

# NRC INSPECTION MANUAL

## INSPECTION PROCEDURE 55093

### REACTOR VESSEL INTERNALS (WELDING) OBSERVATION OF WELDING AND ASSOCIATED ACTIVITIES

#### 55093-01 INSPECTION OBJECTIVES

Ascertain whether activities pertaining to field welding of reactor vessel internals are being accomplished in accordance with Regulatory requirements, applicable codes, standards and licensee's commitments.

#### 55093-02 INSPECTION REQUIREMENTS

Select three of the following areas (a. through h. below whichever are applicable) and observe weld preparation and welding at various stages. Complete inspection requirements 1 through 7 for each of the areas selected.

- a. Internal support structures
- b. Jet pump assemblies
- c. Control rod guide tubes and instrument tubes
- d. Core spray spargers and supports
- e. Feedwater spargers and supports
- f. Down comer assembly
- g. Repair work and miscellaneous tackwelds and plugwelds
- h. Other safety related welding activities

02.01 Welding Identification. Ascertain whether weld identification records are established to permit clear retrieval of accurate weld data in compliance with the ASME Code and licensee's procedures: Select six weld identification records and verify accuracy of these records. Check one weld location for accuracy.

02.02 Weld Preparation. Ascertain by direct observation whether the weld preparation activities include the following:

- a. The surface for welding is reasonably smooth, and free of scale, rust, oil, grease and other deleterious foreign material, including moisture. (Examine areas prepared for welding).

- b. The work area is protected from deleterious contamination such as adverse environmental conditions (rain, snow) or other construction activity during welding. (Examine area with welding activity.)
- c. Cutting, forming, bending and alignment of material complies with the requirements as set forth in the ASME Code Section III, Division 1, Subsection NB, Class 1 - Components and Licensee's procedures. (Verify applicable activity(ies).)
- d. The techniques of alignment and the erection of parts, subassemblies and components for welding is being accomplished in accordance with licensee's/vendors' installation sequence specifications and assembly drawings.

02.03 Welding Material. Ascertain by direct observation and evaluation whether the storage, handling and control of welding materials complies with licensee approved procedures and the ASME Code. Include the following:

- a. Suitable facilities are provided and maintained for the storage of electrodes, flux and other welding materials.
- b. Precautions are taken to minimize the absorption of moisture by fluxes and cored, fabricated and coated electrodes.
- c. Only authorized personnel are allowed to withdraw material.
- d. Only proper amounts of the correct material are dispersed for each job at any particular period of time.
- e. Unused material is returned, properly dispositioned and properly recorded in accordance with approved procedures.
- f. Temperature and humidity are controlled in areas provided for weld filler material after removal from the original cans.
- g. Dispensing of welding material is done in accordance with approved documentation controls which identifies the type and quantity of material, the weld location/number for which the material is designated to be used, and the name of the authorized withdrawer.
- h. No unidentified weld filler material is in evidence at work and storage areas.

02.04 Observation of Welding. Observe one welding activity at each of the previously selected areas and ascertain whether the following is adhered to and in compliance with approved licensee welding procedures:

- a. Weld identification/location corresponds to respective weldcard, drawing, workorder or other welding documentation.
- b. Welding material used corresponds with the material specified.
- c. Welder's qualification meets the requirements for the weld being observed.
- d. Applicable welding procedures are being used and comply with the appropriate specifications and code requirements.
- e. Fitting and alignment methods secure final weld joints with offsets not to exceed the maximum allowable dimensions specified by the ASME code.

- f. Tack welds and temporary attachments are removed unless tack welds are allowed to be incorporated into the final welds.
- g. If tack welds are incorporated into final welds, that all requirements are satisfied in the final welds.
- h. Filler metal, electrode size, type and shielding gas, current and voltage has been predetermined for each weld. The essential variables specified and demonstrated in the procedure qualification are being satisfied in the production welds.
- i. The welding technique is applied as specified for the root portion and the remainder of each joint.
- j. Root pass welds have been observed, accepted and signed off by QC prior to continuation of welding.
- k. Surface of welds are free from coarse ripples, grooves, overlaps, abrupt ridges, valleys, undercuts and otherwise meet specified acceptance standards.
- l. Predetermined hold points are observed for QC examinations and that welding does not proceed prior to QC acceptance and release.
- m. Starting points of each successive pass are staggered.
- n. The welder inspects each bead or layer and corrects observed deficiencies such as remaining slag, sidewall undercutting, etc., prior to depositing the next bead or layer.
- o. Interpass temperatures are observed (where applicable).
- p. Unused filler materials are returned to the welding material storage facility or disposed of in accordance with procedure.
- q. Weld repair, defect removal technique, defect removal verification and re-examination of repair work comply with applicable procedures, codes and standards.
- r. NDE is performed as specified.

