

**NPP KRŠKO
TO.VZ**

TECHNICAL SPECIFICATION

No. ISI 02/20

for

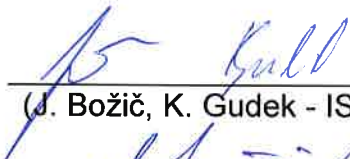
**Inspection of Primary Components
During Outage 2021 and 2022**

EBS IN: 8200906

Revision 2

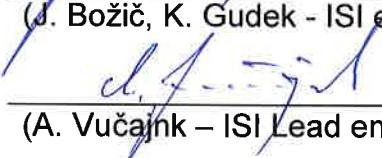
Safety Related

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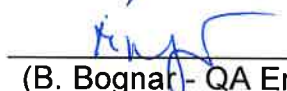
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Table of contents:

- 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 NPP KRŠKO RESPONSIBILITIES**
- 12.0 SPECIAL REQUIREMENTS**
- 13.0 QA REQUIREMENTS**
- 14.0 APPENDICES**

1.0 ACTIVITY

NPP Krško is a pressurized water reactor two-loop plant of Westinghouse design. It is in commercial operation since 1983 and currently is running fourth inspection interval based on ASME Section XI, 2007 Edition with Addenda 2008. Fourth Inspection Interval started in July 2012 and will end in July 2022.

This Technical Specification defines requirements related to 10 year Reactor Vessel Inservice Inspections, Reactor Vessel Internals Inspections and Reactor Vessel Head Inspections. These activities will be performed during 2021 and 2022 outages as follows:

Outage 2021 activities:

- 10 year Reactor Vessel Inspection in accordance with ASME Section XI and ASME Code Case N-770-2 requirements.
- Reactor Vessel Internals Inspection (partially) in accordance with MRP-227, Rev. 1A, MRP-228, Rev. 3 requirements and ASME Section XI, 2007 Edition with Addenda 2008

Outage 2022 activities:

- Reactor Vessel Internals Inspection (partially) in accordance with MRP-227, Rev. 1A and MRP-228, Rev. 3 requirements
- Reactor Vessel Head Inspection in accordance with ASME Code Case N-729-4 requirements.

1.1 Reactor Vessel Activities

The full scope of inservice inspection of NPP Krško reactor vessel is scheduled for April 2021 during normal refueling outage. This Technical Specification will present the requirements for the inspection in the fourth inspection period of the third inspection interval driven by 10 CFR 50.55a, ASME Section XI, Edition 2007, Addenda 2008, NRC Regulatory Guides and applicable ASME code cases.

During the first inspection interval, two inspections have been performed by INTERCONTROLE using focused UT technique. During the second and third inspection intervals, inspections have been performed by INETEC, using contact UT technique. This include inspections at the end of intervals and intermediate inspections 2004, 2015 and 2019 in accordance with MRP-139 and ASME Code Case N-770-1(2) respectively.

NPP Krško reactor vessel is a Combustion Engineering designed and manufactured vessel, made from materials SA-533 grade B, Cl. 1 and SA-508, Cl. 2, and clad with Type 308 and 309 austenitic stainless steel. Interior surfaces are in as-cladded condition.

1.2 Reactor Vessel Internals Activities

Reactor Vessel Internals Inspections are scheduled for April 2021 and October 2022 during normal refueling outages respectively. Inspections during two outages are based on duration of outages and inspection prerequisites for specific component during reactor vessel internals inspection. The scope of inspections is defined in Item 2.0 by component and applicable outage. Until now, NPP Krško has performed inspections of primary components from 2002 and 2013 for baffle to former bolts (BFB) and in 2009 for CRGT Guide Card Inspection.

These inspections shall be done to fulfill commitments from Aging Management Program. Requirements for Reactor Vessel Internals Inspections are based on Pressurized Water Reactor Internals Inspections and Evaluation Guidelines MRP-227, Rev.1A, Inspection Standard for Pressurized Water Reactor Internals MRP-228, Rev.3 and ASME Section XI, 2007 Edition with Addenda 2008.

NPP Krško reactor vessel internals are Westinghouse designed and made from materials listed in Item 2.0.

Note: Based on MRP-227, Rev.1A, Inspection of primary component "W8. Alignment and Interfacing Components; Internals hold down spring" is not applicable for NPP Krško, because it is fabricated from material Type 403.

1.3 Reactor Vessel Closure Head Activities

Reactor Vessel Closure Head (RVCH) Inspection is scheduled for October 2022 during normal refueling outage. NPP Krško RPVH was replaced during Outage 2012 and this will be the first volumetric inspection since then. Replacement head nozzles and partial-penetration welds are made of PWSCC-resistant material (Alloy 690) and are subjected to volumetric examination every 10 calendar years. NPP Krško RPVH contain 33 penetrations nozzles with full length and 3 with partial length. In addition, J-welds of RPVH vent line and ICCMS line will be a part of the scope also as well.

2.0 SCOPE

The scope of inspections is listed based on components and applicable outage

2.1 Reactor Vessel Inspection during Outage 2021

The scope of inspection is listed in Appendix 14.1.

2.2 Reactor Vessel Internals Inspection during Outage 2021

The scope of services related to the reactor vessel internals (RVI) is defined as following:

- Preparation work, inspections, data evaluation and if necessary, based on findings engineering evaluation for justification for continuous operation (JCO).
- For Control Rod Guide Tube Assembly (CRGTA) guide cards inspection Supplier shall prepare contingency/optional scope for CRGTA relocation if that will be needed based on examination results. Relocation-tool shall be sent to the site together with the rest of the equipment and CRGT RELOCATION expert shall be a member of inspection team. This will provide to mobilize contingency/optional scope without delays on outage critical path.
- Based on CAP 2019-3879 and Westinghouse document PPE-19-137, Rev.0, Supplier shall perform detail visual inspection (VT) on baffle to former bolts (BFB) and adjacent area at former plates 2, 3 and 4 at core locations C-11, H-13 and J-12.

The scope of primary and existing components in accordance with MRP-227, Rev.1A and Program TD-20 are listed in Appendix 14.2 and 14.3 respectively.

2.3 *Reactor Vessel Internals Inspection during Outage 2022*

The scope of services related to the reactor vessel internals (RVI) is defined as following:

- Preparation work, inspections, data evaluation and if necessary, based on findings engineering evaluation for justification for continuous operation (JCO).

The scope of primary components accordance with MRP-227, Rev.1A and Program TD-20 is listed in Appendix 14.4.

2.4 *Reactor Vessel Closure Head Inspection during Outage 2022*

The scope of volumetric (UT) and surface (ET) inspection is prescribed in ASME Code Case N-729-4 for reactor heads having nozzles fabricated from PWSCC resistant materials as prescribed in Table 1; Item No. B4.40 and Figure 1 & 2. For NPP Krško UT and ET examination of the following nozzles and partial-penetration J-groove welds shall be performed:

- 33 full length head nozzles
- 3 partial length head nozzles
- RPVH vent line
- ICCMS line

Volumetric examinations (UT) shall be performed on essentially 100% of the required volume of the full length (33) and partial length (3) head nozzle tube, as identified by Figure 2. Demonstrated volumetric leak path assessment through all J-groove welds shall be performed if needed. NPP Krško Replacement Reactor Closure Head design does not contain thermal sleeve (See Appendix 14.8; RVCH dwg). Surface (ET) examination shall be performed on the penetration nozzle inside and outside wetted surface.

Volumetric (UT) examination shall be performed on RPVH vent line and ICCMS line weld as minimum. Surface (ET) may also be performed.

3.0 SAFETY CLASSIFICATION

All activities are considered as Safety Related (SR) activities.

4.0 TYPE OF SERVICE

All inspections are 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 NPP Krško and includes supplier's QA/QC.

5.0 APPLICABLE CODES, STANDARDS AND PROCEDURES

5.1 General

- 10 CFR 50 Appendix B
- 10 CFR 50.55a
- 10 CFR Part 21
- ASME Section XI, 2007 Edition with Addenda 2008
- ASME Section V, 2007 Edition
- NEI 03-08; Guideline for the Management of Materials Issues
- ANSI/ASNT CP-189, Edition 1995
- NUREG-1801; Rev. 2, Generic Aging Lessons Learned (GALL) Report
- Regulatory Guide 1.147, Rev. 18

5.2 Reactor Vessel (RV)

- TD-2E/4; Inservice Inspection Program for the Fourth Inspection Interval
- ASME Code Case N-770-2
- WCAP-14328; Handbook on Flaw Evaluation for the Krško NPP Reactor Vessel.
- SSR-NEK-20.11; Addendum to WCAP-14328
- WB-CN-ENG-15-13; Flaw Evaluation Charts for Krško Reactor Vessel Inlet and Outlet Nozzle Dissimilar Metal Welds

5.3 Reactor Vessel Internals (RVI)

- TD-20; Program Nadzora Notranjih Delov Reaktorske Posode; Rev. 4
- MRP-227, Rev. 1A; Pressurized Water Reactor Internals Inspections and Evaluation Guidelines
- MRP-228, Rev. 3; Inspection Standard for Pressurized Water Reactor Internals - 2018 Update
- WCAP-17096 – NP Rev. 2; Reactor Internals Acceptance Criteria Methodology and Data Requirements
- WCAP-17451-P; Reactor Internals Guide Tube Wear - Westinghouse Domestic Fleet Operational Projections
- WCAP-17937-P; Determination of acceptable baffle-barrel bolting for Krško
- MRP Demonstration Protocol for PWR Internals Bolting Ultrasonic Examination Procedures and Personnel, Rev. 9
- WCAP-17083-P, Rev. B; KRŠKO – 16x16 Upper Internals Guide Tube – Guide Card Wear Evaluation
- WCAP-17684-P; Generic Flaw Acceptance Criteria for Combustion Engineering and Westinghouse MRP-227-A Core Barrel and Core Shroud Welds
- MRP-376; Materials Reliability Program: Evaluation of Westinghouse PWR Reactor Core Barrel Weld Inspection Requirements

5.4 *Reactor Vessel Closure Head (RVCH)*

- TD-2R; Program Nadzora Glave Reaktorske Posode in BMI Penetracij, Rev.5
- ASME Code Case N-729-4

6.0 IDENTIFICATION OF EQUIPMENT AND COMPONENTS

6.1 *Reactor Pressure Vessel – RCPCRV01*

Components/welds specified for examination are identified in Appendix 14.1. Simplified drawings are shown in Appendix 14.6.

