GT2 will be permanently mounted in existing OLTC Regulation Board GT1 & GT2 (XR100XFRG701) in Electrical Equipment Room (Turbine Building).

6.8 Ventilation Requirements

Existing OLTC Regulation Board GT1 & GT2 where the new devices will be installed is a naturally ventilated cabinet and the devices must be suitable for installation in such a cabinet.

7 PERFORMANCE REQUIREMENTS

7.1 General

Voltage and reactive power regulation and OLTC monitoring system on Main Transformers GT1 and GT2 shall be capable of autonomous, automatic operation after started up. After loss of power supply, voltage recovery and a reset of devices the last valid value of desired/reference voltage (or of desired reactive power) shall be re-used. This feature is independent of origin of the value (NEK setting or ELES setting via IEC 61850 protocol).

7.2 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.

7.3 Qualification

N/A

7.4 Separation

N/A

7.5 Calibration

Adequate instrument calibration 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.

8 MATERIALS AND DETAILS OF CONSTRUCTION

The SUPPLIER shall assume complete responsibility for structural design.

All material used shall be new and of the best quality in order to work under the conditions specified. Also fire resistant, flame retardant, low-smoke and halogen-free material shall be used.

All materials shall be suitable for temperature variations and atmospheric conditions, without undergoing any distortion or deterioration.

9 FABRICATION AND ASSEMBLY

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

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

10 INSPECTIONS AND TESTS

10.1 Test Responsibility

The SUPPLIER shall perform all necessary factory acceptance tests (FAT) to verify that supplied equipment meets requirements of applicable codes and standards and this Specification. Testing, inspection, and acceptance criteria shall conform to the applicable codes and standards as specified.

The SUPPLIER shall prepare test procedures for all factory acceptance tests and submit them to the PURCHASER for review and approval.

Any deficiencies or malfunctions, which occur during the tests, shall be corrected and the test repeated.

Test reports shall be prepared for each test and submitted to the PURCHASER for review and approval.

Prior to shipment, each item shall meet the performance requirements specified.

10.2 Visual Inspection

Visual inspection of steel and painting shall include:

a. General workmanship.
b. Assembly and fit of supports.
c. Quantity and size of cutouts as shown on the Drawings.
d. Weld quality and integrity (if welding applied).
e. Surface smoothness.
f. Overall dimensions.
g. Color matching (if painting applied).
h. Paint coverage (if painting applied).
i. Absence of blemishes.
j. Paint thickness (if painting applied).

10.3 Performance Tests

The SUPPLIER shall be responsible for the testing and inspection of components ordered by him and shall perform such testing as early as is practical. The SUPPLIER shall replace defective, damaged, or faulty components at his expense.

Each electrical switch or switching device shall be tested in all switch positions to verify conformance with the switch development requirements.

A continuity ground check of all metallic components capable of carrying current shall be made.

Screws and nuts securing wiring to terminals shall be checked for tightness.

Power and control wiring shall be subjected to a 1500-volt AC high potential test to ground for 1 minute.

Production tests, the test conditions, test methods, and test results shall be accurately recorded, and appropriate test reports prepared. The final reports shall include copies of all original data sheets as recorded (i.e., original handwritten record in lieu of transcribed copy). The final reports shall be reviewed by competent technical personnel who shall certify that the equipment tested meets all requirements of this Specification.

Certifications of design tests shall contain statements on when, where, and by whom the tests were performed and shall state the results of the tests. These certifications shall be signed by a responsible individual in the employment of the SUPPLIER.

11 ITEM QUALIFICATION

11.1 Nuclear Grade Classification

Voltage and reactive power regulators and OLTC monitoring devices on Main Transformers GT1 and GT2 is classified as augment quality[1] equipment.

11.2 Environmental Qualification

Environmental conditions for installed equipment are specified in section 6.2.

Cabinets shall have ingress protection of IP31, as minimum.

11.3 Seismic Qualification

N/A

[1] See item 20 QA PROGRAM REQUIREMENTS.

12 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.

Equipment internals shall be shop cleaned. All the surfaces shall be visibly dry prior sealing and final packaging.

13 CORROSION PROTECTION AND COATING

Galvanized steel, stainless steel and non-ferrous surfaces shall not be painted.

The color for External Surfaces (if painting is applied) shall be light gray (RAL 7038).

The SUPPLIER shall submit corrosion protection and coating procedures to the PURCHASER for review and approval.

