



NPP KRŠKO
TO.VZ

TECHNICAL SPECIFICATION

For
NPP-Krško Steam Generators
Eddy Current Inspection in Outage 2018

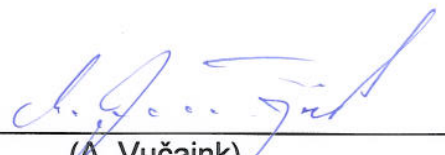
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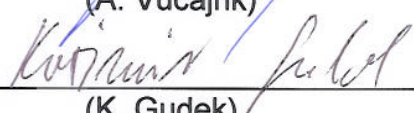
(Rev. 0)

Prepared by:


(A. Vučajnk)

Date: 31 / 03 / 2014

Reviewed by:


(K. Gudek)


Date: 31 / 03 / 2017

Reviewed by:

B. BOGNAR
(QA engineer)

Date: 31 / 03 / 2017

Approved by:


(V. Planinc)

Date: 31 / 03 / 2017

Table of contents:

- 1.0 ACTIVITY**
- 2.0 SCOPE**
- 3.0 SAFETY CLASSIFICATION**
- 4.0 TYPE OF SERVICE**
- 5.0 APPLICABLE CODES, STANDARDS AND PROCEDURES**
- 6.0 IDENTIFICATION OF EQUIPMENT AND COMPONENTS**
- 7.0 TECHNICAL REQUIREMENTS**
- 8.0 QUALIFICATION REQUIREMENTS**
- 9.0 DETAIL SCHEDULE**
- 10.0 SUPPLIER RESPONSIBILITIES**
- 11.0 NEK RESPONSIBILITIES**
- 12.0 SPECIAL REQUIREMENTS**
- 13.0 QA REQUIREMENTS**
- 14.0 APPENDICES**

1.0 ACTIVITY

Technical Specification defines requirements related to performance and scope of the Steam Generator (SG) Eddy Current (ET) inspection during refueling outage 2018, under terms and conditions specified in this document. Potential supplier (bidder) is therefore expected to submit proposal for service mentioned above.

2.0 SCOPE

Scope of services, inspection frequencies and tube sampling are given in procedure: ADP-1.4.322 Inservice Inspection of Steam Generator Tubes, Rev.0, par. 5.2 (Ref. 5.07). In the event of C-2 and C-3 results, scope of inspection shall be increased in accordance with the requirements from SR 3.4.5.2 and SR 3.4.5.3 (Ref. 5.06).

- 1) Scope of bobbin probe inspection, when Steam Generators exhibits C-1 condition, is 50 % of the tubes in each SG. Inspection scope contains tubes not inspected in previous ECT outage.
- 2) MRPC, + point probe, x-probe or Array probe inspection of (up to) 150 indication or positions per SG.
- 3) Plug Position verification of 36 plugged positions with documented VT-video record. Each plugged position shall be recorded and evaluated for Boron residuals – if any. This requirement is based on industry feed-back (Event Analysis Report EAR PAR 08-065).

DEFINITION OF SCOPE:

During next refueling outage (R18) **Standard Scope of Inspection** is to be performed containing as follow:

- 50% tubes - 2714 per SG by bobbin probe
- Up to 150 tubes (positions) by MRPC, + point probe, x-probe or Array probe indication / position confirmation per SG
- Plugs position verification (SG#1 + SG#2 =18 tubes)

Supplier is expected to prepare proposal for Standard Scope of Inspection as stated above.

Outage 2018 Standard Scope of inspection in details:

1) BOBBIN (5428 tubes):

- 50 % of tubes by bobbin probe following the scope of inspection in previous ECT outage

2) MRPC (up to 150 locations per SG):

- Tubes (positions) by MRPC or +point probe - indication confirmation (SG#1&2) = 18 tubes (36 positions).
- All hot leg dents/dings with bobbin voltages ≥ 2.00 volts; ~40 dents/dings.
- Areas of Interest identified during previous and current inspection. ~40 posit.
- 20% of Low Row U-bends
- 25 U-bands.
- PLP (Possible Loose Part) locations identified during the previous inspection. cca 20 TTS locations.
- 20% MBM which have not changed characteristics since the pre-service inspection; < 10 MBMs expected.
- 1 confirmed LPL (Loose Part Location) on SG#1 and 3 LPL on SG#2 (Att.3)
- SG#2 Indications due to foreign object reported in outage 2007 by Plus point probe (Row 1&2) shall be inspected with the same ET technique as in outage 2007 (in accordance with ETSS 27904.1 from EPRI TR 14981; Ref. 5.09).

