RAS H-340

ENTERGY

ENN
ENGINEERING
STANDARD

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Flow Accelerated Corrosion Component Scanning and Gridding Standard

Applicable Site(s):

IP1 ☐ IP2 ☒ IP3 ☒ JAF ☒ PNPS ☒ VY ☐

Safety Related: ____ Yes

__x__ No

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Engineering Guide Owner

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OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

U.S. NUCLEAR REGULATORY COMMISSION
In the Matter of Entergy Nuclear Vermont Yankee LLC
Docket No. 50-271 Official Exhibit No. E4-25-VY
OFFERED by: Applicant/Licensee Intervenor
NRC Staff Other
IDENTIFIED on 7/23/08 Witness/Panel NEC 4
Action Taken: ADMITTED REJECTED WITHDRAWN
Reporter/Clerk MAC

Template Revs-028

DS-03

Requirements and Revision Summary

Revision No.	Date	Changes
0	8/11/04	Original issue

TABLE OF CONTENTS

1.0 PURPOSE

1.1 This Standard defines the methodology for gridding components that are to be inspected under the Flow accelerated Corrosion (FAC) program.

1.2 This Guide is to be used in conjunction with ENN-DC-315, "Flow Accelerated Corrosion Program".

1.3 This Procedure may be used as a guideline for Programs other than Flow Accelerated Corrosion.

2.0 REFERENCES

2.1 NRC Generic Letter 89-08, Erosion/Corrosion Induced Pipe Wall Thinning

2.2 NSAC 202L, EPRI Document, "Recommendations for an Effective Flow Accelerated Corrosion Program".

2.3 ENN Nuclear Management Manual, ENN-NDE-9.05," Ultrasonic Thickness measurement ".

2.4 ENN –DC-315, "Flow Accelerated Corrosion Program."

3.0 DEFINITIONS

3.1 Grid(s) – A pattern of points or lines, on a piping component, where UT thickness measurements will be made. Grid(s) may be permanently marked with circumferential and longitudinal grid lines.

3.2 Grid Point – A specific location on a piping component, where a UT thickness measurement will be made. Grid points are at the intersections of the circumferential and longitudinal grid lines.

3.3 Grid Size – The distance between grid points in the circumferential or longitudinal direction. Also called grid space or grid spacing.

3.4 Grid Point Reading – UT readings taken at the intersection of the grid location.

3.5 Grid Scan– 100% scan of the area between the grid lines. The lowest measurement in each area to be recorded as the measured thickness.

3.6 Quadrant Scan– Piping segments divided in quadrants A, B, C, D that are 90 degrees apart and broken in one-foot lengths or as specified by the FAC engineer.

3.7 Line Scans– piping segments broken into one-foot lengths (Small-Bore pipe).

3.8 Flow Accelerated Corrosion (FAC) - Degradation and consequent wall thinning of a component by a dissolution phenomenon, which is affected by variables such as temperature, steam quality, steam/fluid velocity, water chemistry, component material composition and component geometry. Previously known as Erosion/Corrosion.

4.0 RESPONSIBILITIES

4.1 Supervisor Codes Program

4.1.1 The supervisor charged with the responsibility for the FAC inspection program at each site is responsible for implementation of this standard.

4.2 FAC Program Engineer

4.2.1 The ENN FAC Program Engineer is responsible for development, interpretation, implementation and approval of this standard.

5.0 DETAILS

5.1 Examination Surface Requirements

5.1.1 Generally, only minor surface preparation is necessary. Loose surface debris must be removed from the transducer contact location. Scale and heavy corrosion should be removed by a plant-approved method. Some tightly adhering scale and epoxy coatings can transmit ultrasound and do not require removal.

5.1.2 When the required examination area cannot be prepared or gridded due to interference by another component or part geometry, the examination records shall identify the cause of the limiting condition.

5.1.3 Existing Grids shall not be removed unless directed by the FAC engineer.

5.2 Gridding of Components

5.2.1 A full coverage grid should be used on each component, when practical. The type of grid and examination performed will be determined by the work request, engineering direction or examiner's experience when direction is not provided.

5.2.2 Where components have previously been examined, the gridding system previously identified should be re-used to maintain consistency of data. In cases where the previous gridding cannot be accurately determined for re-examination, the component may be re-gridded in accordance with this procedure or engineering direction. The responsible engineer or designee should be notified that the grid cannot be duplicated and alternative gridding of the component is to be performed.

5.2.3 Gridding of piping components should be performed as follows or as directed by the FAC engineer.

5.2.3.1 The grid sizes, locations, labeling system and Datum Zero location(s) shall be established as directed by the FAC Engineer, NSAC 202L or Table 1. Datum Zero should be marked with a low stress stamp for future inspection identification.