6.2 *Reactor Pressure Vessel Upper Internal – RCPCRV01-RVI*

Components specified for examination are identified in Appendix 14.2, Appendix 14.3 and Appendix 14.4. Simplified drawings are shown in Appendix 14.7.

6.3 *Reactor Pressure Vessel Closure Head – RCPCRV01-RVCH*

Components specified for examination are identified in Appendix 14.5. Simplified drawings are shown in Appendix 14.8

7.0 TECHNICAL REQUIREMENTS

7.1 *Reactor vessel (RV)*

The UT examination shall be performed using advanced remotely controlled compact equipment which can be manipulated in the reactor vessel by small crane on refueling bridge (if necessary). Polar crane will be available for this inspection only for very short limited time and potential Supplier shall present needs for use of polar crane in detailed schedule. VT examination shall be performed using high resolution radiation resistant cameras mounted on manipulator or compact submarine.

UT and VT examinations shall be fully recorded on external hard discs that shall be submitted to NPP Krško representative at the end of examinations.

For components Shell-to-Flange Weld and RV-Supports - 90 and 270 deg. (See Appendix 14.1), Supplier shall have own procedures based on ASME Sec. V, Article 4. Procedures titles shall be listed in bid documents and procedures shall be ready to submit on NPP Krško request.

7.2 *Reactor vessel internals (RVI)*

For conducting RVI visual inspection, following visual examination techniques shall be applied:

- EVT-1 and VT-1 examination

The EVT-1 and VT-1 examination shall be in accordance examination criteria set forth in ASME Section XI, IWB-3520.1 and MRP-227, Rev 1A. The VT shall be done by distance for the verification of the structural integrity of the component. Natural or artificial lighting has to be sufficient (min. 50 fc) to allow the reading of a letter with a height of 1,1 mm from a distance of 0,6 m (Table IWA-2211-1). The level of natural or artificial illumination shall be verified before and after each examination or series of examinations without passing the time limit of 4 hours between each verification (IWA-2210). Each indication shall be registered by photograph or recorded by video and stored on external hard discs that will be submitted to NPP Krško representative at the end of examination.

EVT-1 and VT-1 techniques shall be used for detecting surface imperfections and flaws, such as cracks, wear, erosion, and corrosion.

- VT-3 examination

The VT-3 examination shall be in accordance with the examination criteria set forth in ASME Section XI, IWB-3520.2 and MRP-227, Rev. 1A. The VT shall be performed at distance, for the verification of the structural integrity of the component. Natural or artificial lighting has to be sufficient (min 50 fc) to allow the reading of a letter with a height of 2,7 mm (Table IWA-2211-1). The level of natural or artificial illumination shall be verified before and after each examination or series of examinations without passing the time limit of 4 hours between each verification (IWA-2210). Each indication shall be registered by photograph or recorded by video and stored on external discs that will be submitted to NPP Krško representative at the end of examination.

VT-3 shall be used to determine the general mechanical and structural condition of components and their supports and to detect discontinuities (cracking) and imperfections, such as loss of integrity at bolted and welded connections, lose or missing parts, distortion, debris, corrosion, wear, or erosion.

The VT examination shall be performed using remote controlled equipment such as compact submarine equipped with high resolution radiation resistant cameras. During Outage 2021 RV lower and upper internal will be placed on stands in reactor vessel pool and refueling bridge shall be shared with UT examinations on RV during VT examination of RV lower internal. During Outage 2022 upper internal will be placed on stand in reactor vessel pool and lower internal will stay in reactor vessel. Polar crane will be available for these inspections only for very short limited time. Potential Supplier shall present needs for use of polar crane and refueling bridge in detailed schedule.

For remote visual examinations, the technique resolution requirements are described in MRP-228, Rev.3 for Enhanced Visual Examination (EVT-1), VT-1, and VT-3 examinations and shall be fulfilled. Evidence of damage mechanisms which shall be detected by each technique for reactor internals is included in MRP-227, Rev. 1A. These include stress corrosion cracking (SCC), irradiation-assisted SCC, wear, fatigue, thermal-aging embrittlement, irradiation embrittlement, void swelling and irradiation growth, thermal and irradiation-enhanced stress relaxation, and irradiation-enhanced creep.

- UT examination of bolting in RVI

The UT examination of baffle to former bolting (BFB) in RVI shall be performed using remote controlled equipment such as compact submarine or manipulator that is able to manipulate by small crane on refueling bridge (if necessary). Lower internal will be in reactor vessel. Polar crane will be available for this inspection only for very short limited time and potential Supplier shall present needs for use of polar crane in detailed schedule.

UT and VT examinations shall be fully recorded on external hard discs that shall be submitted to NE Krško representative at the end of examinations.

7.3 Reactor Vessel Closure Head – RVCH

Techniques, equipment and qualifications shall be in accordance with ASME Section XI, 2007 Edition with 2008 Addenda. The UT volumetric examination of Reactor Vessel Closure Head nozzles and associated partial-penetration J-groove welds shall be qualified in accordance with (a) through (j) of ASME Code Case N-729-4; 2500 EXAMINATION REQUIREMENTS which applies to Demonstration Specimen Set, Procedure Demonstration, Personnel (ASME XI, Appendix VIII, Supplement 10), Detection and False Calls, Location Tolerance, Length & Depth sizing, Orientation, Essential Variables Change and Retest.

8.0 QUALIFICATION REQUIREMENTS

8.1 Reactor vessel (RV)

8.1.1 Qualification requirement for examination

Supplier is required to apply ultrasonic examination system qualified in accordance with ASME XI, Appendix VIII Supplements 2, 4, 6, 7 and 10 (Supplement 14 is optional) through Electric Power Research Institute Performance Demonstration Initiative (EPRI PDI) qualification program. For Supplement 10, Supplier is required to document their demonstrated best effort depth sizing RMS error. Appendix 14.1 shows qualification requirements for each weld.

Visual VT-1 examination of Nozzle Inside Radius Sections shall be performed in accordance with requirements of 10 CFR 50.55a, b(2)(xxi)(A) and ASME Code Case N-648-1. Supplier is required to use inspection system with magnification that has a resolution sensitivity to resolve 0.044 in. (1.1 mm) lower case characters without an ascender or descender. This sensitivity shall be demonstrated to the NPP Krško representative before start of examination.

8.1.2 Qualification requirement for personnel

Non-destructive examination (NDE) personnel shall be trained, qualified and certified in accordance with ANSI/ASNT CP-189, ASNT Standard for Qualification and Certification of Nondestructive Personnel. NDE personnel involved in ultrasonic data evaluation shall possess a valid ASME XI, Appendix VIII certificate obtained through EPRI PDI qualification for the supplement in which are involved. NDE personnel shall fulfill training requirements required by 10 CFR 50.55a and ASME Sec. XI. Inspection leader shall possess a Level III certificates for UT and VT.

8.2 Reactor vessel internals (RVI)

8.2.1 Examination system requirements

Examinations systems requirements of MRP-228, Rev.3 shall be implemented for all examinations as follows:

- Technical justifications (TJ) are required for qualification of NDE systems other than visual examinations, and examination systems shall meet the qualification requirements for TJ for NDE System Qualification. TJs are also required when determining measurement uncertainty for flaw, degradation, or wear measurements (that is, guide card wear, internals hold-down spring, core clamping, and so on) except when the evaluation factors associated with landmarks and rulers are used when determining crack length. The ASME Section V, Article 14 provides the requirements for a TJ.
Ultrasonic examination of RVI bolting shall be qualified in accordance with EPRI MRP Demonstration Protocol for PWR Internals Bolting Ultrasonic Examination Procedures and Personnel. Qualification samples required by Demonstration Protocol (bolts with artificial flaws) shall be provided by Supplier. NPP Krsko representative shall supervise the qualification process.
- All examination personnel, equipment, examinations, classification and measurement of indications, and documentation associated with visual examinations shall meet the requirements of MRP-228, Rev.3; Sections 2.3.4, 2.3.5, 2.3.6, 2.3.7, 2.3.8, and 2.3.9

- All examination personnel, examinations, classification of indications, documentation, and performance demonstrations associated with UT shall meet the requirements of MRP-228, Rev.3; Sections 2.4.4, 2.4.6, 2.4.7, 2.4.8 and 2.4.9, respectively.
- Personnel performing NDE methods other than VT and UT of bolting shall meet the requirements of MRP-228, Rev.3; Section 2.5.
- Technical justifications are required for determining the measurement uncertainty and shall meet the requirements of MRP-228, Rev.3; Sections 2.1.1 and 3.3.

8.2.2 Qualification requirement for personnel

Non-destructive examination personnel shall be trained, qualified and certified in accordance with ANSI/ASNT CP-189, ASNT Standard for Qualification and Certification of Nondestructive Personnel. VT and UT examination personnel shall be additionally qualified in accordance with ASME Sec. XI, Mandatory Appendix VI and requirements from MRP-228, Rev.3 respectively.

8.3 Reactor Vessel Closure Head – RVCH

All qualification requirements from ASME Code Case N-729-4 for personnel, equipment and procedures shall be fulfilled. Non-destructive examination personnel shall be trained, qualified and certified in accordance with ANSI/ASNT CP-189, ASNT Standard for Qualification and Certification of Nondestructive Personnel and ASME XI. Leading analyst and inspection leader shall possess a Level III certificates for UT.

PDI requirements refers to UT of 33 full length and 3 partial length head nozzles only. UT and / or ET examination of RPVH vent line and ICCMS line connection welds are excluded. Also, PDI qualification is not required for surface (ET) examination of the penetration nozzle ID (inside) and OD (outside) wetted surface.