14 MARKING AND IDENTIFICATION

All components must be clearly identified and marked in such way to eliminate any question or confusion at subsequent identification.

The SUPPLIER shall provide temporary markings of all equipment (e.g. on front of rack housings). Markings shall be confirmed by NEK.

NEK will provide final markings.

A complete list of preliminary labels, markings and identifications shall be provided to NEK for approval in order to harmonize them with NEK standard labeling system. The SUPPLIER shall provide only temporary markings for front side of cabinets, as NEK will provide permanent labels.

The SUPPLIER shall provide supplement data of all devices and spare parts for NEK MECL database in Excel spreadsheet provided by NEK.

15 PACKAGING, HANDLING AND STORAGE

Exposed finish surfaces shall be protected against corrosion or physical damage during shipment or storage. Electrical equipment controls and insulation components shall be protected against moisture and water damage.

The SUPPLIER shall prepare procedures for packaging, handling, storage and cleaning after installation. The packaging procedure shall take into account the method of transportation to be used, as well as the possible storage duration and storage environment. The procedures shall be submitted to the PURCHASER for review and approval.

If any special storage requirements are required, the SUPPLIER shall inform the PURCHASER sufficiently in advance of shipping to allow for necessary preparation.

16 NONCONFORMING MATERIALS

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

17 RECORDS

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 a minimum, identify SUPPLIER'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 sent to NEK.

18 OTHER REQUIREMENTS

18.1 SUPPLIER's Responsibilities

The SUPPLIER shall be responsible for complying with all detailed requirements of this Specification. Review and approval of any drawings, specifications and/or tests by the PURCHASER shall in no way relieve the SUPPLIER from these responsibilities.

Specific requirements which the SUPPLIER shall follow during design and fabrication process are given in the sections 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15 of this Specification.

In addition to the requirements of this Specification, the SUPPLIER shall be responsible for performing analyses, tests, inspections and other activities which the SUPPLIER considers necessary to make sure that the design, material and workmanship are satisfactory for the service intended, or as may be required by common usage or practice.

The SUPPLIER shall obtain resolution of any conflict from the PURCHASER prior to proceeding with any work involving that conflict.

18.2 PURCHASER's Responsibilities

The PURCHASER shall have the following responsibilities:

1. Provide the SUPPLIER with all available documentation upon request.
2. Provide any special requirements applicable to the installation of equipment.
3. Designate a contract Responsible Engineer who will serve as the principal interface with the SUPPLIER.

Whenever the PURCHASER's approval is required in this Specification for submittals, procedures, methodologies, approaches or options, such approval shall be provided in writing or if provided orally shall be confirmed in writing. The PURCHASER will provide all required approvals in a timely fashion consistent with the project schedule.

The PURCHASER shall review proposed additions to the approved products listing and determine if they meet the requirements of the NEK Chemical Control Program. Approved products will be allowed on site with proper labeling.

19 RIGHT OF ACCESS

PURCHASER's representative shall be allowed to all areas where the design, fabrication, and assembly of the components, subcomponents and accessories will take place such as shops, working areas, and engineering offices of the SUPPLIER and its suppliers at any time for the purpose of quality assurance audits, surveys, inspection and witnessing. Witness and hold points with advance notice requirements should be stipulated.

Such surveys will include examination of documentary evidence of activities affecting quality and will be carried out on a planned, periodic basis during the course of the work to verify compliance with all aspects of the program and to determine the effectiveness thereof.

20 QA PROGRAM REQUIREMENTS

20.1 SUPPLIER's QA Program

The SUPPLIER must have established and implemented efficient QA Program which complies with standard ISO 9001 or comparable standard and conforms to relevant PURCHASER QA requirements, specified in specification NEK QS-610, rev.2 Generic Quality Assurance Program Requirements QA Program.

The relevant PURCHASER QA requirements of specification QS-610 rev. 2 are: General Requirements (requirements 1.1, 1.2, 1.6, 1.7), Documents for Submission (requirement 3), Organization (requirement 4.1), QA Program (requirement 4.2), Design Control (requirements 4.3.1 to 4.3.9), Procurement Document Control (requirements 4.4.1 to 4.4.7, 4.4.9), Instructions, Procedures, and Drawings (requirement 4.5), Document Control (requirement 4.6), Control of Purchased Items and Services (requirement 4.7.1 to 4.7.4), Identification and Control of Items (requirement 4.8), Control of Special Processes (requirement 4.9), Inspection (requirement 4.10), Test Control (requirement 4.11), Control of Measuring and Test Equipment (req. 4.12), Handling, Storage, and Shipping (requirement 4.13), Inspection, Test, and Operating Status (requirement 4.14), Inspection, Test, and Operating Status (requirements 4.15.1, 4.15.3 to 4.15.7), Corrective Action (requirement 4.16), Records (requirement 4.17) and Audits (requirement 4.18).