## 55093-03 INSPECTION GUIDANCE

### General Guidance

Pressurized Water Reactors. Field welding of reactor vessel internals varies significantly with different vendors. For example reactor vessel internals from Babcock and Wilcox require no field welding and are not subject to inspection under this procedure unless it has been determined that major repair work or modifications require such welding activities. Westinghouse Electric reactor vessel internals require minor field welding activities such as at the control rod guide tube and miscellaneous tackwelds. Most of these welds are subject to liquid penetrant and visual inspection and therefore only partially subject to inspection under this procedure.

Reactor vessel internals from Combustion Engineering require presently more extensive field welds; such as welding the core support barrel to the lower support structure plus some plug and tack welding. Applicable portions are subject to inspection under this procedure.

Boiling Water Reactors. BWR vessel internals require more field welding than PWR vessel internals. Inspection requirements as listed in this procedure are prepared mainly for BWR's. Applicable portions are subject to inspection under this procedure.

Prior to the observation of welding and associated activities the following items should be reviewed:

- a. NRC requirements.
- b. Licensees commitments relative to applicable codes and standards.
- c. NSSS vendors specifications pertaining to the field welding of reactor vessel internals.
- d. Applicable portions of the SAR.
- e. Licensee programs and procedures pertaining to the subject.
- f. Applicable portions of the QA Manual.
- g. Licensee commitments relative to welding and associated activities.

The IE inspector should be thoroughly familiar with the ASME codes in particular:

- a. Section III Division I Article NA 4000.
- b. Section IX in its entirety.

The knowledge of welding methods and techniques, their applications, limitations and evaluations, is essential for this inspection.

It may not be possible to complete all inspection requirements of Section II in this procedure during one site inspection.

### Specific Guidance

- 1.- Accuracy of weld locations is essential for future references during inservice inspection, therefore a selected weld location from the weld records should be verified by IE inspector.
- 2.- On weldments where alignment and weld preparation are complete, but where welding has not started, the weld area should be free from paint, grease and rust, and the alignment and gap should be within the specified limits. QC inspection is essential prior to welding.
- 3.- The weld filler material being used should comply with the welding specification. The filler material used for austenitic stainless steel welding should have been tested for delta-ferrite content in production welds and the content should not exceed specified limits. This information should be obtained from the records for filler material. Unused weld filler material should be separated from other types of material and stored in heated cans (if specification requires), and stubs properly removed from the work location.
- 4.- Welders qualification records should be reviewed and welders activities and workmanship should be observed. The appearance of the weld in progress should be reviewed for porosity.

- 4d.- Where welding is in progress, the IE inspector should assure himself that the applicable procedures are being followed, and only specified materials are being used.

The environmental conditions should be satisfactory, and the work should be performed in a clean dry location. For interpass temperatures, IE inspector should obtain the limitations from licensees procedure or NSSS vendors specification and assure himself that temperatures stay within these limits to prevent detrimental effects on the mechanical properties of the metal.

- 4q.- Special Procedures may be required to provide for the removal, rework and reinspection of all unacceptable defects. These procedures shall define "Major Defects," and how they are handled.

- 4r.- The NDE procedures being used should be reviewed to determine whether the procedures are in conformance with the requirements specified in the SAR. These procedures should include appropriate quantitative or qualitative acceptance criteria for determining weld acceptability. The NDE records must be correlated to the specific weld(s).

NDE procedures should be reviewed to assure the procedures or instructions require demonstration that the testing technique is capable of detecting and locating discontinuities described in the code.

#### 55093-04 REFERENCES

SAR, Chapters 1, 3, 4, and 17, including pertinent codes and standards referenced in these chapters

Regulatory Guide 1.31, Control of Stainless Steel Welding

Regulatory Guide 1.44, Control of the Use of Sensitized Stainless Steel

Regulatory Guide 1.58, Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel

Regulatory Guide 1.71, Welder Qualification for Limited Accessibility Areas

Regulatory Guide 1.85, Code Case Acceptability ASME Section III Materials

ASME Codes, Section III, Division I, Subsections NA and NB  
Section IX, and Section XI.

END