9.0 DETAIL SCHEDULE

9.1 Reactor vessel (RV)

UT and VT examinations of reactor vessel are scheduled for April 2021. 60 days before outage Supplier will be informed about exact start of examination. Examinations will be on the outage critical path and they shall be performed in parallel with MPR 227 inspections. For this scope of examinations, it is scheduled maximum net 132 hours which includes lowering of tool into the reactor vessel, data collection and analyses, lifting and decontamination of tool above reactor vessel pool. This time is estimated based on previous inspections. Any shortage of the inspection critical time by Supplier is welcome. In addition to this, Supplier shall discuss with NPP Krško representative time necessary for preparation activities, such as material transportation to reactor building, assembling and equipment decontamination.

9.2 Reactor vessel internals (RVI)

9.2.1 Outage 2021

The first part of MRP-227 examinations of reactor vessel internals are scheduled for April 2021. 60 days before outage Supplier will be informed about exact start of examination. Examinations of lower internal will be on the outage critical path and they shall be performed in parallel with 10-years ISI reactor vessel examination. For this scope of examinations, it is scheduled maximum net 132 hours and additional 138 hours are available for upper internal. These includes lowering of tool into the reactor vessel pool, data collection and analyses, lifting and decontamination of tool above reactor vessel pool. Any shortage of the inspection critical time by Supplier is welcome. In addition to this, Supplier shall discuss with NPP Krško representative time necessary for preparation activities, such as material transportation to reactor building, assembling and equipment decontamination.

9.2.1 Outage 2022

The second part of MRP-227 examinations of reactor vessel internals are scheduled for October 2022. 60 days before outage Supplier will be informed about exact start of examination. For this scope of examinations, it is scheduled maximum net 230 hours. These includes lowering of tool into the reactor vessel (lower internal is in RV), data collection and analyses, lifting and decontamination of tool above reactor vessel pool. This time is also available for examination on upper internal, if for some reason examination during Outage 2021 were not to be completed. Any shortage of the inspection time by Supplier is welcome. In addition to this, Supplier shall discuss with NPP Krško representative time necessary for preparation activities, such as material transportation to reactor building, assembling and equipment decontamination.

9.3 Reactor Vessel Closure Head – RVCH

The examinations of reactor vessel closure head are scheduled for October 2022. 60 days before outage Supplier will be informed about exact start of examination. For this scope of examinations, it is scheduled maximum net 240 hours. These includes insertion of tool under the reactor vessel closure head, data collection and analyses, lifting and decontamination of tool above reactor vessel pool. Any shortage of the inspection time by Supplier is welcome. In addition to this, Supplier shall discuss with NPP Krško representative time necessary for preparation activities, such as material transportation to reactor building, assembling and equipment decontamination.

10.0 SUPPLIER RESPONSIBILITIES

Supplier shall provide to NPP Krško:

10.1 Documentation that shall be included in the bid proposal

10.1.1 Examination of the Reactor Vessel (RV)

- detailed technical description about NPP Krško reactor pressure vessel examination including manipulator presentation, its positioning into the reactor vessel (polar crane, refueling bridge crane needs), detailed schedule of the examination, required NPP Krško support and space near to the reactor pressure vessel pool for equipment assembly, control units and personnel, ect.
- list of all procedures and examiners for the examination of the reactor pressure vessel qualified at EPRI PDI corresponding to the specific supplement; procedures and examiners shall be listed at EPRI PDQS
- list of the procedures that shall be qualified at EPRI PDI to fulfill all NPP Krško examination requirements including Supplier's commitment about latest date of the qualification; these qualifications shall be completed no later than December 2020
- procedures titles for the UT examinations of components listed in Attachment 14.1 not designated as "PDI" (Shell-to-flange weld and RV supports 270 and 90 deg.), procedures titles related to the equipment calibration and verification, data collection, data analysis etc.
- list of company references for UT and VT examination of RV
- Quality Assurance (QA) Manual that complies with 10 CFR 50 Appendix B and 10CFR Part 21.

10.1.2 Examination of the Reactor Vessel Internals (RVI)

- detailed technical description about NPP Krško reactor pressure vessel internals examination including manipulator presentation, its positioning (polar crane, refueling bridge crane needs), detailed schedule of the examination, required NPP Krško support and space close to reactor pressure vessel pool for equipment assembly, control units and personnel, ect.
- list of all procedures and examiners for the examination of the reactor pressure vessel internals.
- list of the procedures that shall be developed and required technical justifications (TJ) to fulfill all NPP Krško examination requirements including Supplier's commitment about latest date of the justification/qualification; these TJs shall be completed no later than December 2020 for examinations during Outage 2021 and no later than June 2022 for examinations during Outage 2022. (Ref. 2.2 and 2.3).
- list of company references which includes at least three (3) VT inspections (measurements), and at least three (3) UT inspections of BFB in last 10 years performed on Westinghouse design internals.
- list of company references which includes at least three (3) JCO in last 10 years performed on Westinghouse design internals.
- Quality Assurance (QA) Manual that complies with 10 CFR 50 Appendix B and 10CFR Part 21

10.1.3 Examination of the Reactor Vessel Clouse Head (RVCH)

- Technical description of NPP Krško RVCH remote control inspection tool with description of probes, manipulator presentation, positioning, NEK support needed (equipment hatch, polar crane, working lay-down ...).
- Detailed Inspection plan (time schedule) of the examination.
- List of all procedures and certificates for RVCH required by this specification
- Organization chart with personnel and their qualifications as required in 7.3 and 8.3.
- List of company references for RVCH volumetric UT examination
- Quality Assurance (QA) Manual that complies with 10 CFR 50 Appendix B and 10CFR Part 21.

10.2 Documentation that shall be delivered not later than 60 days before start of the examination:

- Suppliers "Written Practice" (procedure for training, qualification and certification in accordance with ASME sec. XI and CP 189); this practice shall be approved by NPP Krško Level III project leader
- Supplier's organization chart for each examination activity to be performed including responsibilities of the personnel
- QA/QC plan where NPP Krško and Supplier's team leader will define check points (R, W, H, T)
- certificates of the all trained and qualified examination personnel and QA engineer as required in Section 8.0 with valid permits to work in radiation area.

Supplier shall provide support during communication with Slovenian Nuclear Safety Authorities (SNSA) and Authorized Organization Representative if needed. Supplier shall provide one designated individual per shift with work leader status.

10.2.1 Examination of the Reactor Vessel (RV)

- all EPRI PDI qualified procedures as well as examination procedures for the UT of the Shell-to-flange weld and RV supports 270 and 90 deg. for review and approval of NPP Krško representative

10.2.2 Examination of the Reactor Vessel Internals (RVI)

- all procedures as well as qualified examination procedures in accordance with MRP-227, Rev. 1A and MRP-228, Rev.3 for review and approval of NPP Krško representative.

10.2.3 Examination of the Reactor Vessel Closure Head (RVICH)

- EPRI PDI qualified procedures for the volumetric UT examination of Reactor Vessel Closure Head nozzles and associated partial-penetration J-groove welds for review and approval of NPP Krško representative. All other UT and ET procedures for volumetric and surface examination of items from 2.4 (Scope) as listed in appendix 14.5 shall be handed over for review and approval.

10.3 Documentation that shall be delivered after the examinations (RV, RVI, and RVCH):

- preliminary report of the performed examinations not later than 5 days after completion of full scope of the examination which includes as a minimum:
 - short overview of the examination with results and evaluation of the all indications according to acceptance criteria
 - non-conformities with their status
 - qualitative judgment of the work performed
 - all UT and VT records on external hard discs (four copies)
- final report (4 copies) not later than 30 days from the completed scope of work which includes as a minimum:
 - overview of the examination scope with results and evaluations
 - non-conformities with their statuses
 - list of all applied examination and control procedures
 - list of all personnel and their certificates
 - equipment and material list including consumables with all calibration evidences and certificates
 - results of the examinations and evaluations
 - all QA reports

11.0 NPP KRŠKO RESPONSIBILITIES

NPP Krško shall provide to the Supplier the following:

- all available drawings and technical details can be presented at NPP Krško site during pre-outage meetings
- all required on-site specific training courses (HP, work leader, side specific, etc.)
- on-site transportation and lifting by polar crane (Supplier shall use own certified refueling bridge crane operator(s))
- supply of electric power and compressed air
- reactor vessel basic calibration blocks
- NPP Krško site specific training
- HP coverage
- support for decontamination

12.0 SPECIAL REQUIREMENTS

N/A

13.0 QA REQUIREMENTS

Supplier's QA Program

The Supplier shall provide a Quality Assurance (QA) Manual that complies with 10 CFR 50 Appendix B and 10CFR Part 21 and satisfies the requirements of the NPP Krško specification QS 610 Rev.1 - »Generic Quality Assurance Program Requirements«.

QA Program review and acceptance by the NPP Krško shall be a prerequisite for selection of a Bidder as a Supplier. The Supplier shall implement and maintain this program while carrying out the requirements of this specification; all proposed changes to the program shall be submitted to and approved by the NPP Krško prior to implementation.

The Supplier shall pass the requirements of this specification to its subcontractor(s) and retain full responsibility for their performance in accordance with the requirements of this specification.

Applicable Codes and Standards:

- 10 CFR 50 Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
- 10 CFR 21, Reporting of Defects and Noncompliance
- ANSI/ASME NQA-1-2008, Addenda 2009/2011, Quality Assurance Requirements for Nuclear Facility Applications

During performance of the activity it is a duty of the Supplier's QA engineer to continuously monitor the inspection team, to refer in writing and verbally about work progress, as well as about deviations from prescribed requirements.