3) Plugs position verification (VT2 & VT1 inspection):

- 36 plug positions to be inspected by VT providing plug position video-record.

Eventual traces of foreign object - damage (scratches, dents, cracks) on the Tube Sheet cladding surface shall also be reported if detected during normal ET acquisition process (due to NEK TD-2S Aging program.).

Supplier shall provide all necessary personnel, equipment and consumables required for performance of Steam Generator Eddy Current Inspection.

3.0 SAFETY CLASSIFICATION

ECT Inspection of Steam Generators is considered as Safety Related (SR) activity.

4.0 TYPE OF SERVICE

SG ET Inspection is considered as type of service with fixed price for defined activity and scope according to supplier's procedures which will be reviewed and accepted by NEK and includes supplier's QA/QC.

5.0 APPLICABLE CODES, STANDARDS AND PROCEDURES

- 5.01 TD-OH Program uparjalnikov rev.2
- 5.02 ASME B&PV Code Section V, Edition 2007
- 5.03 ASME B&PV Code Section XI, Edition 2007 with the Addenda 2008
- 5.04 ANSI/ASNT CP-189 (1995)
- 5.05 Steam Generator Management Program: Pressurized Water Reactor Steam Generator Examination Guidelines: Rev. 7. EPRI – TR-1013706 (October 2007)

- 5.06 NEK Technical Specification SR 3.4.5.0
- 5.07 ADP-1.4.322 Inservice Inspection of Steam Generator Tubes
- 5.08 ISI-4.301 General Procedure for Eddy Current Inspection of SG tubes
- 5.09 Steam Generator Foreign Object Handbook – EPRI TR 1014981
- 5.10 PERFORMANCE DEMONSTRATION DATABASE: ETSS # 27904.1 Appendix A Technique Specification Sheet (Rev. 0 June 2007)
- 5.11 NRC INFORMATION NOTICE 2004-10, Loose Parts in Steam Generators
- 5.12 Generic Letter 97-06: DEGRADATION OF STEAM GENERATOR INTERNALS
- 5.13 EPRI - TR 1020989; Foreign Object Prioritization Strategy for Triangular Pitch Steam Generators.
- 5.14 NEER-G/2008/en/0100 Rev. A: Operational and Maintenance Manual of Replacement SG Krško Model SG 72W/D4-2.

6.0 IDENTIFICATION OF EQUIPMENT AND COMPONENTS

NPP – Krško Replacement Steam Generators model 72W-D4/2 with I - 690 TT $\frac{3}{4}$ " tubes, triangular pitch and grid supports design. MECL: RCPCSGN1, RCPCSGN2

7.0 TECHNICAL REQUIREMENTS

ECT Steam Generators inspection (data acquisition, data analysis, Computerized-Automated Data Screening, inspection planning and data management) as well as overall System Performance for EC Steam Generator examination including technique, analysis and human performance, process controls and field analysis feedback, shall be performed in accordance with requirements of *EPRI document TR-1013706 Ref. 5.05*

7.1 ECT TECHNIQUES, INSPECTION PLANS & PROBES

Bobbin probe inspection:

- 1) R1 through R10, C1 through C131 HL straight length using 0.630" diameter bobbin probe from 11-HL to TE-HL;
- 2) R1 through R10, C1 through C131 CL straight length and U-band (except R1 U-bends) using 0.610" and/or 0.590" diameter bobbin probe from 11HL to TECL;
- 3) R11 through R107, C1 through C131 full length test using 0.630" diameter bobbin probe from TE-CL to TE-HL and/or TE-HL to TE-CL;
- 4) "3-frequency bobbin coil mix" ET technique shall be implemented based on the reference 5.11.

MRPC, + point probe, X-probe or array probe inspection:

- 5) R1 C1 through C131 U-band test by using 1 coil MRPC or + point probe from 11-CL to 11-HL and/or 11-HL to 11-CL;
- 6) Confirmation of bobbin probe indications by 3 coil MRPC or + point probe

- 7) SG#2 Indications due to foreign object reported in outage 2007 by Plus point probe (Row 1&2) shall be inspected with the same ET technique as in outage 2007 (in accordance with ETSS 27904.1 from EPRI TR 1014981; Ref. 5.09).

7.2 ECT EQUIPMENT, SYSTEM AND SOFTWARE

ECT Data acquisition equipment, system and software options to be used:

Equipment (manipulators with dual and/or multiple probe pusher system), ET - Instrument, System and appropriate software for data acquisition, analysis & management shall be qualified as required by SGMP PWR Steam Generator Examination Guidelines: Rev. 7 (ref. 5.05).