5.2.3.2 Grids should be established such that the column letters are oriented circumferentially and the row numbers are oriented axially. The size or length of the last grid should be documented on the sketch of the component showing the gridding performed.

5.2.3.3 Piping fittings (elbows, reducers, tees, etc.) to be examined should be gridded from two inspection grids upstream of the weld (component upstream weld) to two inspection grids downstream of the weld (component downstream weld). Gridding will start and stop (when applicable) adjacent to the toe of the weld of the component unless the last grid on the component is within 1/2" of the toe of the weld. Reference attachment 7.2 and 7.3 respectively.

5.2.3.4 For expanders (or diffusers) and expanding elbows, grid lines may be extended two pipe diameters upstream and two pipe diameters beyond the component being examined. Reference attachment 7.3

5.2.3.5 For diffusers, expanding elbows and where examination is to be continued on the piping downstream of the component, the gridding should continue for a distance of two pipe diameters from the weld. The size or length of the last grid should be documented on the sketch of the component showing the gridding performed.

5.2.3.6 Where piping components are to be examined, the component should be gridded from two inspection grids upstream of the upstream weld (where applicable) and continued for a distance of two pipe diameters beyond the downstream weld. Where the downstream component does not extend two pipe diameters, the gridding should extend an additional two inspection grids downstream of the adjoining weld. (Reference Attachment 7.1).

5.2.3.7 When determining the grid size for a reducer, expander or elbow, the grid size shall be determined by the smaller diameter or as directed by the FAC engineer or FAC program documents.

5.2.4 Large tanks or vessels should be examined by sampling. Square type grids may be established by engineering for examination of a side or portion of a tank.

5.2.5 When component accessibility is limited due to plant geometry, configuration or radiological conditions that makes gridding and/or low stress stamping impractical, an alternate method may be used with the approval by an NDE Level III. Any alternate methods used shall be documented and detailed on the examination report.

5.2.6 The grid sizes to be used shall be in accordance with NSAC 202L or as identified in Table1. Other grid sizes may be used at the discretion of the responsible engineer or an NDE Level III examiner.

TABLE 1. GRID SPACING GUIDELINES

NOMINAL PIPE SIZE	GRID SPACING
1" - 6"	1"
8" - 10"	2"
12" - 14"	3"
16" - 18"	4"
20"	5"
24" and up	6"

5.2.7 Gridding reference system

5.2.7.1 High temperature paints, china markers, or other marking devices should be used to mark the grid locations. All markers, paints, etc., used for gridding shall be approved by the plant's chemical control program prior to use.

5.2.8 For flow accelerated corrosion examinations, a low stress V stamp may be used to establish a starting reference point A_o when permanent stamping of all intersecting points is not specified by the responsible engineer or an NDE level III examiner.

The tip of the V should be placed on the upstream weld centerline or adjacent the A1 location (or starting point) and pointed along the centerline in a clockwise direction with flow. Locate the V mark or begin stamping of the weld or component using one of the following rules or as directed by the responsible engineer.

- If the component has been previously examined, gridding should be reestablished where possible.
- Examinations continuing from an adjacent component should continue the grid established.
- For elbows, the upstream extrados (outside radius) of the elbow will be used as the grid starting location.
- If the component is a tee and not connected to an elbow being examined. The upstream intrados (inside radius) of the tee will be used as a starting point. The branch of the tee should be gridded starting at the branch weld to the main run. Numbering of the branch should be performed with flow.
- If the component is connected to any elbow or tee being examined, continue the grid from the upstream adjacent component.
- If the component is on a horizontal run and not connected to an elbow or tee, use the upstream top dead center of the component as the starting point.
- If the component is on a vertical run and not connected to an elbow or tee, use the upstream elbow extrados for the starting point. If the upstream elbow cannot be seen, use the downstream elbow's extrados.
- If the above rules cannot be followed, choose the most convenient location on the upstream side of the component for a starting location.
- For examinations not identified within the FAC program, the gridding methods contained within this standard may be used or modified as necessary to conduct the examination.

5.3 Calibration Requirement

5.3.1 General

5.3.1.1 Calibration shall be in accordance with ENN-NDE-9.05 or other site approved procedures.

5.4 Reference System and Scanning

5.4.1 Quadrant Scans

5.4.1.1 The following guidelines shall be employed for the establishment of quadrants and scan paths. Configurations that are not addressed herein shall be brought to the attention of the FAC Engineer for determination. Quadrant scanning should be utilized for small bore piping and large bore piping and components in high radiation areas and where Microbiological Influenced Corrosion (MIC) and pitting due to cavitation is suspected in high radiation areas.