14.0 APPENDICES

- 14.1 Scope of the reactor vessel examination – 10 year
- 14.2 Scope of NPP Krško Primary Components per MRP-227, Rev.1A for Outage 2021
- 14.3 Scope of NPP Krsko Existing Components per MRP-227, Rev.1A for Outage 2021
- 14.4 Scope of NPP Krško Primary Components per MRP-227, Rev.1A for Outage 202
- 14.5 Scope of the Reactor Vessel Closure Head examination for Outage 2022
- 14.6 Reactor Vessel drawings
- 14.7 Reactor Vessel Internals drawings
- 14.8 Reactor Vessel Closure Head drawings
- 14.9 Reactor Vessel Closure Head stand drawings
- 14.10 Containment laydown area

14.1 Scope of the reactor vessel examination – 10 year

Component Id.	Class	System	Isi Figure	Test Iso. Dwg.	Line Ident.	Component Description	Exam. Cat.	Item	Surf.	Vol.	Vts.	Component Remark
1-003-HL2-BW-1	1 RC	003			H.L. Loop 2	Butt Weld	R-A	R1.20		UT		PDI: To exam. in con. With RV outlet nozzle (BW-19)
1-004-CL2-BW-7	1 RC	004			C.L. Loop 2	Butt Weld	R-A	R1.20		UT		PDI: To exam. in con. With RV inlet nozzle (BW-18)
1-005-RCPCRV-BW-1	1 RC	005			RCPCRV	Shell-to-Flange Weld	B-A	B1.30		UT		ASME XI, Appendix 1, I-2110; ASME V, Article 4
1-005-RCPCRV-BW-10	1 RC	005			RCPCRV	Longitudinal Shell Weld	B-A	B1.12		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-2	1 RC	005			RCPCRV	Circumferential Shell Weld	B-A	B1.11		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-3	1 RC	005			RCPCRV	Circumferential Shell Weld	B-A	B1.11		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-4	1 RC	005			RCPCRV	Shell-to-Lower Head Weld	B-A	B1.11		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-5	1 RC	005			RCPCRV	Longitudinal Shell Weld	B-A	B1.12		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-6	1 RC	005			RCPCRV	Longitudinal Shell Weld	B-A	B1.12		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-7	1 RC	005			RCPCRV	Longitudinal Shell Weld	B-A	B1.12		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-8	1 RC	005			RCPCRV	Longitudinal Shell Weld	B-A	B1.12		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-BW-9	1 RC	005			RCPCRV	Longitudinal Shell Weld	B-A	B1.12		UT		PDI: ASME XI, App. VIII, Supplements 4 and 6
1-005-RCPCRV-CSL	1 RC	005			RCPCRV	Core Support Lugs (4 pcs.)	B-N-2	B13.60		VT-3		Accessible surfaces - scope of MRP 227, exist. components
1-005-RCPCRV-LI	1 RC	005			RCPCRV	Lower Internals	B-N-3	B13.70		VT-3		Accessible surfaces - scope of MRP 227, exist. components
1-005-RCPCRV-UI	1 RC	005			RCPCRV	Upper Internals	B-N-3	B13.70		VT-3		Accessible surfaces - scope of MRP 227, exist. components
1-005-RCPCRV-VI	1 RC	005			RCPCRV	Vessel Interior	B-N-1	B13.10		VT-3		Accessible surfaces - scope of MRP 227, exist. components
1-006-RCPCRV-BW-11	1 RC	006			RCPCRV	Outlet Nozzle-to-Vessel Weld	B-D	B3.90		UT		PDI: ASME XI, App. VIII, Supplements 4, 6 and 7
1-006-RCPCRV-BW-12	1 RC	006			RCPCRV	Inlet Nozzle-to-Vessel Weld	B-D	B3.90		UT		PDI: ASME XI, App. VIII, Supplements 4, 6 and 7
1-006-RCPCRV-BW-13	1 RC	006			RCPCRV	Outlet Nozzle-to-Vessel Weld	B-D	B3.90		UT		PDI: ASME XI, App. VIII, Supplements 4, 6 and 7
1-006-RCPCRV-BW-14	1 RC	006			RCPCRV	Inlet Nozzle-to-Vessel Weld	B-D	B3.90		UT		PDI: ASME XI, App. VIII, Supplements 4, 6 and 7
1-006-RCPCRV-BW-15	1 RC	006			RCPCRV	SI Nozzle-to-Vessel Weld	B-D	B3.90		UT		PDI: ASME XI, App. VIII, Supplements 4, 6 and 7
1-006-RCPCRV-BW-16	1 RC	006			RCPCRV	SI Nozzle-to-Vessel Weld	B-D	B3.90		UT		PDI: ASME XI, App. VIII, Supplements 4, 6 and 7
1-006-RCPCRV-IR-A	1 RC	006			RCPCRV	Inlet Nozzle Inside Rad. Sect.	B-D	B3.100		VT-1		Loop A; Code case N-648-1, as defined in RG 1.147, Rev. 16
1-006-RCPCRV-IR-B	1 RC	006			RCPCRV	Inlet Nozzle Inside Rad. Sect.	B-D	B3.100		VT-1		Loop B; Code case N-648-1, as defined in RG 1.147, Rev. 16
1-006-RCPCRV-OR-A	1 RC	006			RCPCRV	Outlet Nozzle Inside Rad. Sect.	B-D	B3.100		VT-1		Loop A; Code case N-648-1, as defined in RG 1.147, Rev. 16
1-006-RCPCRV-OR-B	1 RC	006			RCPCRV	Outlet Nozzle Inside Rad. Sect.	B-D	B3.100		VT-1		Loop B; Code case N-648-1, as defined in RG 1.147, Rev. 16
1-006-RCPCRV-RVS-270	1 RC	006			RCPCRV	RV- Support - 270 deg.	B-K	B10.10		UT		ASME XI, Appendix 1, I-2110; ASME V, Article 4
1-006-RCPCRV-RVS-90	1 RC	006			RCPCRV	RV- Support - 90 deg.	B-K	B10.10		UT		ASME XI, Appendix 1, I-2110; ASME V, Article 4
1-006-RCPCRV-SIR-A	1 RC	006			RCPCRV	SI Nozzle Inside Rad. Sect.	B-D	B3.100		VT-1		Loop A; Code case N-648-1, as defined in RG 1.147, Rev. 16
1-006-RCPCRV-SIR-B	1 RC	006			RCPCRV	SI Nozzle Inside Rad. Sect.	B-D	B3.100		VT-1		Loop B; Code case N-648-1, as defined in RG 1.147, Rev. 16
1-006-RV-BW-17	1 RC	006			RCPCRV	Outlet Nozzle-to-Safe End Weld	R-A	R1.20		UT		PDI: ASME XI, App. VIII, Supplement 10 (Supp. 14 optional)
1-006-RV-BW-18	1 RC	006			RCPCRV	Inlet Nozzle-to-Safe End Weld	R-A	R1.20		UT		PDI: ASME XI, App. VIII, Supplement 10 (Supp. 14 optional)
1-006-RV-BW-19	1 RC	006			RCPCRV	Outlet Nozzle-to-Safe End Weld	R-A	R1.20		UT		PDI: ASME XI, App. VIII, Supplement 10 (Supp. 14 optional)
1-006-RV-BW-20	1 RC	006			RCPCRV	Inlet Nozzle-to-Safe End Weld	R-A	R1.20		UT		PDI: ASME XI, App. VIII, Supplement 10 (Supp. 14 optional)
1-006-RV-BW-21	1 SI	006			RCPCRV	SI Nozzle-to-Safe End Weld	R-A	R1.11		UT		PDI: ASME XI, App. VIII, Supplement 10 (Supp. 14 optional)
1-006-RV-BW-22	1 SI	006			RCPCRV	SI Nozzle-to-Safe End Weld	R-A	R1.11		UT		PDI: ASME XI, App. VIII, Supplement 10 (Supp. 14 optional)

14.2 Scope of NPP Krško Primary Components per MRP-227, Rev.1A for Outage 2021

Primary Item	Effect (Mechanism)	Examination Method	Material	Pice	References Drawings /Documents	Expansion Link (MRP-227-1A; Table 4.3; Note 1)	Examination Coverage
W1.Control Rod Guide Tube Assembly Guide plates (cards)	Loss of Material (Wear)	Per the requirements of WCAP-17451-P	A 240 Type 304	37x13	701J685 MRP-227-1A; Fig. 4-11 WCAP-17083-P; Rev B WCAP-17096-NP WCAP-17451-P MRP-227-1A WEC NSAL-17-1	None	100% Per plant specific requirements;; WCAP-17083-P; Rev. B
W2.Control Rod Guide Tube Assembly Lower flange welds	Cracking (SCC, Fatigue) Aging Management (IE and TE)	Enhanced visual (EVT-1) examination	Accord. to base mat.	37	ISI-6119E42 (Figure 8.2.1) MRP-227-1A; Fig. 4-12 WCAP-17096-NP MRP-227-1A	W2.1.Remaining CRGT assembly lower flange welds W2.2.BMI column bodies	100% of outer (accessible) CRGT lower flange weld surfaces and 0.25-inch of the adjacent base metal on the individual periphery CRGT assemblies. (MRP-227-1A; Table 4.3; Note 2)
W3.Core Barrel Assembly Upper flange Weld (UFW)	Cracking (SCC)	Enhanced visual (EVT-1) examination	Applicable base mat.	1	ISI-6119E42 (Figure 8.2.3) MRP-227-1A; Fig. 4-13 WCAP-17096-NP MRP-227-1A	W3.1.Upper girth weld (UGW), W3.3.lower flange weld (LFW), W3.2.Upper axial welds (UAW), and W3.4.Lower support forging or casting	100% of the accessible weld length of one side of the UFW and 3/4" of adjacent base metal shall be examined. (MRP-227-1A; Table 4.3; Note 6)
W4.Core Barrel Assembly Lower girth weld (LGW)	Cracking (SCC, IASCC), Aging Management (IE)	Enhanced visual (EVT-1) examination	Applicable base mat	1	ISI-6119E42 (Figure 8.2.3) MRP-227-1A; Fig. 4-13 WCAP-17096-NP MRP-227-1A	W4.1.Upper core plate, W4.4.Lower support column bodies (cast, noncast), W4.2.Middle axial welds (MAW), W4.3.Lower axial welds (LAW)	100% of the accessible weld length of the OD of the LGW and 3/4" of adjacent base metal shall be examined. (MRP-227-1A; Table 4.3; Note 6)
W9.Thermal Shield Assembly Thermal shield flexures	Cracking (Fatigue) or Loss of Material (Wear) that results in thermal shield flexures excessive wear, fracture, or complete separation	Visual (VT-3) examination	A 240 Type 304	6	ISI-6119E42 (Figure 8.2.3) MRP-227-1A; Fig. 4-18 WCAP-17096-NP MRP-227-1A WEC TB-19-5	None	100% of accessible surfaces of 100% of thermal shield flexures. (MRP-227-1A; Table 4.3; Note 10)

