

NRC INSPECTION MANUAL

INSPECTION PROCEDURE 73053

PRESERVICE INSPECTION - OBSERVATION OF WORK AND WORK ACTIVITIES

PROGRAM APPLICABILITY:

73053-01 INSPECTION OBJECTIVES

Ascertain whether the onsite preservice inspection of Class 1, 2 and 3 pressure retaining components are performed in accordance with Regulatory requirements and licensee's commitments.

73053-02 INSPECTION REQUIREMENTS

02.01 Review licensee's preservice inspection (PSI) plans and schedules and ascertain whether component examinations, system leakage and hydrostatic tests meet the following requirements of the Safety Analysis Report and the licensee's PSI program:

- a. Number of items to be inspected.
- b. Methods of examination.
- c. Extent of examinations.

02.02 Review the qualifications and certifications of one of each of the three levels of examiners (Level I, II, III). Ascertain whether the qualification records properly reflect the following:

- a. Employer's name
- b. Person certified
- c. Activity qualified to perform
- d. Level of qualification
- e. Effective period of certification
- f. Signature of employer's designated representative
- g. Basis used for certification
- h. Annual visual acuity and color vision examination and periodic recertification.

02.03 Observe four different methods of examination of components and ascertain whether the following requirements are met:

- a. Approved NDE procedures are available, are being followed and specified NDE equipment is being used.
- b. ND Examination personnel are knowledgeable of examination method and operation of NDE equipment.
- c. ND Examination personnel with proper level of qualification and certification are performing the various examination activities including designation of NDE method/technique to be used, equipment calibration, examination, and interpretation/evaluation/acceptance of NDE results.
- d. Examination results, evaluation of results, and any corrective actions/repairs/replacements are being recorded as specified in the PSI program and NDE procedures.
- e. During observation of each selected method of examination, the inspector should consider the impact attributes of the method to determine acceptability of the observation. The following lists of attributes identifying the importance should be evaluated by the inspector to determine acceptability of the activity being observed.

A. Volumetric Examination Using Ultrasonic Technique. The following should be consistent with the approved procedure and Section XI:

- (1) The type of apparatus used, including frequency range as well as linearity and signal attenuation accuracy.
- (2) The extent of coverage (beam angles, scanning, surface, scanning rate and directions) as well as the scanning technique.
- (3) Calibration, methods and frequency including the type, size, geometry and material of identified calibration blocks as well as location and size of calibration reflectors within the block are clearly determined and recorded.
- (4) The sizes and frequencies of search units.
- (5) Beam angle or angles.
- (6) Methods of compensation for the distance traversed by the ultrasonic beam as it passes through the material including distance - amplitude correction curves, electronic distance - amplitude correction and transfer mechanisms, if used.
- (7) Reference reflectors for accomplishing transfer and the frequency of use of transfer mechanisms, if applicable.
- (8) The reference level for monitoring discontinuities is as defined and the scanning gain setting is as specified.
- (9) Methods of demonstrating penetration.
- (10) Levels or limits for evaluation and recording of indications.
- (11) Method of recording significant indications.

(12) Acceptance limits are determined.

If an automated or a programmable reactor inspection system is used for examination, ascertain whether the following additional requirements are met:

(13) The instruction manual and/or program procedure is being followed.

(14) The examination personnel are thoroughly familiar with the inspection system, its application, operation and its limitations.

(15) The test examination permits continuous observation of scanning pattern to achieve 100% volumetric coverage of welds and base metal sections designated for examination.

(16) There is a continuous recording of meaningful and reproducible data with accurate orientation to the reference points.

(17) The initial unit calibration, examination block calibration, and subsequent calibrations are being done in accordance with the instruction manual and/or program procedure.

(18) The type of couplant used and certification of specified material.

B. Volumetric Examination Using Radiographic Technique. The following should be consistent with the approved procedure and Section XI:

(1) The type of material to be radiographed has been identified and confirmed.

(2) The material and weld surface condition requirements (irregularities, weld ripples, surface finish, etc.) meet the limits.

