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7.0 METHODOLOGY

This assessment focuses on inclusions and lamination damage

ASME FFS –1 addresses damage relevant to vessel equipment Tag #

- laminations
- crack-like flaws

ASME FFS – 1 Part 13 discusses evaluation procedures for laminations and is generally applicable where

- original design criteria were in accordance with a recognized code of construction
- the material is considered to have sufficient toughness
- the component is subject to < 150 cycles of pressure and temperature variation

Level 1 and Level 2 assessments apply to damage to Type A components with internal pressure loading, only.

Level 3 assessment can be performed where Level 1 and Level 2 assessment procedures do not apply or when these assessment levels produce overly conservative results. Also, Level 3 assessment can be used where components are in cyclic service.

Part 13 does not apply to pressurized components with hydrogen type damage and will not be used. Whether hydrogen damage is present is not known with complete certainty.

ASME FFS – 1 Part 7 discusses evaluation procedures for hydrogen damage covering HIC, SOHIC, step-wise cracking and hydrogen blistering.

Level 1 assessments apply to damage to Type A components with internal pressure loading, only.

Level 2 assessments apply to damage to Type A components with internal pressure and supplemental loading and Type B Class 1 components, only.

Level 3 assessment can be performed where Level 1 and Level 2 assessment procedures do not apply or when these assessment levels produce overly conservative results. Also, Level 3 assessment can be used where components are in cyclic service.

Part 7 applies to pressurized components with hydrogen type damage but is not used; blistering is not present and vessel contents are not associated with HIC or SOHIC damage. Whether hydrogen damage is present is not known with complete certainty.

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ASME FFS – 1 Part 9

Part 9 uses fracture mechanics principles to evaluate crack-like flaws and discusses evaluation procedures in pressurized components and are generally applicable where

- original design criteria were in accordance with a recognized code of construction
- the component is not operating in the creep range
- dynamic loading effects are not significant
- *crack-like flaws are susceptible to crack growth*

Level 1 assessments may be made contingent on the following limiting conditions with the screening evaluation as presented, herein;

1. limitations with regard to crack-like flaw geometries

- | | |
|---|------------------|
| i) the component is a cylinder, plate or sphere | OK |
| ii) cylinders are limited to geometries with $R / t \geq 5$ | OK |
| iii) wall thickness at the location of the flaw $< 1\frac{1}{2}$ inches | NOT OK |
| iv) crack-like flaw may be surface type, flaw depth limited and permitted crack is 8 inches | NOT OK |
| v) crack like flaw is oriented in axial or circumferential direction | NOT OK |
| vi) crack like flaw is more than 1.8 sqrt (D t) from any major structural discontinuity | NOT OK |
| vii) membrane stresses are within original design limits | OK |
| viii) flaw has not grown after a pressure test | not determined |
| ix) weld joint geometry is single V or double V configuration | OK |
| x) material is P1, Group 1 or 2 with allowable stress ≤ 172 MPa [25 ksi] | NOT OK |
| xi) $SMYS \leq 276$ MPa [40 ksi], $SMTS \leq 483$ MPa [70 ksi] | NOT OK |
| xii) fracture toughness, $K_{mat} \geq K_{IC}$ defined in Annex 9F | to be determined |

When Level 1 assessment limitations are not met; use Level 2 or Level 3

Level 2 assessment procedures may be applied if all the conditions applicable to Level 1 are satisfied. Since Level 1 assessment conditions were not met, the Level 2 assessment procedure is not applicable. A Level 3 assessment is required.

Level 3 assessment can be performed where Level 1 and Level 2 assessment procedures do not apply or when these assessment levels produce overly conservative results. Crack like flaws susceptible to crack growth are evaluated using Level 3.