14.3 Scope of NPP Krsko Existing Components per MRP-227, Rev.1A for Outage 2021



Item	Effect (Mechanism)	Reference	Examination Method	Examination Coverage
W10.Core Barrel Assembly Core barrel flange	Loss of material (Wear)	ASME Code Section XI	Visual (VT-3) exam to determine general condition for excessive wear.	All accessible surfaces at specified frequency
W11.Upper Internals Assembly Upper support ring or skirt	Cracking (SCC, Fatigue)	ASME Code Section XI	Visual (VT-3) examination	All accessible surfaces at specified frequency
W12a.Lower Internals Assembly Lower core plate	Cracking (IASCC, Fatigue) Aging Management (IE)	ASME Code Section XI as supplemented by TB-16-4	Visual (VT-3) exam of the lower core plates to detect evidence of distortion and/or loss of bolt integrity.	All accessible surfaces at specified frequency
W12b.Lower Internals Assembly Lower core plate	Loss of material (Wear)	ASME Code Section XI as supplemented by TB-16-4	Visual (VT-3) examination	All accessible surfaces at specified frequency
W14.Alignment and Interfacing Components Clevis bearing Surface wear surface Clevis insert bolts (Note 1)	Loss of material (wear) Cracking (SCC)	ASME Code Section XI as supplemented by TB-14-5 (Note 1)	Visual (VT-3) examination	All accessible surfaces at specified frequency
W15.Alignment and Interfacing Components Upper core plate alignment pins	Loss of material (Wear)	ASME Code Section XI as supplemented by TB-16-4	Visual (VT-3) examination	All accessible surfaces at specified frequency

Notes

1. The clevis inserts are attached to integrally welded reactor vessel lugs and the inserts are bolted to the lugs. The ASME Code examination of accessible surfaces is considered to include all details of the clevis configuration, including the bolting and locking devices. The bolting is fabricated from nickel-based materials and is susceptible to stress corrosion cracking (SCC). Although failure of the bolting does not itself cause loss of support function, asset impairment or issues with core barrel removal are a subsequent possibility.

Westinghouse technical bulletin TB 14-5 dated 8/25/2014 provides additional information regarding possible visual indications that clevis bolting failure may have occurred. This information should be reviewed to ensure a heightened awareness of the examiners is applied to this Code inspection.

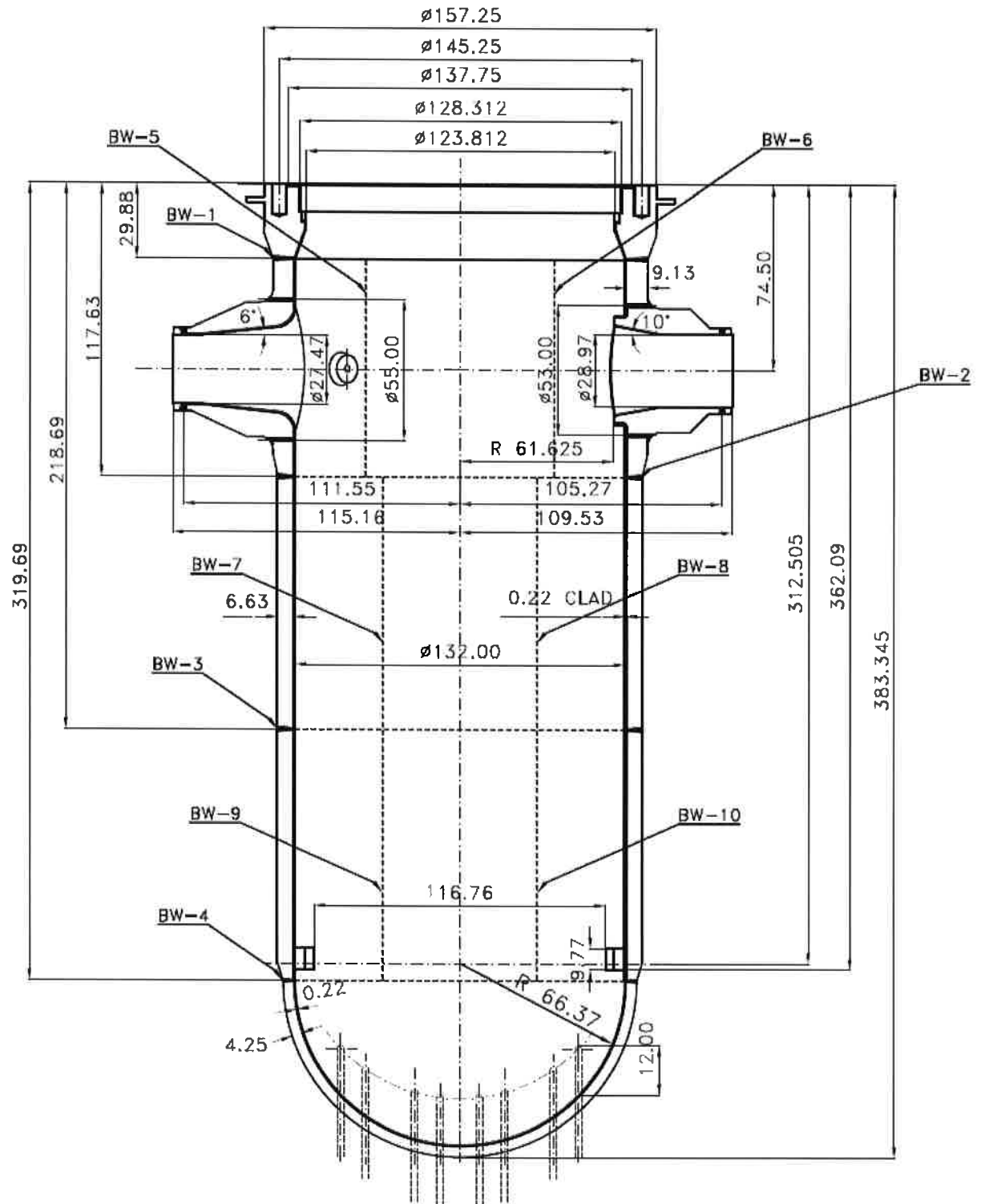
14.4 Scope of NPP Krsko Primary Components per MRP-227, Rev.1A for Outage 2022

Primary Item	Effect (Mechanism)	Examination Method	Material	Pice	References Drawings /Documents	Expansion Link (MRP-227-1A; Table 4.3;Note 1)	Examination Coverage
W5.Baffle-Former Assembly Baffle-edge bolts	Cracking (IASCC, Fatigue) that results in • Lost or broken locking devices • Failed or missing bolts • Protrusion of bolt heads Aging Management (IE and ISR) (MRP-227-1A; Table 4.3; Note 4)	Visual (VT-3) examination	A 193 Gr 8M Type 316	560	ISI-6119E42 (Figure 8.2.2) MRP-227-1A, Fig. 4-14 WCAP-17096-NP MRP-227	None	Bolts and locking devices on high fluence seams. 100% of components accessible from core side.
W6.Baffle-Former Assembly Baffle-former bolts (MRP-227-1A; Table 4.3; Note 7)	Cracking (IASCC, Fatigue) Aging Management (IE and ISR) (MRP-227-1A; Table 4.3; Note 4)	Volumetric (UT) examination	A 193 Gr 8M Type 316	728	6117D42 (Figure 8.2.2) MRP-227-1A, Fig. 4-15 GBRA 059 999 - 2002 GBRA 141 040 - 2013 WCAP-17096-NP MRP-227-1A	W6.2.Lower support column bolts, W6.1.Barrel-former bolts	100% of accessible bolts. (MRP-227-1A; Table 4.3; Note 3)
W7.Baffle-Former Assembly (Includes: Baffle plates, baffle edge bolts, corner bolts, and indirect effects of void swelling in former plates)	Distortion (Void Swelling), or Cracking (IASCC) that results in assemblies • Abnormal interaction with fuel • Gaps between plates • Vertical displacement of baffle plates • Broken or damaged edge bolts	Visual (VT-3) examination	SA 240 Type 304	1	ISI-6119E42 (Figure 8.2.1) MRP-227-1A, Fig. 4-16 WCAP-17096-NP MRP-227-1A	None	Core side surface: • High fluence baffle joints • Top and bottom edge of baffle plates • Bolts and locking devices

