(d) For degradation evaluated to be structurally acceptable for the evaluation period in accordance with U-S2-4, examination at 0.5$r_{allow}$ shall be performed to verify the predicted growth. If $r_{allow}$ exceeds twice the time to the end of the evaluation period, examination is not required.

(a) Daily leakage monitoring (e.g., vessel or tank level indications, sump measurements, etc.) shall be performed to ensure that leakage, if any, does not exceed the acceptance limits, in accordance with U-S2-2.1(b), and for trending purposes. If acceptance limits are exceeded, repair/replacement activities shall be performed.

(f) The degradation growth evaluation of (c) shall be updated when new leakage monitoring or examination results become available, considering all previous examination and leakage monitoring results. If the updated flaw size from examination or the predicted flaw size from the flaw growth analysis exceeds the acceptance criteria of U-S2-6, repair/replacement activities shall be performed no later than the end of the updated evaluation period.

(g) Repair/replacement activities shall be performed no later than the end of the evaluation period. Repair/replacement activities shall be in accordance with IWA-4000.

U-S2-2.6 Nonplanar Part-Through-Wall Degradation Considering Degradation Growth

In addition to the requirements of U-S2-2.4 or U-S2-2.5 above, nonplanar part-through-wall degradation shall be evaluated in accordance with the requirements of U-S2-4.3.

U-S2-3 NOMENCLATURE

$C$ = material constant in austenitic steel stress corrosion cracking equation, (in./hr)(ksi/\sqrt{in.})$^{-n}$

$D_o$ = vessel or tank outer diameter (for cylindrical portions of vessels and tanks), in. (mm)

$[(\text{mm}/\text{s}) (\text{MPa}/\text{m})^{n}]$
$da/dt = \text{flaw growth rate for stress corrosion cracking in austenitic steel, in./hr (mm/s)}$

$K_I = \text{applied stress intensity factor, ksi} \sqrt{\text{in.}}$ (MPa$\sqrt{\text{m}}$)

$K_{IC} = \text{fracture toughness, ksi} \sqrt{\text{in.}}$ (MPa$\sqrt{\text{m}}$)

$K_{\text{max}} = \text{maximum stress intensity factor under long-term, steady-state conditions used in the stress corrosion cracking equation for austenitic steel, ksi} \sqrt{\text{in.}}$ (MPa$\sqrt{\text{m}}$)

$L = \text{maximum extent of a local thinned area with } t < t_{\text{nom}}, \text{ in. (mm)}$

$L_{\text{axial}} = \text{crack length for through-wall nonplanar degradation in axial direction, in. (mm)}$

$L_{\text{circ}} = \text{crack length for through-wall nonplanar degradation in circumferential direction, in. (mm)}$

$L_m = \text{maximum extent of a local thinned area with } t < t_{\text{min}}, \text{ in. (mm)}$

$L_m(\sigma) = \text{axial extent of wall thinning below } t_{\text{min}}, \text{ in. (mm)}$

$L_{\text{min}} = \text{circumferential extent of wall thinning below } t_{\text{min}}, \text{ in. (mm)}$

$n = \text{material constant in austenitic steel stress corrosion cracking equation}$

$p = \text{maximum operating pressure at the degradation location, ksi (MPa)}$

$R = \text{vessel or tank mean radius (for cylindrical portions of vessels and tanks), in. (mm)}$

$R_o = \text{vessel or tank outer radius (for cylindrical portions of vessels and tanks), in. (mm)}$

$S = \text{allowable stress at the operating temperature, ksi (MPa)}$

$S_T = \text{temperature correction factor in austenitic steel stress corrosion cracking equation}$

$T = \text{metal temperature at the degradation location, } ^\circ\text{F (°C)}$

$t = \text{wall thickness, in. (mm)}$

$t_{\text{loc}} = \text{allowable local thickness for a nonplanar flaw that exceeds } t_{\text{min}}, \text{ in. (mm)}$
Delete the following definitions from IWA-9000.