5.4.1.2 Quadrants should be established by direction of flow and directional plane of piping with "A", "B", "C", "D" beginning at the datum line and ending at 360 degrees (clockwise-direction). The length of each quadrant should be a maximum of 12.0" unless directed by the FAC Engineer. In some cases, there may be two or three sets of quadrants for a component, i.e., A 1, B 1, C 1, D 1 and A2, B2, C2, D2, etc.

5.4.1.3 Scanning should begin at the datum point of quadrant "A" proceeding clockwise with flow. Each quadrant shall be examined separately.

5.4.2 Line Scans

5.4.2.1 As an alternative, small-bore piping may be examined in sections (i.e., scanned 360° for 1 foot length, etc.), rather than quadrants. These examinations will be performed at the discretion of the FAC Engineer, who will provide location and extent of examination and Datum Zero, if applicable.

5.4.3 Grid Scans

5.4.3.1 The following guidelines shall be employed when utilizing a grid system.

- The grid sizes, locations, labeling system and Datum Zero location(s) shall be established as directed by the FAC Engineer, NSAC 202L or Table 1. Datum Zero should be marked with a low stress stamp for future inspection identification. Permanent markers (i.e. paint, sharpie etc.) may also be used.
- When grid scan readings are identified to be taken during an examination, a 100% scan of the grid area or square shall be performed for the lowest wall thickness reading contained within the area. The grid area scanned will be identified by the lowest column or row, letter or number identified by the grid points containing the examination area (i.e. A1 scan location would be between point columns A and B and rows 1 and 2.)
- When scanning for Microbiological Influenced Corrosion (MIC), cavitation, pitting or other areas of concern, 100% grid scanning shall be performed.

5.4.4 Grid Point Reading

5.4.4.1 Flow Acceleration Corrosion (FAC) readings shall be taken as directed by the FAC Engineer with the Grid Point method (one reading at the grid intersection) except where the grids intersect a circumferential weld (normally the first and last grid columns). Those grids areas shall be 100 % scanned and the lowest reading shall be recorded or stored.

5.5 Paint Thickness Measurement

5.5.1 If necessary due to the UT technique being used the following may be used for painted surfaces.

5.5.1.1 Where thickness readings are taken through painted surfaces, compensation for the paint thickness should be performed where readings are used for component acceptance. An average, range or actual paint

thickness (mils of paint) should be identified during the examination and recorded on the examination data sheet along with the paint thickness gauge used for measurement. Complete removal of paint is still considered the most accurate means of taking thickness measurements.