8.0 QUALIFICATION REQUIREMENTS

Inspection personnel shall be trained, qualified and certified in accordance with following requirements:

- 1) ASME B&PV Code Section XI, Edition 2007 with the Addenda 2008
- 2) ASME B&PV Code Section V, Edition 2007
- 3) ANSI/ASNT CP-189, ASNT Standard for Qualification and Certification of Non Destructive Testing Personnel, 1995 Edition
- 4) EPRI – PWR Steam Generator Examination Guidelines: Rev.7, Vol.1, App. G (Qualification of NDE personnel for analysis of NDE data): Requirements (TR-107569-V1R5) – latest revision.
- 5) EPRI - Steam Generator Eddy Current Data Analysis – Performance Demonstration Review Material (PDD), Research Project S-530, (including latest updates).

Data acquisition personnel shall be qualified & certified for at least level I or II. Data analysis personnel shall be qualified & certified as Level II / QDA. Leading analyst (s) performing data resolution shall have ASNT NDT Level III certificate (Ref. 5.04) and valid QDA certificate. Supplier shall have Company - Written Practice (Procedure for Qualification & Certification of NDT Personnel) as required by Ref. 5.04. In Company – Corporate ET Level III shall have ASNT NDT Level III certificate. If training, qualification & certification of NDT personnel has been organized and performed **in-house Bidders Company** (without Outside Organization) all activities shall be administrated by ASNT ET Level III also.

Supplier's ET personnel shall pass Site Specific written and practical ET exam (as per ref. 5.05) on NPP Krško site administrated by independent IQDA contracted by NEK before start of inspection activities (see section 12.0).

TO.VZ-ISI (NEK) will perform technical and regulations evaluation of potential suppliers bidding - proposals based on the requirements prescribed in paragraph 5.0, 7.0, 8.0 and 12.0. (Remark: TO.VZ-ISI: Leading ISI Engineer and NEK Corporate NDT Level III).

9.0 DETAIL SCHEDULE

Steam Generator Eddy Current inspection activities shall be performed on around o'clock basis, 24 hours / per day. Supplier shall propose a detail schedule of the inspection which shall not exceed 86 hours for inspection of both Setam Generators working in parallel. 86 hours' time frame refers to SG platform equipment set-up, inspection and completed tear down (i.e. critical path of EC data acquisition activities). EC Inspection is scheduled for April 2018; from 12th April 11:00 to 16th April 01:00 for both Steam Generators SG#1 and SG#2, see Att. 1. Eventual changes of Outage plan are possible and will be hand-over to supplier.

10.0 SUPPLIER RESPONSIBILITIES

Potential Contractor (Supplier) shall provide bidding - technical proposal including the following documents:

- Site Inspection Organization Chart / scheme with names and responsibilities.
- Trained, qualified and certified inspection personnel as required in Section 8.0 with a List of valid ET - certificates in accordance with requirements from paragraphs 5.0 and 8.0.
- Suppliers Company Written Practice as required in paragraph 8.0 QUALIFICATION REQUIREMENTS.
- Applicable procedures i.e. for equipment installation, data collection, data analysis etc. All working procedures shall be prepared in accordance with applicable regulations (Sections 5.0, 7.0, 8.0 & 12.0) for the review and approval.
- Suppliers ET procedures shall address FME (Foreign Material Exclusion) responsibilities of acquisition personnel.
- Site Inspection Organization Chart including at least 1 individual per shift with NEK Work-Leader status.
- Bidders Company Reference list of ET data acquisition & analysis on vertical PWR Steam Generators same or similar to model 72W-D4/2 having I-690 TT ¾" tubing, triangular pitch, lattice bars supports, baffle plate and Siemens design tube band supports (AVB), see Att.2. Only Company References from the NPP's with data acquisition & analysis - together in the time interval 2009-2017 will be taken into account!

Other supplier responsibilities / documents to be provided **after awarding** a contract:

- Preparation, training, Inspection Plan for activities to be performed
- Performance of all field activities in accordance with ALARA principles specified and mutually agreed with NPP-Krško Health Physics dep.
- List of Calibrated equipment as specified by Section 7.0 and consumables required for performance of Eddy Current Steam Generator Inspection.
- Completion of required scope within available time frame (Section 9.0)
- Turn over of SG primary channel head, platform and all working areas clean and in the same condition as at the start of activities
- Two copies (master & copy) of ECT data
- Reports of inspection performed (Daily, Preliminary and Final reports). All reports shall be hand over to NPP Krško representative for review and comments.