[These terms were removed from Section XI, Appendix IV in the 1993 Addenda.]

text information: information stored on the recording media to support recorded eddy current data. Examples include tube and steam generator identifications, operator name, date of examination, and examination results.

unit of data storage: each discrete physical recording medium on which eddy current data and text information are stored. Examples include tape cartridge and floppy disk.
(e) The Owner shall determine methods for estimating the geometry of degradation in inaccessible or uninspectable regions, e.g., size correlated to leakage rate. If using this approach to determine a maximum flaw size, such as a size correlated to an observed leak rate, a factor of 2 shall be applied to the flaw dimensions.

2.3 Evaluation Methodology

Degradation shall be evaluated as planar in accordance with the requirements of 2.4 or 2.5. To prevent bursting, nonplanar part-through-wall degradation shall also be evaluated in accordance with the requirements of 2.6.

2.4 Bounding Flaw Evaluation

(a) A bounding flaw length shall be assumed for structural evaluation purposes, based on one or more of the following limiting factors:

(1) geometric limitations (e.g., overlapping welded plates in tanks which could limit degradation propagation or the ability to detect the degradation beyond a specified length)

(2) stress limitations (e.g., degradation growing into a decreasing stress field such that growth is terminated)

(3) environmental limitations (e.g., degradation growing into a nonaggressive environment)

(b) The bounding flaw shall be assumed to be a planar through-wall flaw over its entire length.

(c) A structural integrity evaluation shall be performed to determine acceptance of the bounding flaw. Acceptable methods for the required evaluation are provided in 3.1, and acceptance criteria are provided in 5. For bounding flaws that do not meet the acceptance criteria, the provisions of 2.5 shall be met.

(d) Bounding flaws that meet the acceptance criteria of 5 shall be monitored daily to ensure that leakage does not exceed leakage limits in accordance with 2.1(b) and for trending purposes. If leakage limits are exceeded within the evaluation period, structural integrity shall be reconfirmed and leakage limiting measures applied, or repair/replacement activities shall be performed.

(e) Repair/replacement activities shall be performed no later than the end of the evaluation period. Repair/replacement activities shall be in accordance with IWA-4000 or
FIG. 3 ALLOWABLE WALL THICKNESS AND LENGTH OF LOCALLY THINNED AREA

FIG. 4 ILLUSTRATION OF NONPLANAR THROUGH-WALL DEGRADATION DUE TO WALL THINNING
Table IWD-3410-1

<table>
<thead>
<tr>
<th>Examination Category</th>
<th>Component and Part Examined</th>
<th>Acceptance Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-A</td>
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<td>IWD-3510</td>
</tr>
<tr>
<td>D-B</td>
<td>Pressure-retaining components</td>
<td>IWD-3511</td>
</tr>
</tbody>
</table>

IWD-3500 Acceptance Standards

IWD-3510 Standards for Examination Category D-A, Welded Attachments for Vessels, Piping, Pumps, and Valves

In the course of preparation, the requirements of IWC-3500 may be used.

IWD-3511 Standards for Examination Category D-B, All Pressure-Retaining Components

IWD-3511.1 Visual Examination, VT-2.

A component whose visual examination (IWA-5240) detects any of the following relevant conditions shall meet IWD-3132 and IWA-5250 prior to continued service:

(a) any through-wall or through-weld, pressure-retaining material leakage from insulated and noninsulated components
(b) leakage in excess of limits established by the Owner from mechanical connections (such as pipe caps, bolted connections, or compression fittings) or from components provided with leakage-limiting devices (such as valve-packing glands or pump seals)
(c) areas of general corrosion of a component resulting in leakage
(d) discoloration or accumulated residues on surfaces of components, insulation, or floor areas that may be evidence of leakage or
(e) leakages or flow test results from buried components in excess of limits established by the Owner
Visual examinations that detect relevant conditions may be supplemented by other examinations (IWA-2220, IWA-2230, or IWA-2240) to determine the need for corrective measures, analytical evaluation, or repair/replacement activities.