(3) The material thickness is within the specified range.

(4) Type of radiation source, effective focal spot or effective source size, X-ray equipment, voltage rating, and equipment manufacturer.

(5) Film brand, type, shelf-life and number of films in cassette are identified and verified.

(6) Minimum source to film distance.

(7) Blocking or masking technique, if used.

(8) Type and thickness of intensifying screens and filters.

(9) Exposure conditions for procedure qualification.

(10) Radiographic film processing requirements.

(11) Quality of radiographs - limits on mechanical, chemical, or other blemishes, such as fogging, process marks, scratches, finger marks, loss of detail, or false indications.

(12) Film density and sufficient contrast for single and composite viewing.

(13) Use of densitometers for assuring compliance with film density requirements.

- (14) System of radiograph identification.
- (15) Use of location markers.
- (16) Methods of reducing and testing for back-scatter.
- (17) Selection and use of penetrameters including:
 - (a) Penetrameter placement including special requirements for single and double wall viewing.
 - (b) Number of penetrameters.
 - (c) Shims under penetrameters.
- (18) Radiographic technique for double wall viewing.
- (19) Evaluation and disposition of radiographs.

C. Volumetric Examination Using Eddy Current Technique. The following should be consistent with the approved procedure and Section XI:

- (1) The 2-channel Eddy Current Examination equipment has been identified including indicator, meter, tube, strip recorder and tape (whichever is applicable).
- (2) Method for maximum sensitivity is applied.
- (3) Method for determining material permeability of material to be examined has been recorded.
- (4) Material permeability has been recorded.
- (5) Method of examination (Impedance, Phase-Analysis or Modulation Analysis) has been recorded.
- (6) Examination equipment has been calibrated in accordance with the applicable performance reference.
- (7) Amplitude and phase has been calibrated with the proper applicable calibration reference and is recalibrated at predetermined frequency. (Reference flaw simulates length, depth and shape.)
- (8) 100% coverage of steam generator tubes occurs during the examination.
- (9) Acceptance criteria is specified or referenced and is consistent with the procedure or the ASME Section V. Results are consistent with acceptance criteria.

D. Surface Examination Using Liquid Penetrant Technique. The following should be consistent with the approved procedure and Section XI:

- (1) The specified examination method is consistent with the procedure and consists of either one color contrast or fluorescent particle technique.
- (2) The penetrant, penetrant remover, emulsifier and developer are identified and consistent with ASME Code Section V.

- (3) Penetrant materials used for nickel base alloys were analyzed for sulfur content. Residual total sulfur does not exceed the established limits.
- (4) Penetrant materials used for the examinations of austenitic stainless steel were analyzed for total halogens. The total residual halogen content does not exceed the established limits.
- (5) If fluorescent penetrant examination method is used, color contrast examination does not follow.
- (6) Acceptable pre-examination surface preparation is done prior to examination.
- (7) The drying time following surface cleaning meets or exceeds requirements.
- (8) The method of penetrant application and penetration time is consistent with the penetrant manufacturer's recommendation, and code requirements.
- (9) The examination surface temperature ranges between 60° and 125°F. If the temperature is outside this range, a special procedure must be qualified.
- (10) Methods of removing water washable penetrant do not exceed 50 psi and 110°F, respectively.
- (11) If applying emulsifier (when applicable), the emulsification time does not exceed five minutes without being specially qualified in the procedure.
- (12) Removal of solvent removable penetrant (when applicable).
- (13) The surface is dry prior to developing.
- (14) The type of developer, method of developer application, and the time interval between penetrant removal and developer application.
- (15) Examination technique and time interval between developer application and evaluation.
- (16) Examination conditions for fluorescent penetrants (when applicable).
- (17) Technique for evaluation of indications.
- (18) Reporting of examination results.
- (19) Requalification conducted when changes are encountered in any of the following parameters:
 - Surface treatments which may alter the condition of surface openings (blast cleaning, acid etching).
 - Change in precleaning materials or methods.
 - Change in the type of penetrant materials (including developer, etc.) or in processing technique.