- Containers for data acquisition, analysis and management (for suppliers personnel)

11.0 NEK RESPONSIBILITIES

NPP Krško shall provide the following:

- All necessary applicable as-built drawings (Att. 2), technical details and previous ET reports of Replacement Steam Generators (for History management purpose).
- latest revisions of applicable NPP-Krško ET and field service procedures
- NPP Krško Eddy Current Data Analysis Guidelines document
- Site specific field service training courses for supplier personnel (HP i.e RZ II & RZ III, shift-work leader, indoctrination etc.)
- Applicable ET calibration blocks
- Clean SG mock-up for training purpose and on-site transportation & lifting
- Access to SG platform and primary channel head manways
- Power supply , compressed air and demineralized water
- HP coverage and decontamination of supplier equipment
- Support of mechanical and electrical shop if necessary
- Independent IQDA oversight (Ref. 5.05) will be designated by NPP Krško.
- Site Specific written and practical ET exam on site administrated by independent IQDA
- ISI representative (ISI engineer) will take care of explanation, field application and necessary instruction to site specific requirements from applicable NPP-Krško procedures as referred to. Supplier's personnel are obliged to follow ISI representative instructions.

12.0 SPECIAL REQUIREMENTS

Data analysis shall be performed in accordance with organization plan from reference 5.05 SGMP PWR SG Examination Guidelines rev. 7; Figure 6-1, Typical Data Flow (page 6-12).. Three (3) frequency mixer-channel shall be integrated in applicable-bobbin ETSS to fulfill requirements from ref. **5.11 NRC INFORMATION NOTICE 2004-10, Loose Parts in Steam Generators** to assure detection of potential loose parts.

Applicable block (yes/no) within analyses flow chart shall also be integrated into ETSS to provide detection of tube lattice grids support ET signal anomalies as required by **Generic Letter 97-06: Degradation of Steam Generators Internals**.

Site Specific written and practical Exam will be administrated by independent IQDA individual contracted by NEK. Suppliers ET personnel will receive all necessary documents (NEK Specific Analyze Guidelines, applicable NEK ET procedures, acceptance criteria, ...) and ET data for training purpose on site. Scope of Written exam will include questions from documents mentioned above (SG design, degradation mechanisms, NEK specific characteristics,..) and suppliers ET procedures. Practical exam will contain NEK ET data. Both exams will be conducted on the PC stations with

software grading similar to QDA exam. Scope and criteria for written and practical Site Specific exam are defined in ref. 5.05.

13.0 QA REQUIREMENTS

Supplier shall attach to the proposal a copy of his Quality Assurance (QA) Manual which shall conform to the requirements of 10CFR 50 Appendix B, 10 CFR Part 21 and NEK's Quality specifications QS 610 "Generic Quality Assurance Program Requirements" and QS 600 "Quality Assurance Specification for Software" (Att. 3 & 4). In the case that supplier is already on NPP-Krško Approved Supplier List, written statement about present status and applicability of QA Program & software for required scope shall also be hand over in proposal.

Supplier shall submit documentation's before start of contracted scope of service containing, as a minimum, the following:

- a) Service work implementation-organization chart in respect of duties, responsibilities and authorities of inspection personnel
- b) QA/QC Sequence and Inspection Plan to be reviewed and approved by NPP-Krško and Authorized Organizations to determine the level of supervision; (R-Record, W-Witness, H-Hold, T-Test will be added).
- c) Supplier's Approved Documents List related to scope of service
- d) Set (copy) of applicable procedures
- e) List and copy of NDT-ET personnel qualification and certification documents in accordance with requirements from Section 8.0.
- f) Copy of Medical and vision test reports of inspection personnel
- g) Occupational External Radiation Exposure History records for personnel to be working in controlled area (for NPP-Krško HP)
- h) List of ET equipment, techniques and software with appropriate (if applicable) calibration records and certificates

During service performance and after completion of Inspection, supplier QA representative is obliged to prepare and deliver written reports as follow:

Daily reports:

For every day of service covering period of 24 hours, the report shall contain previous day scope performed and eventual deviation reports as well as work interruptions and delays.

Preliminary Report:

Within 1 day after the completion of inspection, preliminary report (two (2) copies) with results of inspection containing list of tubes with indications exceeding the reporting limit determined by applicable criteria and regulation. In addition, Inspection Plan versus performed inspection activities shall be included as well as list of deviation reports with their status.

Final Report:

Not later than one (1) month after inspection completed, the Final Inspection Report in four (4) copies shall be submitted for each SG. Inspection report shall contain completion of scope data, results of all inspected tube, tube sheet maps with indications presentation, histograms presenting indication depth vs. number of indications (for bobbin coil only) for every 10% of depth, as well as inspection plans versus inspection activities performed. In addition, list of inspection personnel with qualification and certification documents as well as list of ET equipment, techniques and software with appropriate (if applicable) calibration records and certificates. Also, an analysis of indications found, their statistical analysis, two copies of ET raw data (master & copy) and recommendations for the scope of the further inspections should be included in Report. In addition, report shall contain list of deviation reports (with their status), procedures implemented, reports of on-site QA audits as well as overall service performed assessment. Front page of the Final Report File shall contain Total pages information. In addition entire file shall have page numbering.

14.0 APPENDICES

Att.1: Outage plan 2018

Att. 2: SG as-built drawings: (2-1), (2-2), (2-3), (2-4), (2-5) (Available on the NEK Site)

Att. 3: Foreign object left in operation after Outage 2016.

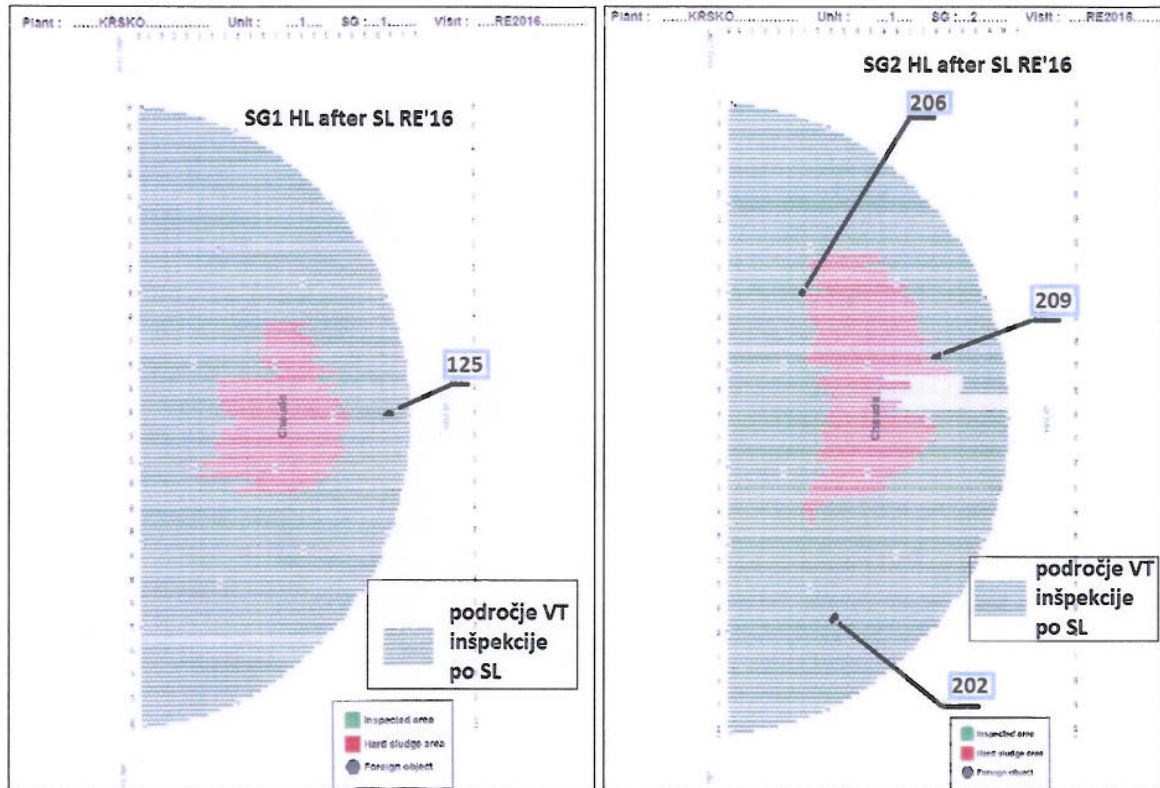
Att. 3 : NEK QS 610, "Generic Quality Assurance Program Requirements"

Att. 4: NEK QS 600, "Quality Assurance Specification for Software"

Remark: All SG drawings have proprietary information status. Potential vendor will have access to study design details only on the site of NPP Krško.

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Att. 3: Lose Part Locations (LPL) after Outage 2016:



Remark: Detail description, row/column location and orientation of the LPL will be provided to supplier after awarding a contract.