The SUPPLIER 's QA program shall assure that all materials, manufacturing practices, examinations and testing conform to the requirements of this Specification. All technical and quality requirements shall be met.

One (1) copy of the SUPPLIER 's QA program manual shall be submitted to NEK with the Bid. All portions of QA program that have been revised during the period under this specification must be accepted by NEK beforehand within 2 weeks of submittal by SELLER.

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 SPECIAL HANDLING

The SUPPLIER shall specify any special handling requirements and provide the PURCHASER with appropriate procedure, which shall explain and emphasize them in detail.

The SUPPLIER shall provide any special requirements and advice for maintaining cleanliness of the components during extended site storage, indoors or outdoors, and installation.

The SUPPLIER shall also specify additional requirements necessary to maintain equipment warranties.

Special handling requirements shall be provided in the vendor technical manual.

22 SHELF LIFE

The SUPPLIER shall not ship any item that has less than five-year remaining shelf life at time of shipment.

The SUPPLIER shall provide shelf life data as follows:

1. Expiration date,
2. Cure date or manufacturing date, and
3. Material composition.

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

23 10CFR21 REPORTING

N/A

24 COMMERCIAL GRADE ITEM DEDICATION

N/A

25 SUPPLIER DOCUMENTATION REQUIREMENTS

The SUPPLIER documentation requirements are given in the sections 5, 10, 11, 12, 13, 15, 16, 20, 27, 28, 30, 31, 33 and 34 of this Specification.

Each shipment must be accompanied by certification containing the signature of a person responsible for the quality function of the SUPPLIER, stating the material or items conform to all purchase order requirements. Applicable part numbers and other item identification, qualification reports and the NEK Purchase Order number shall be referenced by the certification.

The SUPPLIER shall provide to the PURCHASER a list of recommended spare and replacement parts or assemblies for the ordered / supplied item. The appropriate delineation of the technical and quality assurance related data required for ordering these parts or assemblies shall also be identified. Each part of supplied Augmented Quality component must be classified for AQ application and must be notified on replacement parts list or Bill of Material. This data shall be supplied as part of the final documentation package for information.

26 PURCHASER PROPRIETARY DATA

The PURCHASER has a proprietary interest in all of the 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 there from (hereinafter collectively referred to as the "Information"). All such information shall be considered to be proprietary to the PURCHASER. The right to use of all such Information shall be transmitted to the SUPPLIER only for its personnel use and shall be entirely restricted to the performance of the contract and subject to the confidentiality provision.

27 NONCONFORMANCE REPORTS

Nonconformances with specification requirements, approved drawings, and applicable codes and standards invoked by this Specification will not be accepted until approved by the PURCHASER.

Nonconformances to be reported for approval by the PURCHASER are those ones, which cannot be brought within specification requirements by rework or replacement. When such condition exists, the SUPPLIER shall initiate a Nonconformance Notice (NCN) using the SUPPLIER's standard proposed disposition. In addition, the SUPPLIER shall:

1. Segregate the nonconforming item to prevent any further processing which may result in a change of the nonconformance as identified.
2. Properly disposition and send the NCN to the PURCHASER.
3. Provide technical justification if recommended disposition is "Accept-As-Is" or "Repair".

The resolution NCN shall be approved by the PURCHASER. Further engineering and/or manufacturing after detection of non-conformances, prior to the PURCHASER's approval shall be at the SUPPLIER's risk.

The non-conformance report shall provide a method by which the SUPPLIER shall obtain a documented response and approval from PURCHASER when non-conformances are identified. The use of the non-conformance reports will pertain to work at the SUPPLIER's and/or subcontractors' shops.

28 REPAIR RECORDS

Together with the documentation package shipment the SUPPLIER shall provide the PURCHASER with all generated repair records and they shall include as a minimum the following information:

1. Summary of repair/refurbishment work that has been performed on the item(s).
2. Brief analysis of the reason for failure of the item(s).
3. Details of any special processes used during repairs that were not used during fabrication.
4. A list of replacement parts installed in the repaired items(s).