5.5.2 All UT thickness performed on coated surfaces shall be performed under the direction of the site NDE Level III

6.0 RECORDS

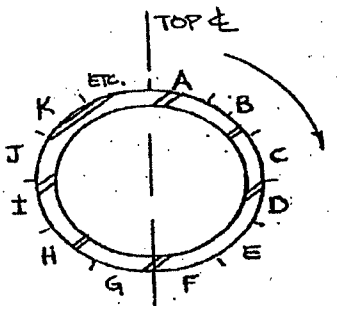
None

7.0 ATTACHMENTS

7.1 Straight Pipe grid marking Convention.

7.2 Grid Layout for an Elbow.

7.3 Inspection Grid layout for Tees and Expanders/Reducers



VIEW A-A

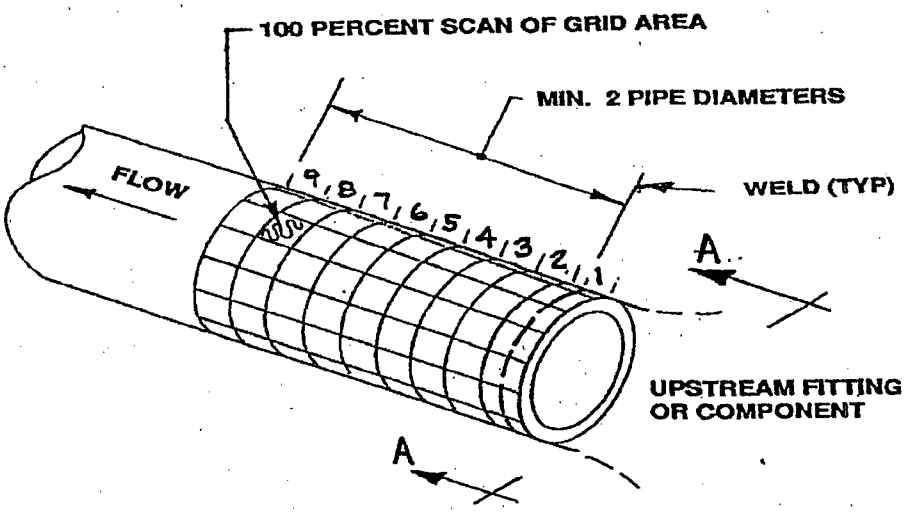
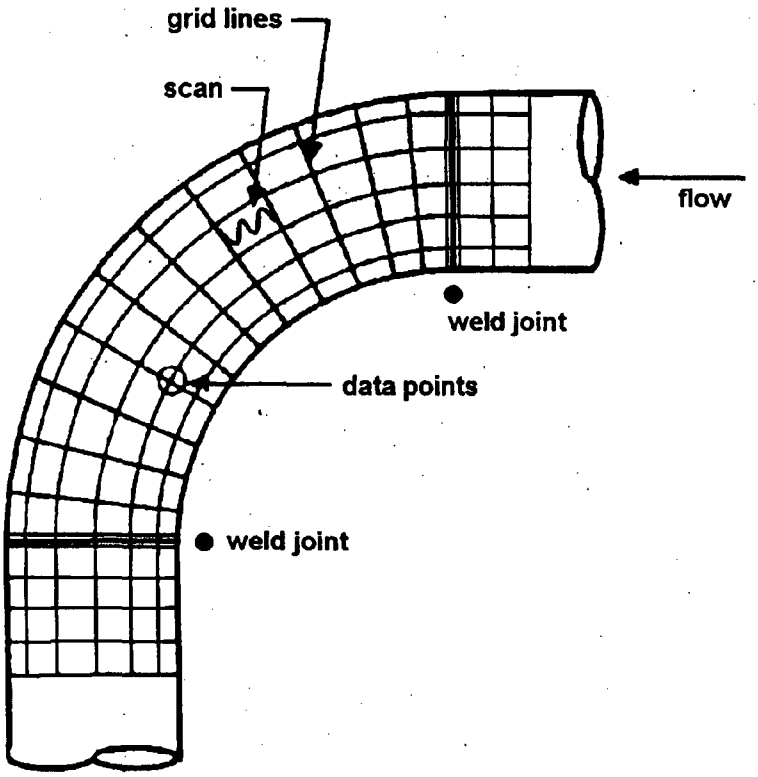


FIGURE A.1 STRAIGHT PIPE GRID MARKING CONVENTION

ATTACHMENT 7.2 GRID LAYOUT FOR AN ELBOW



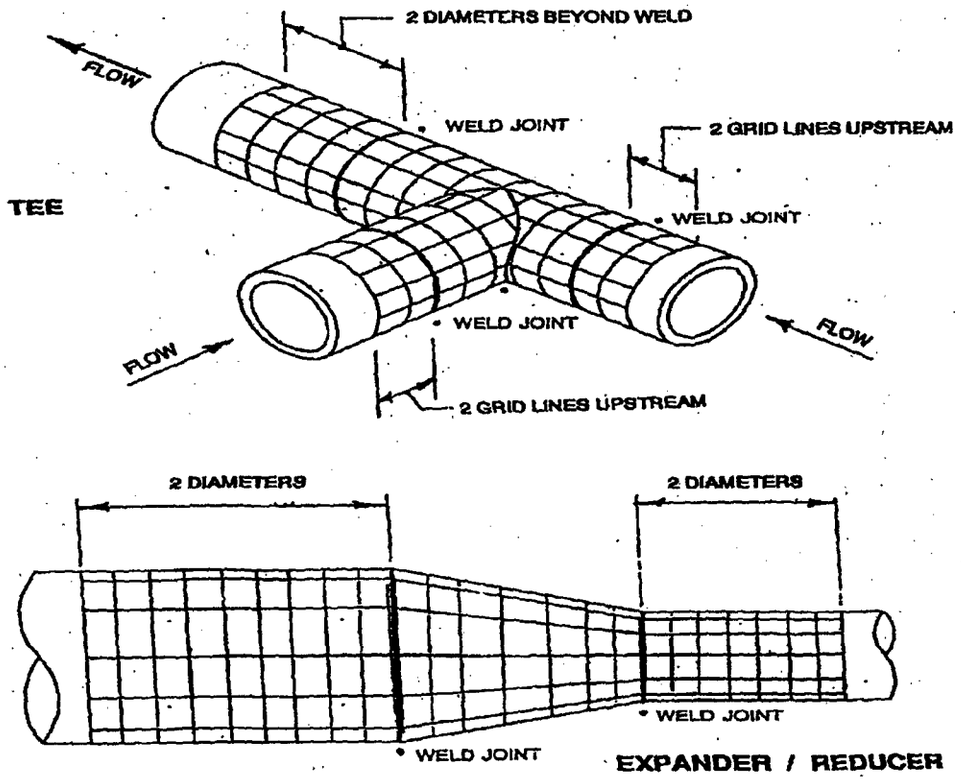


FIGURE A.3 INSPECTION GRID LAYOUT FOR TEES AND EXPANDERS/REDUCERS