TABLE IWD-3410-1

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ARTICLE IWD-3000

ACCEPTANCE STANDARDS

IWD-3100 EVALUATION OF EXAMINATION RESULTS

IWD-3110 PRESERVICE EXAMINATIONS

In the course of preparation. The requirements of IWC-3100 may be used.

IWD-3120 INSERVICE EXAMINATIONS

(a) In the course of preparation. The requirements of IWC-3120 may be used.

(b) Components whose examination reveals flaws that do not meet the standards of IWD-3400 shall be subjected to supplemental examination, or to a repair/replacement activity. Requirements for evaluation are described in IWD-3600.

IWD-3200 SUPPLEMENTAL EXAMINATIONS

In the course of preparation. The requirements of IWC-3200 may be used.

IWD-3400 STANDARDS

In the course of preparation. The requirements of IWC-3400 may be used.

IWD-3500 ACCEPTANCE STANDARDS

In the course of preparation. The requirements of IWC-3500 may be used.

IWD-3510 Standards for Examination Category D-A, Welded Attachments for Vessels, Piping, Pumps, and Valves

In the course of preparation. The requirements of IWC-3500 may be used.

IWD-3511 Standards for Examination Category D-B, All Pressure Retaining Components

IWD-3511.1 Visual Examination, VT-2. A component whose visual examination (IWA-5240) detects any of the following relevant conditions\(^1\) shall meet IWD-3132 and IWA-5250 prior to continued service:

(a) any through-wall or through-weld, pressure-retaining material leakage from insulated and noninsulated components;

(b) leakage in excess of limits established by the Owner from mechanical connections (such as pipe caps, bolted connections, or compression fittings) or from components provided with leakage limiting devices (such as valve packing glands or pump seals);

(c) areas of general corrosion of a component resulting in leakage;

(d) discoloration or accumulated residues on surfaces of components, insulation, or floor areas that may be evidence of leakage; or

(e) leakages or flow test results from buried components in excess of limits established by the Owner.

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1 Relevant conditions are defined in IWA-9000; they do not include conditions that result in condensation on components, normal collection of fluid in sumps,
Supplement 12 Requirements for Coordinated Implementation of Selected Aspects of Supplements 2 and 3

1.0 Scope

This Supplement provides for expansion of Supplement 2 qualifications to permit coordinated qualification for Supplement 3.

2.0 Detection and Length Sizing

2.1 Ferritic Piping.

Examination personnel, equipment, and procedure qualification requirements for detection and length sizing for Supplements 2 and 3 are satisfied when the following requirements are met.

(a) For detection qualification, at least three additional flawed grading units and six additional unflawed units in ferritic piping shall be added to the test set. A grading unit shall include at least 3 in. (75 mm) continuous weld length. All nine ferritic grading units shall be correctly identified.

(b) The demonstration shall meet the requirements of Supplement 2, except that for length sizing qualification, the minimum number of flaws shall be ten, and the specimen set shall include at least three, but not more than four, flaws in ferritic material.

(c) The ferritic grading units added to expand the qualification are not required to span the full thickness and diameter ranges of the Supplement 2 test set.

3.0 Depth Sizing

Examination personnel, equipment, and procedure qualification requirements for depth sizing for Supplements 2 and 3 are met by the following demonstration.

(a) Specimens

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

(2) The specimen set shall include at least four but no more than five Supplement 3 flaws.

(3) The overall flaw depth distribution shall meet the requirements of Supplement 2, 1.3(b)(c).

(b) The demonstration shall be conducted in accordance with the requirements of Supplement 2, 2.2(b).

(c) The examination procedure, equipment, and personnel are qualified for depth sizing when the RMS error of the flaw depth measurements, as compared to the true flaw depths, does not exceed 0.125 in. (3.2 mm).