E. Surface Examination Using Magnetic Particle Technique. The following should be consistent with the approved procedure and Section XI:

- (1) Examination by the continuous method (current on while particles are being applied) with adequate material surface preparation.

- (2) If dry particles are used, the particle color provides good contrast with background and component surface temperature is less than 600°F.
- (3) If wet particles are used, they are suspended in suitable liquid medium and component surface temperature is below 135°F.
- (4) Viewing conditions for fluorescent particles are consistent with ASME Section V (if applicable).
- (5) Examination is conducted with sufficient overlap to achieve 100% coverage and two separate examinations are made with field directions perpendicular to each other.
- (6) When prod method is used, prod spacing does not exceed eight inches, is not less than three inches, and arcing is minimized. Material surface is clean.
- (7) Magnetizing current for the prod method ranges between 100-125 amps per inch of prod spacing for section thickness more than ¾-inch and 90-110 amps/inch for sections less than ¾-inch thick.
- (8) If coil or direct contact methods are used, current and technique are consistent with ASME Section V.
- (9) If Yoke method is to be used, pole spacing is within three to six inches and minimum lifting power is 10 lbs. for alternating current and 40 lbs. for direct current.
- (10) Results are consistent with acceptance criteria.

F. Visual Examinations. The following should be consistent with the approved procedure and Section XI:

- (1) Type of visual examination used, direct or remote.
- (2) Lighting levels.
- (3) Cleanliness of surface to be examined.
- (4) Measurement of clearances, tightness of bolting, physical displacement, structural adequacy, freedom of motion and verification of settings as applicable.
- (5) Results are compared to acceptance criteria and required corrective measures taken.

G. System Pressure Tests. The following should be consistent with the approved test procedure and section XI:

- (1) Test conditions of pressure and temperature.
- (2) Test condition holding time.
- (3) Rate of temperature and pressure increase.
- (4) Pressure and/or temperature measuring instrumentation.

(5) Sources of detected leakage located, evaluated and corrective measures taken.

(6) Gauges calibrated prior to test.

02.04 If applicable, observe the repair affecting the pressure retaining boundary of one component which is being performed as a result of the preservice inspection. If observation is not possible because work is not in progress, examine a minimum of three records of inspection requirements (a) to (h) below and ascertain whether the requirements of the Safety Analysis Report and PSI Program are met:

- a. Licensee's approved Quality Assurance Program is applied to control the quality affecting activities of the repair.
- b. Welding is performed by welders who are qualified and are using procedures which are qualified in accordance with Section IX and any additional heat treating and impact tests required by Section XI.
- c. Welding procedure is available to the welder and welder is following procedure requirements.
- d. Welding materials are controlled in accordance with appropriate instructions for purchasing, receiving, storing, disbursing and handling of welding materials.
- e. Completed weld meets visual examination acceptance standards including surface preparation.
- f. Completed weld is examined by qualified examination and certified NDE personnel using approved procedures.
- g. Preservice inspection has been performed and results recorded.
- h. new or repaired pressure retaining welds are pressure tested.

73053-03 INSPECTION GUIDANCE

03.01 General Guidance

It is intended that this inspection procedure will be accomplished prior to fuel loading. The preservice inspections of interest in this procedure are those nondestructive examinations of Class 1, 2 and 3 components and system leakage and hydrostatic tests performed to meet the requirements of Section Xi of the licensee's PSI program. Inservice testing of pumps and valves are described in Subsections IWP and IWV of Section XI is not included within the scope of this procedure. The IE inspector should perform his inspection during peak periods of preservice inspection activity at the licensee's facility.

The IE inspector shall be thoroughly familiar with NDE methods and techniques, their applications, limitations and the recording and analysis of examination results. He shall be able to evaluate findings or indications and determine if these are acceptable within code limits or require repair work.