14.5 Scope of the Reactor Vessel Closure Head examination for Outage 2022

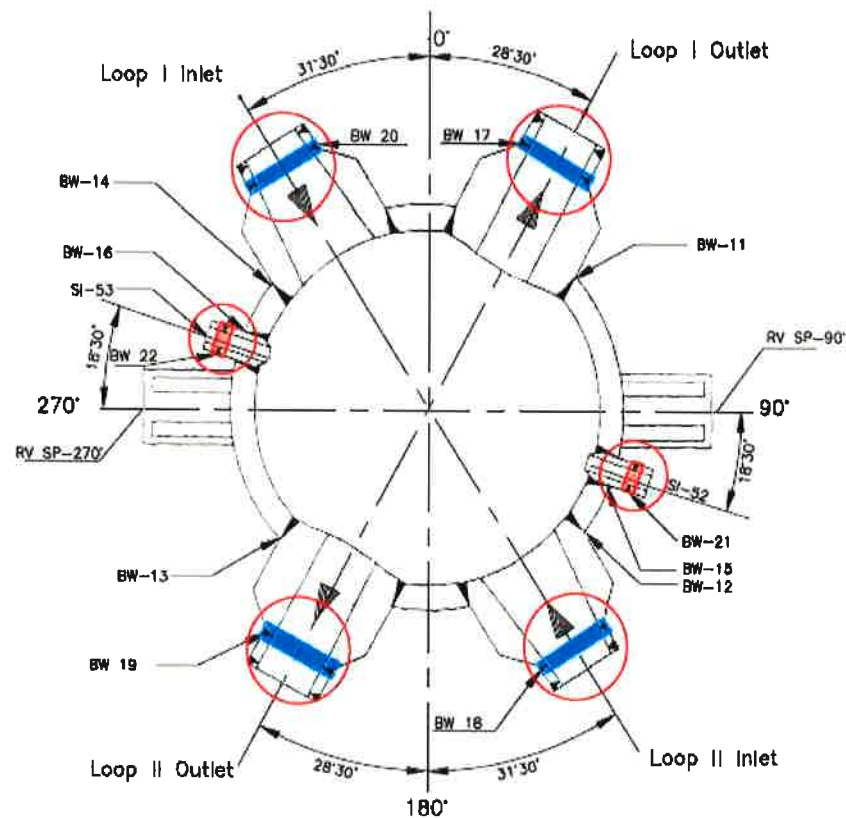
No	Location/ (Size)	Item description	Pcs.	Drawings	Appl. program/ Document
1	RV (4 inch)	CRDM penetration nozzle and J-groove weld (as required by CC-N-729-4; Figure 2) Penetration material: SB-167 UNS NO6690TT Buttering: Inconel 690 Weld material: Inconel 690	33	10036E84 (1,2) 1EA1.2000	Code Case N-729-4
2	RV (4 inch)	CETNA penetration nozzle and J-groove weld (as required by CC-N-729-4; Figure 2) Penetration material: SB-167 UNS NO6690 Buttering: Inconel 690 Weld material: Inconel 690	3	10036E84 (1,2) 1EA1.2000	Code Case N-729-4
3	RV (1 inch)	RV Head vent line penetration and J-groove weld (as required by CC-N-729-4; Figure 2) Penetration material: SB-167 UNS NO6690 Buttering: Inconel 690 Weld material: Inconel 690	1	10036E84 (1,2) 1EA1.3000 (1,3)	Code Case N-729-4
4	RV (1 inch)	ICCMS penetration and J-groove weld (as required by CC-N-729-4; Figure 2) Penetration material: SB-167 UNS NO6690 Buttering: Inconel 690 Weld material: Inconel 690	1	10036E84 (1,2) 1EA1.3000 (1,3)	Code Case N-729-4

