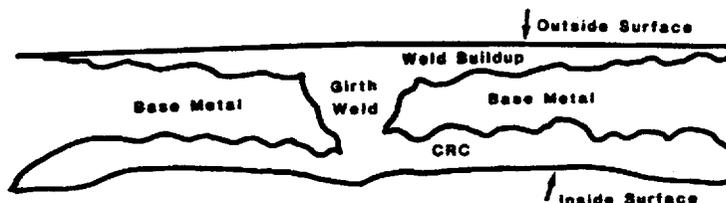


Proposed Code Case and Code change to ASME Section XI, Appendix VIII, Supplement 2

The following proposed Code action is the result of NRC, PDI, and EPRI attempts to consolidate the requirements contained in the current Code Appendix VIII rules and the NRC Final Rulemaking. Outstanding items were identified and resolved during a joint meeting with NRC, PDI, and EPRI on 10/11/00 and they were finalized during a PDI and EPRI meeting on 11/28/00. The Code action is presented as both a Code Case and a Code Change because selected revisions are needed quickly to address implementation commitments and concerns.

The major difficulty with the current Supplement 2 is that it provides requirements for qualification of procedures, personnel, and equipment when examining wrought austenitic piping welds from the outside surface. However, there are additional welds, primarily the safe-end-to-pipe weld in PWR Reactor nozzles, that are examined from the inside surface. PDI has committed to support this activity and is currently procuring appropriate test specimens. In support of this activity, primarily paragraphs 1.1 General, 1.1(b), 1.1(c), and 2.0 have been revised to address qualification from either surface.

An additional problem occurs because Supplement 2 does not specifically include or exclude wrought austenitic piping welds that contain corrosion resistant cladding (CRC). CRC is typically limited to BWR's where it was applied to the inside of a small number of pipes to mitigate IGSCC. Because of radial shrink the outside of the pipe often received supplemental weld material also. The following illustrates what may be considered a worst case configuration. The difference in the qualification requirements for procedures, personnel and equipment for examination of this configuration compared to a typical austenitic piping weld is significant and paragraph 1.1 specifically excludes it. PDI is preparing a Guidelines document to address these welds. Owners are continuing to examine these welds in accordance with their current licensing commitments.



This revision also consolidates commitments for qualifications meeting Generic Letter 88-01 on piping welds susceptible to IGSCC. These are contained primarily in paragraphs 1.2(c)(3) and 3.1. This revision also incorporates lessons learned from hundreds of qualifications. For example, it requires a larger sample set size with 100% detection for procedure qualification, modifies the requirements for identifying flawed regions to candidates, and requires that each detected flaw be length sized. These revisions are contained in several individual paragraphs.

**SUPPLEMENT 2 — QUALIFICATION
REQUIREMENTS FOR WROUGHT
AUSTENITIC PIPING WELDS**

1.0 SPECIMEN REQUIREMENTS

Qualification test specimens shall meet the requirements listed herein, unless a set of specimens is designed to accommodate specific limitations stated in the scope of the examination procedure (e.g., pipe size, access limitations). The same specimens may be used to demonstrate both detection and sizing qualification.

1.1 General. The specimen set shall conform to the following requirements.

(a) Specimens shall have sufficient volume to minimize spurious reflections that may interfere with the interpretation process.

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(b) The specimen set shall consist of at least four specimens having different nominal pipe diameters and thicknesses. The set shall include pipe specimens not thicker than 0.1 in. more than the minimum thickness, nor thinner than 0.5 in. less than the maximum thickness for which the examination procedure is applicable. It shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. If the procedure is applicable to pipe diameters of 24 in. or larger, the specimen set must include at least one specimen 24 in. or larger in diameter but need not include the maximum diameter.

(c) The specimen set shall include examples of the following fabrication condition:

- (1) unground weld reinforcement (crowns);
- (2) wide crowns, such that the total crown width is 1½ to 2 times the nominal pipe wall thickness;
- (3) geometric conditions that normally require discrimination from flaws (e.g., counterbore, weld root conditions such as excessive I.D. reinforcement);
- (4) typical limited scanning surface conditions (e.g., diametrical shrink, single-side access due to safe ends or fittings).

(d) All flaws in the specimen set shall be cracks.

(1) Mechanical fatigue cracks and either IGSCC or thermal fatigue cracks shall be used. At least 75% of the cracks shall be either IGSCC or thermal fatigue cracks.

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(2) At least 50% of the cracks shall be coincident with fabricated conditions described in (c) above.

1.2 Detection Specimens. The specimen set shall include detection specimens that meet the following requirements.

(a) Specimens shall be divided into grading units. Each grading unit shall include at least 3 in. of weld length. If a grading unit is designed to be unflawed,

This Supplement is applicable to austenitic piping welds examined from either the inside (I.D.) or outside (O.D.) surface. The applicable qualification criteria shall be satisfied separately. This Supplement is not applicable to piping welds containing supplemental corrosion resistant cladding applied to mitigate IGSCC.

, within 1/2 inch NPS,

(c) Taking into consideration the accessible scanning surface, the O.D. or I.D. specimen set shall include appropriate examples of the following fabrication conditions:

for O.D. scans, or O.D. reinforcement for I.D. scans, as appropriate);

, clad surfaces, or counterbore within the scanning area, as appropriate).

**TABLE VIII-S2-1
PERFORMANCE DEMONSTRATION DETECTION TEST
ACCEPTANCE CRITERIA**

Detection Test Acceptance Criteria		False Call Test Acceptance Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum Number of False Calls
5	5	10	0
6	6	12	1
7	6	14	1
8	7	16	2
9	7	18	2
10	8	20	3
11	9	22	3
12	9	24	3
13	10	26	4
14	10	28	5
15	11	30	5
16	12	32	6
17	12	34	6
18	13	36	7
19	13	38	7
20	14	40	8

at least 1 in. of unflawed material shall exist on either side of the grading unit. The segment of weld length used in one grading unit shall not be used in another grading unit. Grading units need not be uniformly spaced around the pipe specimen.

(b) Detection sets shall be selected from Table VIII-S2-1. The number of unflawed grading units shall be at least twice the number of flawed grading units.

(c) Flawed grading units shall meet the following criteria for flaw depth, orientation, and type.

(1) A minimum of $\frac{1}{3}$ of the flaws, rounded to the next higher whole number, shall have depths between 5% and 30% of the nominal pipe wall thickness. At least $\frac{1}{3}$ of the flaws, rounded to the next higher whole number, shall have depths greater than 30% of the nominal pipe wall thickness.

(2) At least one and a maximum of 10% of the flaws, rounded to the next higher whole number, shall be oriented axially. The remainder of the flaws shall be oriented circumferentially.

(3) Service-induced flaws shall be included when available.

1.3 Sizing Specimens. The specimen set shall contain sizing specimens that meet the following requirements.

(a) The minimum number of flaws shall be ten.

For initial procedure qualification, detection sets shall include the equivalent of three personnel qualification sets. Extension of procedure qualifications to qualify new values of essential variables requires at least one personnel qualification set.

When the procedure is intended to detect IGSCC, at least four field-removed, IGSCC flawed grading units shall be included in the detection test set.

For initial procedure qualification, sizing sets shall include the equivalent of three personnel qualification sets. Extension of procedure qualifications to qualify new values of essential variables requires at least one personnel qualification set.

A95 (b) Flaws in length sizing sample sets shall meet the requirements of para 1.2(c)(1), when given in conjunction with a detection test. When the length sizing test is administered independently, the flaw depth requirements do not apply.

A95 (c) Flaws in the depth sizing sample set shall be distributed as follows:

Flaw Depth (% Wall Thickness)	Minimum Number of Flaws
5-30%	20%
31-60%	20%
61-100%	20%

The remaining flaws shall be in any of the above categories.

2.0 CONDUCT OF PERFORMANCE DEMONSTRATIONS

The specimen inside surface and identification shall be concealed from the candidate. All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited.

2.1 Detection Test. Flawed and unflawed grading units shall be randomly mixed.

2.2 Length and Depth Sizing Test

(a) For the length sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region.

(b) For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate. For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

3.0 ACCEPTANCE CRITERIA

3.1 Detection Acceptance Criteria. Examination procedures, equipment, and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls.

3.2 Sizing Acceptance Criteria. Examination procedures, equipment, and personnel are qualified for sizing if the results of the performance demonstration satisfy the following criteria:

When scanning from the O.D.,

When scanning from the I.D., flaw location and specimen identification shall be obscured to maintain a "blind test".

(a) Each reported flaw in the detection test shall be length sized. When only length sizing is being tested, the regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the length of the flaw in each region with the exception of IGSCC flaws where the location is not provided to the candidate.

(b) The depth sizing test may be performed in conjunction with or separate from the detection test. When only depth sizing is being tested, the regions of each specimen containing a flaw to be sized may be identified to the candidate.

(a) Personnel demonstrations shall meet the requirements of Table VIII-S2-1 for both detection and false calls. If the procedure is intended to detect IGSCC, failure to detect more than one of the IGSCC flaws is unacceptable for personnel qualifications.
(b) Procedure qualifications shall demonstrate detectability of each flaw, within the scope of the procedure. Successful personnel demonstrations may be combined to satisfy the requirements for procedure qualification.