03.02 Specific Guidance

1. Pursuant to 10 CFR 50.55a(g), the licensee performs a preservice inspection of pressure retaining components in accordance with the provision of Section XI. In some instances, inspection requirements in addition to those of Section XI are imposed by the NRC and these may be documents in the Safety Analysis Report and /or the licensee's PSI Program.

In order to review the licensee's plans and schedules for the preservice inspection, the inspector must obtain and review the applicable paragraphs of the Safety Analysis Report, the licensee's PSI Program and the applicable ASME Section XI code. Exceptions to or exemption from examination requirements shall be documented by the licensee to permit exclusion from subsequent inservice inspections. If the inspector finds that justification for an approved examination exception or exemption is not valid, this finding shall be brought to the attention of IE:HQS for resolution. Specific requests for relief from PSI examination must be approved by the NRC and are found in the SER.

2. Personnel involved in the performance, evaluation or supervision of nondestructive examination of safety-related items should meet the qualification and certification requirements in SNT-TC-IA (Applicable Supplement) and ASME Section XI. Qualification certificates, and last annual visual acuity, color vision test should be made part of the NDE records.

The IE inspector should verify that NDE activities are performed according to these levels. No one shall perform NDE activities of a higher level for which one is not qualified (examination evaluation, etc.).

The three levels of Examiners are:

Level I – Authorized to perform specific set-ups, calibrations, and tests under the guidance of Level II or III individual.

Level II – Authorized to set-up, calibrate, examine and record data, evaluate and report examination results.

Level III – Authorized to develop approve inspection and examination procedures. Administer training, examinations and certifications if specified.

3. The inspector is to observe four different methods of examination. Various methods of examination from which this selection may be made are:
 - a. Volumetric examination of weld using manual A-scan ultrasonic technique.
 - b. Volumetric examination of weld using automatic or programmable ultrasonic technique.
 - c. Volumetric examination of nozzle-to-vessel radiused section using ultrasonic technique.
 - d. Volumetric examination of weld using radiographic technique.
 - e. Volumetric examination of components (CRD housings, bolts, studs, bolt hole ligaments, integrally welded supports).
 - f. Volumetric examination of steam generator tubes using eddy current technique.

- g. Surface examination of weld, or bolts, nuts, studs using PT or MT technique.
- h. Visual examination of core support structures, support components (mechanical or hydraulic) or other component listed in Section XI.
- i. Visual examination during system leakage or hydrostatic test.

The intent here is to provide the inspector sufficient flexibility to ascertain whether the examinations are being conducted properly. It is expected that when different methods of examination are in progress simultaneously, the inspector will select methods of examination of higher Regulatory interest, e.g., volumetric examination of reactor pressure vessel pressure retaining welds or nozzle radiused sections, volumetric examination of Class 1 component pressure retaining welds inside containment, volumetric examination of steam generator tubes.

In the interest of efficient use of resources, it is not required for the inspector to observe complete examination of a component or weld. Rather, the inspector should observe a method of examination until he is confident in his determination of the certification of the examiners, compliance with NDE procedure requirements during examining, and the evaluation and recording of examination of welds using the manual A-scan ultrasonic technique, it is expected that the inspector can obtain examination of one weld using a straight or one angle beam in one direction, i.e., it is not necessary to observe all straight and angle beam examinations in the several directions in the test of the weld.

- 4. When repair work is referred back to construction forces, the only inspection requirement would be to assure that construction QA programs continue to control weld repair.

When repair work is being controlled by a new operating QA program the following is applicable:

- a. Obtain from licensee records such as repair procedure, drawings, sketches and/or work orders which indicate the extent of the planned repair pertaining to NDE findings on one component.

Ascertain whether work and inspection procedures are provided consistent with licensee's Quality Assurance Program and work to be accomplished.

- b. Refer to guidance provided for Inspection Procedure No 55700, Welding. Specific requests for relief from testing requirements must be approved by the NRC and are found in the SER.
- c. For the NDE associated with repair, ascertain by procedure/record review or observation whether the re-examination is at least equivalent to the original examination that detected the flaw and results used to establish a new preservice record prior to return of the plant to service.