14.6 Reactor Vessel drawing

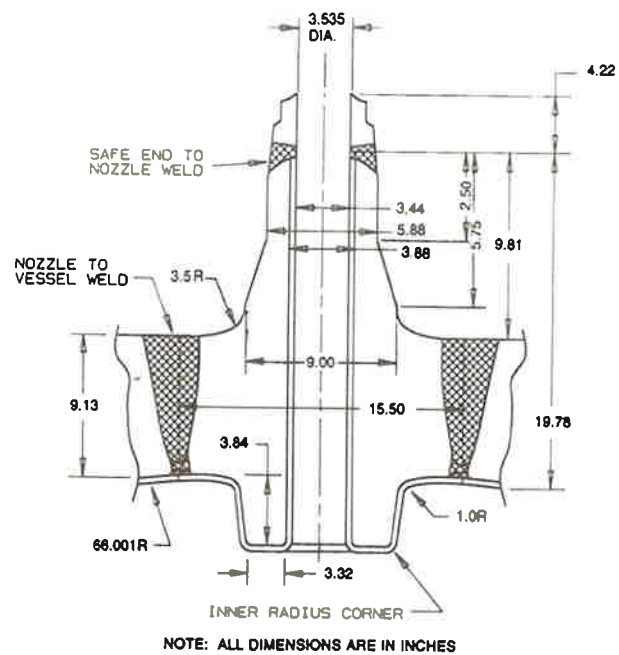


NPP Krsko RV vertical cut view

14.6 Reactor Vessel drawing (cont.)

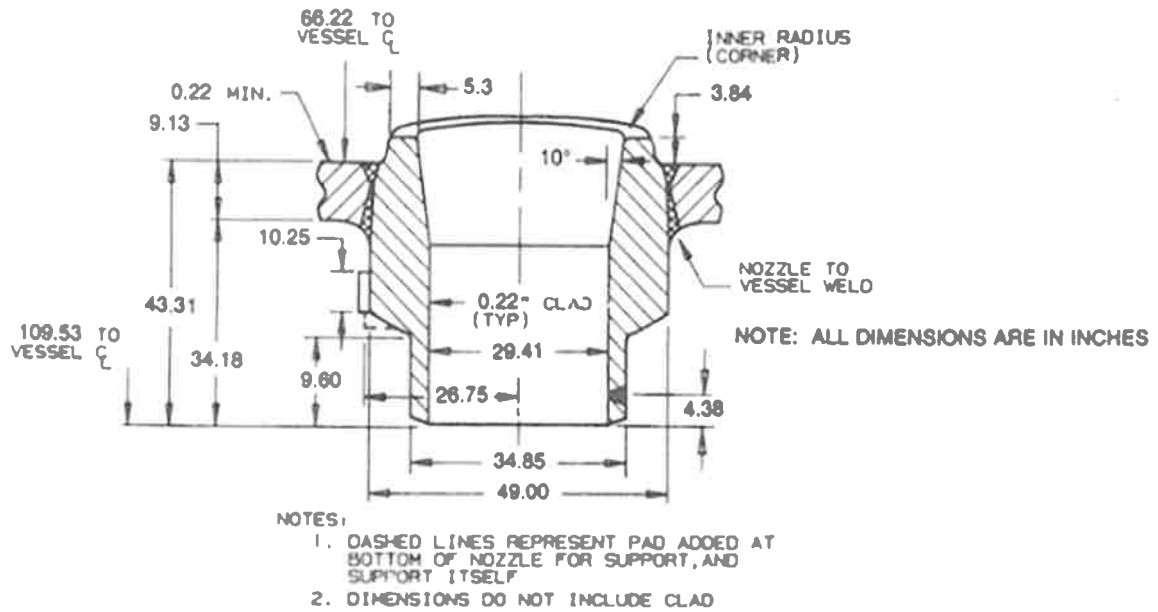


NPP Krsko RV horizontal cut view

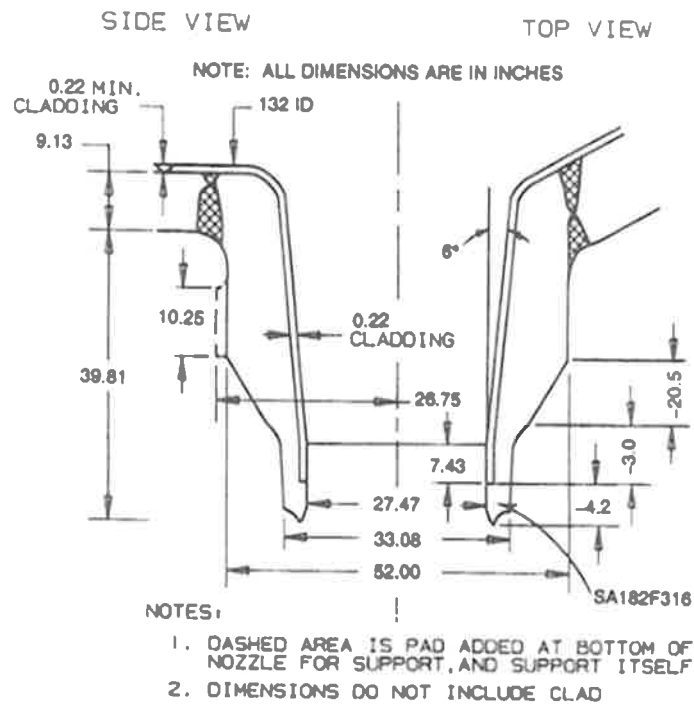


Safety Injection Nozzle

14.6 Reactor Vessel drawing (cont.)

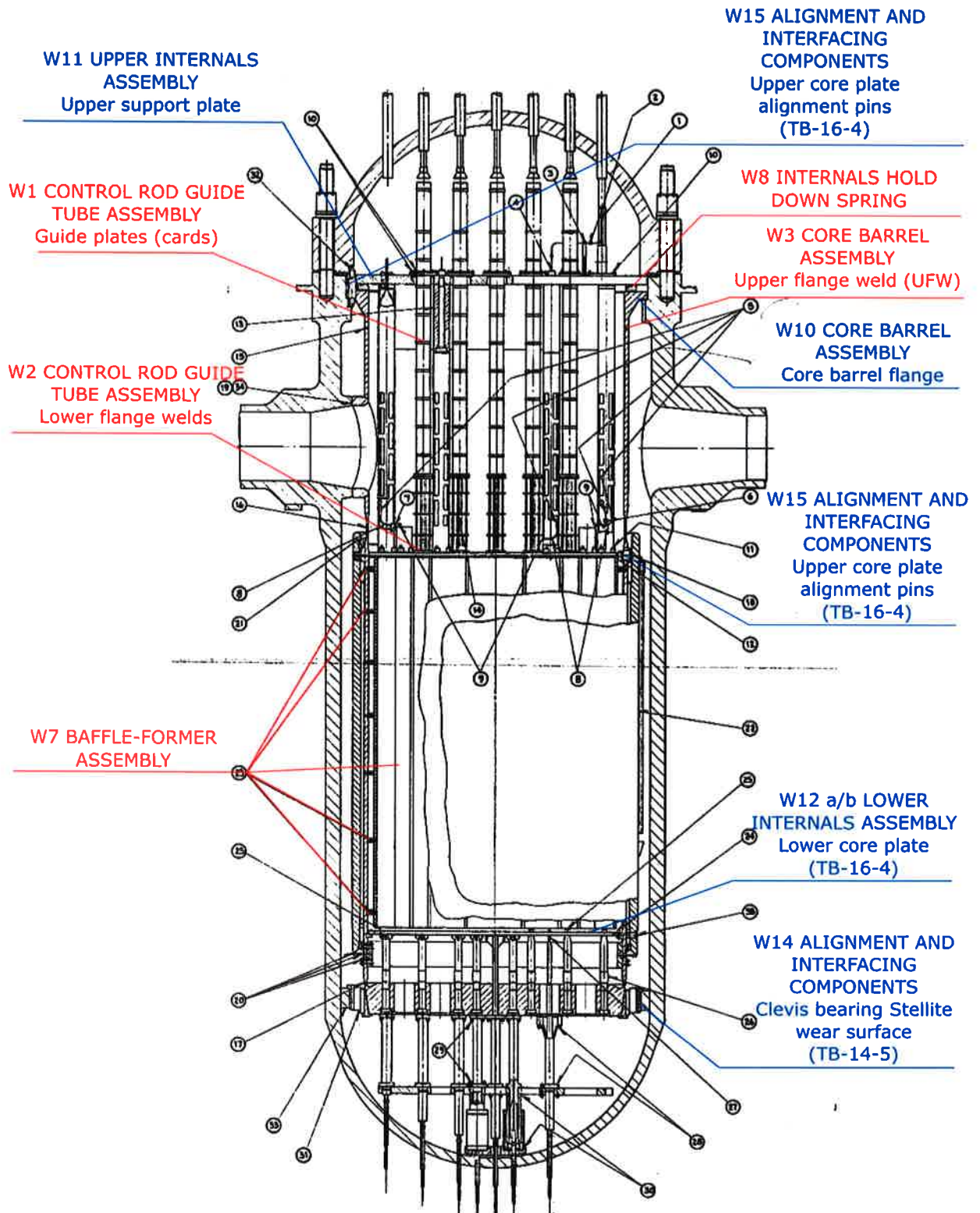


Outlet Nozzle



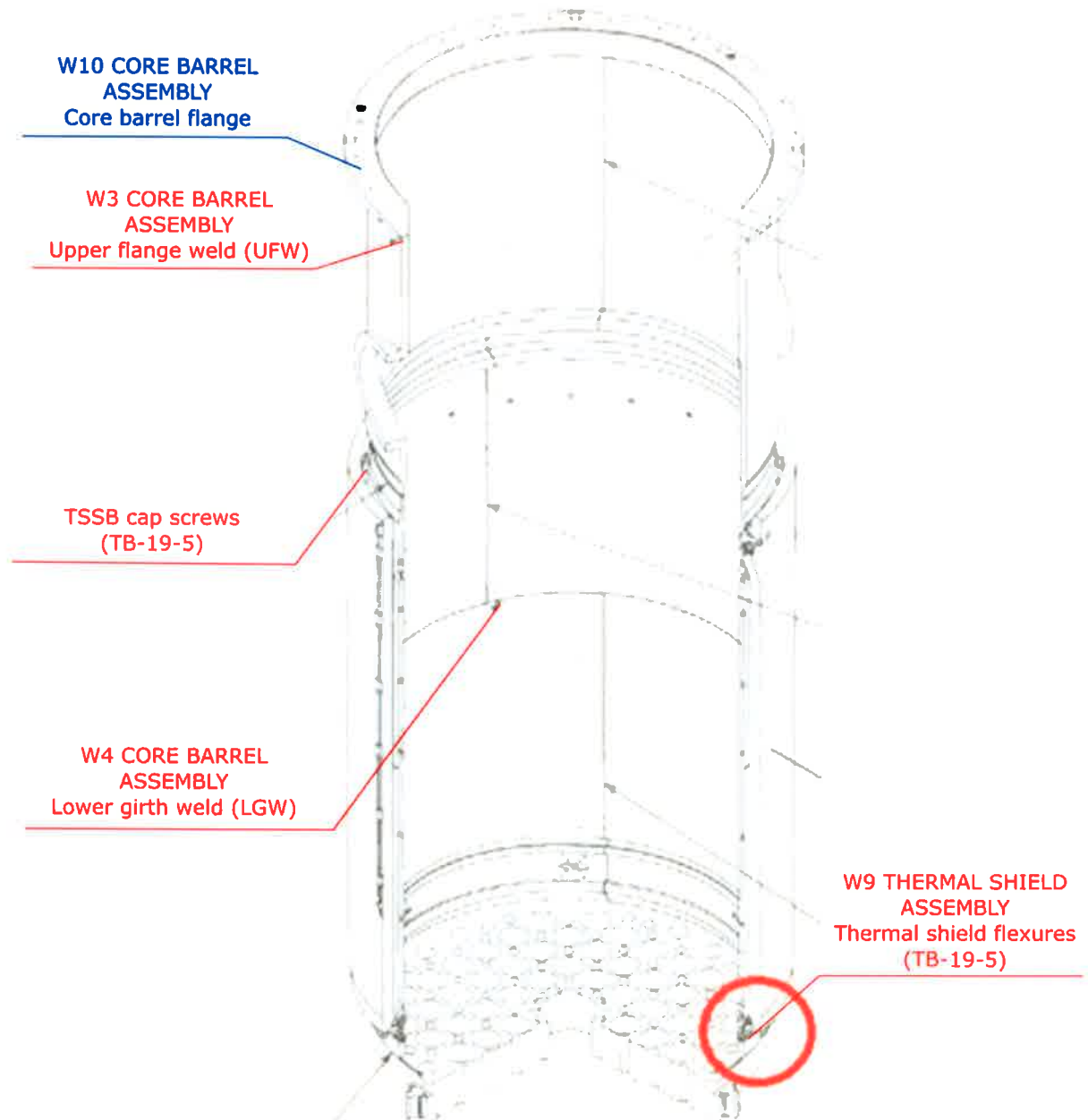
Inlet Nozzle

14.7 Reactor Vessel Internals drawing



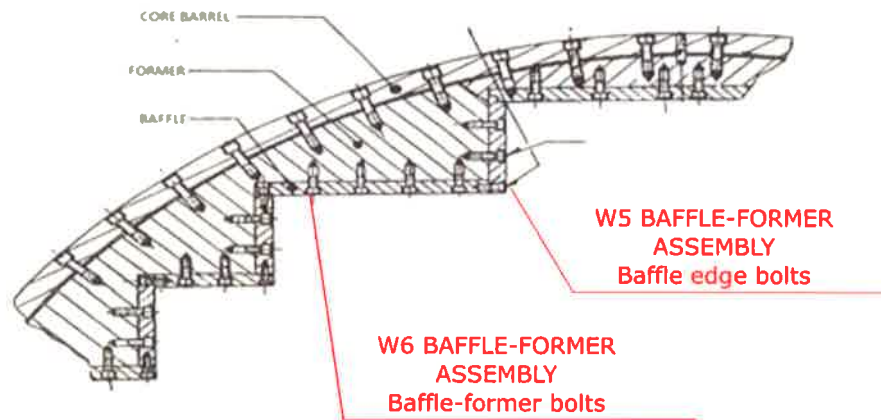
NOTE:
COMPONENTS IN **RED** ARE PRIMARY COMPONENTS PER MRP-227, Rev. 1A
COMPONENTS IN **BLUE** ARE EXISTING COMPONENTS PER MRP-227, Rev. 1A

14.7 Reactor Vessel Internals drawing (cont.)



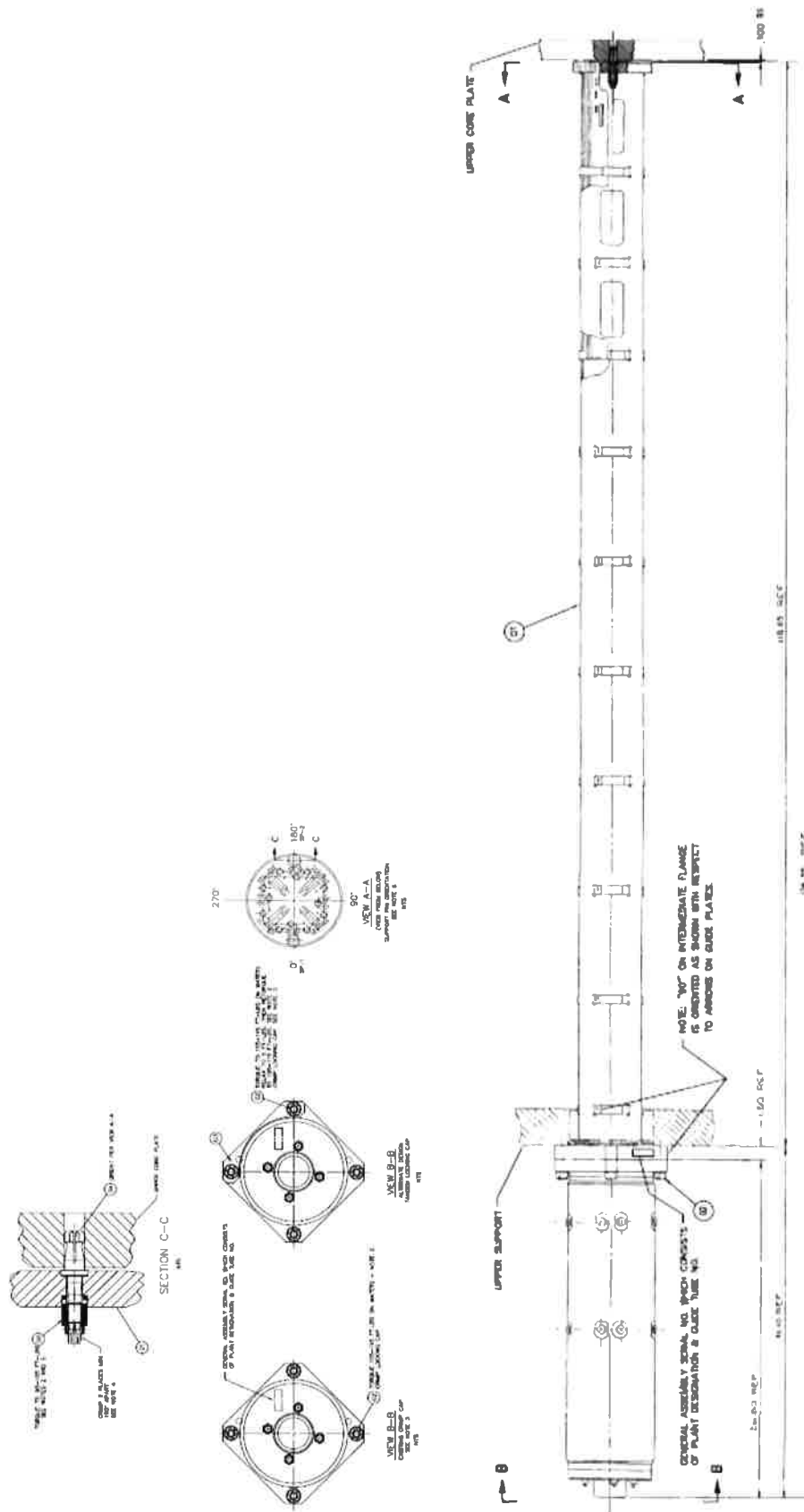
NOTE:
COMPONENTS IN **RED** ARE PRIMARY COMPONENTS PER MRP-227, Rev. 1A
COMPONENTS IN **BLUE** ARE EXISTING COMPONENTS PER MRP-227, Rev. 1A

14.7 Reactor Vessel Internals drawing (cont.)



NOTE:
COMPONENTS IN RED ARE PRIMARY COMPONENTS PER MRP-227, Rev. 1A

14.7 Reactor Vessel Internals drawing (cont.)



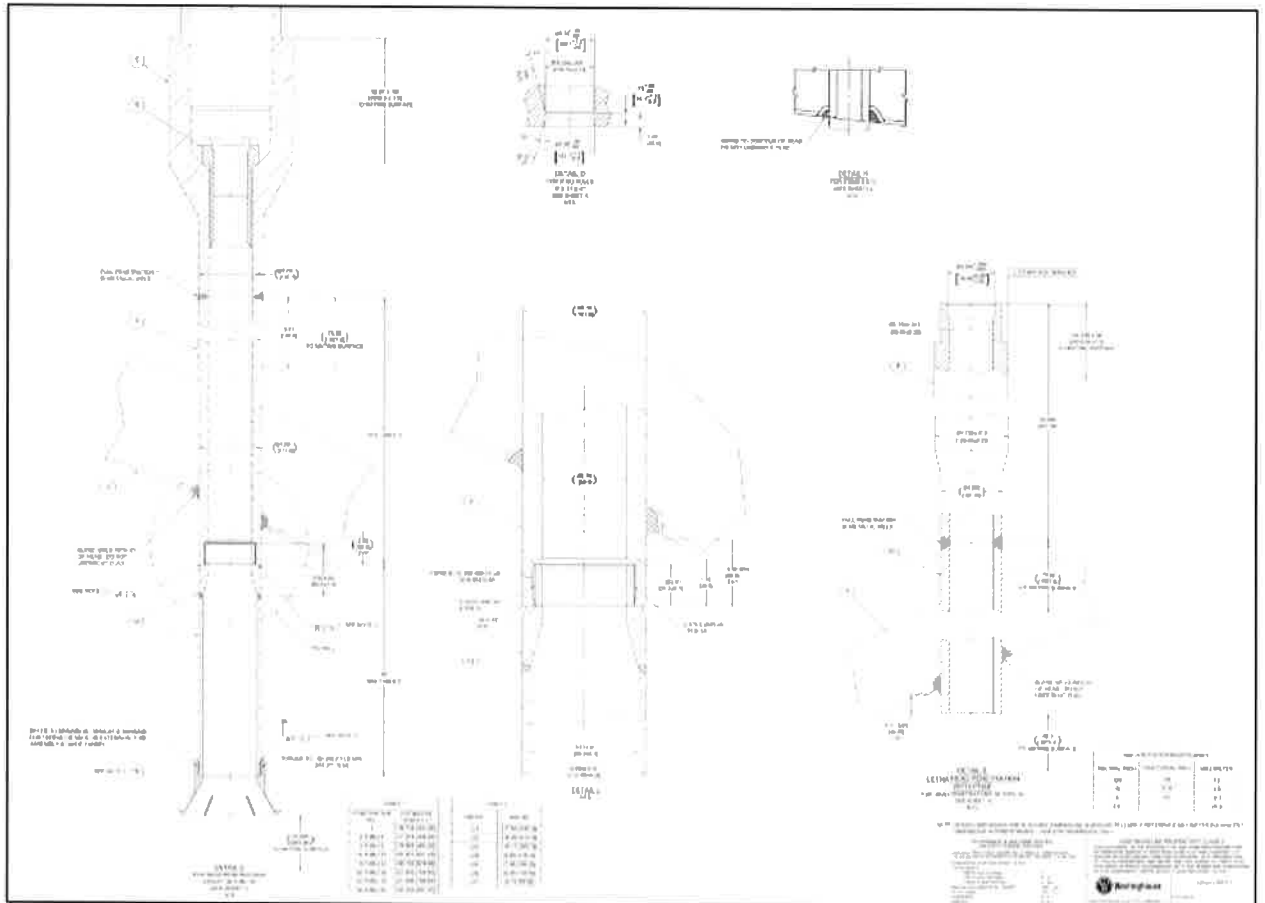
Ref. Dwg. 6466E30; 16x16 2-loop Guide Tube

2



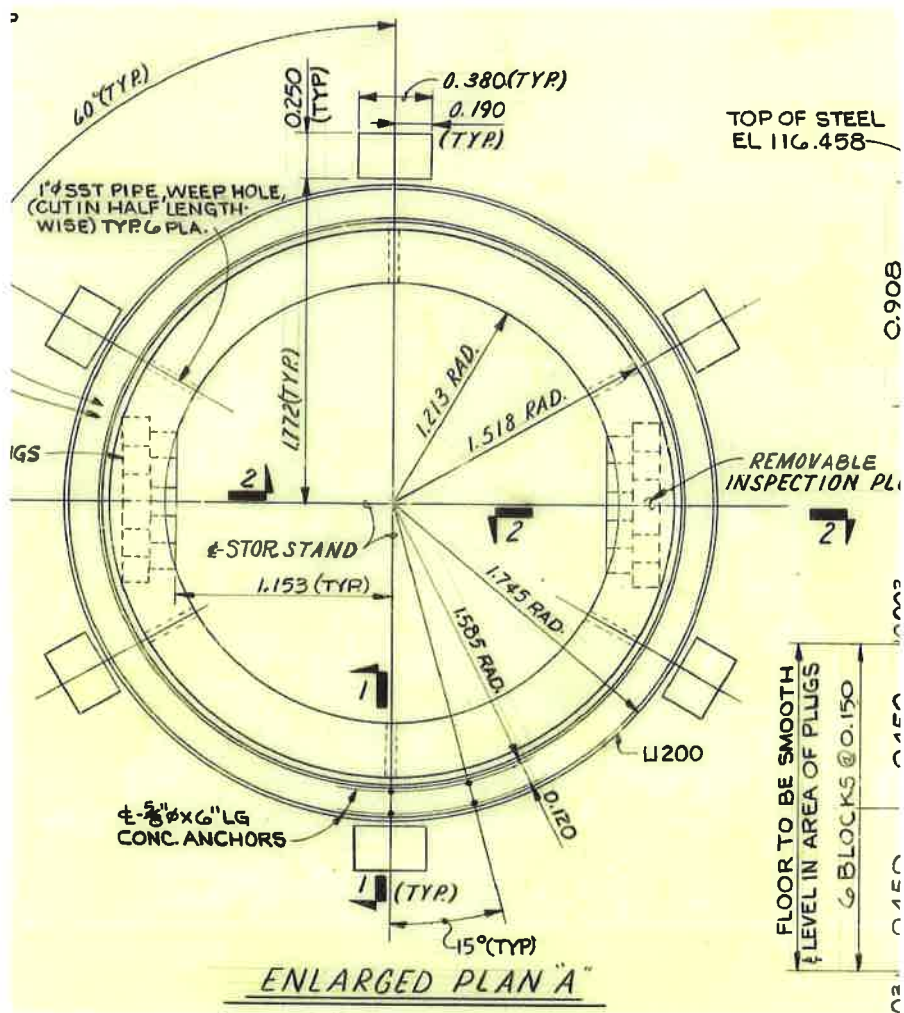
2

14.8 Reactor Vessel Closure Head drawing (cont.)

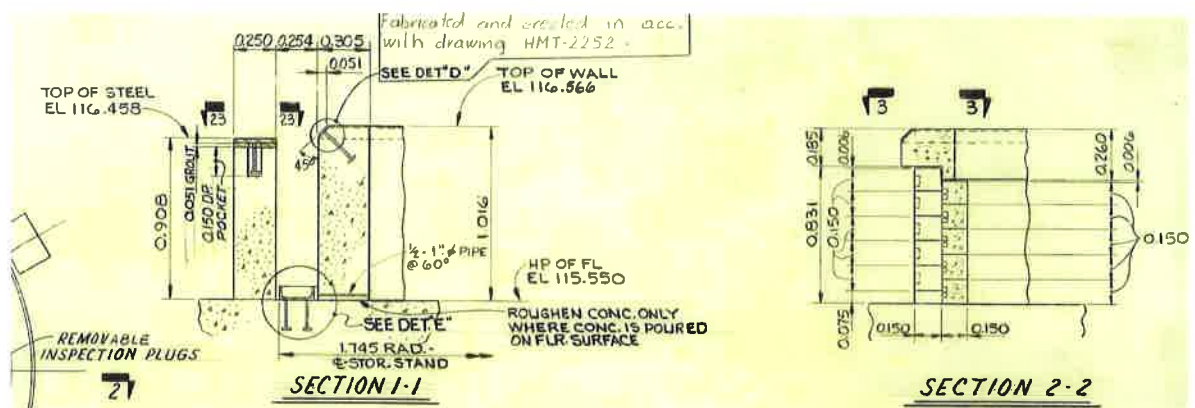


Replacement Reactor Vessel Closure Head Assembly: Dwg.: E-10036E84 (sheet 2 of 3)

14.9 Reactor Vessel Closure Head stand drawing



Ref. Dwg. E-411-230



Ref. Dwg. E-411-230