29 SOURCE INSPECTION/SURVEILLANCE NOTIFICATION

SUPPLIER shall provide access to the SUPPLIER 's plant facilities and records pertaining to this Specification for the purpose of planning and performing source inspection / surveillance activities.

The PURCHASER requires ten (10) working days advance notice for the purpose of establishing hold points and ten (10) working days advance notice that witness or hold points have been reached.

The SUPPLIER shall contact the PURCHASER’s designated representative when a witness or hold points have been reached. The SUPPLIER will not proceed past that point until inspection has been established or waived by the PURCHASER.

Inspection or examinations performed by the PURCHASER, or designated representatives do not relieve the SUPPLIER of its responsibility to meet the requirements of this Specification.

30 SHIPPING REQUIREMENTS

The SUPPLIER shall provide packaging and shipping methods for protection from the effects of temperature extremes, humidity, transit shocks and jarring.

The shipping container shall be clearly tagged with the NEK identification number and NEK Purchase Order number.

Material and all certifications or accompanying documentation supplied within the scope of this specification shall be directly shipped from the SUPPLIER to PURCHASER. The import agent shall not take possession of material or documentation.

The PURCHASER's authorized source inspectors have the right to hold shipment if purchase order requirements are not met.

31 DELIVERY SCHEDULE

After contract award, the SUPPLIER shall, on the basis of delivery milestones defined in the contract, provide an integrated detailed delivery schedule with milestones for fabrication and delivery of component(s) which will be provided within the scope of this Specification.

32 WITNESS AND HOLD POINTS

The SUPPLIER shall provide the Manufacturing and Inspection Plan of overall activities in accordance with the scope of contractual activities to the PURCHASER for review and approval.

The PURCHASER shall have the right to determine his own witness and hold points in the SUPPLIER's Manufacturing and Inspection Plan. For these witness and hold points the PURCHASER may establish notification points for which the SUPPLIER shall give prior notification to the PURCHASER. In addition, the PURCHASER may establish hold points and temporary notification points if necessary to ensure resolution of quality problems or temporary quality problems.

Predetermined hold points and notification points require receipt of notification at least ten (10) working days in advance of the scheduled time of performance.

Predetermined witness and hold points require receipt of notification at least ten (10) working days in advance of the scheduled time of performance.

The following hold points for which a prior notification is required are:

1. Factory tests,
2. Shipping release.

The SUPPLIER shall not proceed beyond the predetermined hold points without written approval from the PURCHASER.

33 VENDOR TECHNICAL MANUAL AND REGISTERED UPDATES

The SUPPLIER shall furnish a vendor technical manual with all necessary information for operation and maintenance, updated specific data and equipment(s) drawings. Standard manuals are not acceptable unless clearly marked or modified to indicate the concerned equipment.

A special attention shall be paid to technical documentation and instructions for the following topics:

1. Storage,
2. Installation,
3. Operating instructions,
4. Maintenance instructions and servicing schedule,
5. Troubleshooting,
6. Replacement parts,
7. Special tools and instrumentation,
8. Drawings of components and related equipment.

The SUPPLIER shall also provide drawings for all components and related equipment with a list of components, appertaining “part numbers” and their materials as part of the manual together with the list of recommended spare parts.

34 TRAINING

The SUPPLIER shall provide on-site training on the fundamentals of voltage and reactive power regulation and OLTC monitoring issues. The SUPPLIER shall provide information on the operation of the devices and the use of the configuration / status display software.

The SUPPLIER shall also provide necessary hands-on training for NEK personnel that will perform the equipment firmware upgrades and any configuration changes in firmware that may need to be done in the future.

35 ATTACHMENTS

Attachment 1: BIDDER'S Equipment Specification Exceptions form (1 page)

Attachment 2: QS-610, Rev.2, Generic Quality Assurance Program Requirements

Attachment 3: SP-3, Rev.5, Cyber Security Program

ATTACHMENT 1
EQUIPMENT SPECIFICATION EXCEPTIONS
KRŠKO NUCLEAR POWER PLANT

The BIDDER certifies that the Proposal is in complete and absolute agreement with this Specification, except as specifically outlined below (use additional sheets if required).

BIDDER'S NAME

MANUFACTURER'S NAME

QUOTATION NUMBER

SIGNATURE

TITLE

Exceptions from this Specification: