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WOLF CREEK
NUCLEAR OPERATING CORPORATION

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NOV 1 0 1999

ET 99-0048

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Washington, D. C. 20555

Subject: Docket No. 50-482: Request to Use a Proposed Alternative to 10 CFR 50.55a (g)(4)

Gentlemen:

Pursuant to the requirements of 10 CFR 50.55a(a)(3), Wolf Creek Nuclear Operating Corporation (WCNOC) requests approval to use a proposed alternative to the requirements of 10 CFR 50.55a(g)(4). This alternative would allow early implementation of ASME Code Case N-513, which was included in the rulemaking published in the Federal Register (64FR51369) on September 22, 1999. The use of this alternative would be subject to the provisions included in the Federal Register on September 22, 1999. This rulemaking will be effective on November 22, 1999.

The Attachment I to this letter contains the circumstances surrounding this request and the basis that use of the proposed alternative provides an acceptable level of quality and safety. Attachment II identifies commitments made by this correspondence. The Enclosure provides a copy of ASME Code Case N-513 for your convenience.

This issue was discussed with Mr. Jack Donohew of the NRC Staff during telephone conversations on October 20 and October 27, 1999.

If you have any questions concerning this matter, please contact me at (316) 364-4034, or Mr. Michael J. Angus, at (316) 364-4077.

Very truly yours,

Richard A. Muench

RAM/rlr

Attachments

Enclosure

cc: J. N. Donohew (NRC), w/a/e
W. D. Johnson (NRC), w/a/e
E. W. Merschoff (NRC), w/a/e
Senior Resident Inspector (NRC), w/a/e

ML993280421

REQUEST TO USE PROPOSED ALTERNATIVE TO 10 CFR 50.55a(g)(4)

Background

During plant operation on October 16, 1999, a 10 ml per minute Essential Service Water (ESW) System leak was discovered downstream of valve EFV0058. The ESW System consists of two redundant cooling water trains. The cause of the leak is erosion induced wear and porosity in a weld buildup on the end of the tee on the inside surface of the piping, which extends through the pipe wall.

The affected ESW System line is an ASME Code Class 3 return line from the Component Cooling Water heat exchanger. The ESW System removes heat from the plant components which require cooling for safe shutdown of the reactor or following a Design Basis Accident and transfers the heat to the Ultimate Heat Sink (UHS). In addition, the system provides emergency makeup to the spent fuel pool and Component Cooling Water System, and is the backup water supply to the Auxiliary Feedwater System. The leak is on the 24" X 24" X 24" carbon steel tee on line EF080HBC-24. During normal plant operations, the ESW within the power block receives water from the Service Water System and supplies water to the safety related components and air compressors. After removing heat from plant components, the heated water is returned to the Service Water System and/or to the UHS depending on plant conditions.

NRC Generic Letter (GL) 91-18, Revision 0, provides information to Licensees regarding the NRC Inspection Manual section on Operability. Section 6.15 of this GL states: "Upon discovery of leakage from a Class 1, 2, or 3 component pressure boundary (i.e., pipe wall, valve body, pump casing, etc.) the licensee should declare the component inoperable. The only exception is for Class 3 moderate energy piping as discussed in Generic Letter 90-05. For Class 3 moderate energy piping, the licensee may treat the system containing the through-wall flaw(s), evaluated and found to meet the acceptance criteria in Generic Letter 90-05, as operable until relief is obtained from the NRC."

Performing an immediate Code repair or replacement would require removing the "A" train ESW from service and draining the system. An estimate of the time required to perform a Section XI Code repair identified that the repair could not reasonably be performed within the 72 hour allowed outage time specified by Technical Specification 3.7.4. In addition, loss of availability of one of the two ESW trains to perform a Code repair or replacement at this time is not commensurate with the safety significance of this flaw. Therefore, in accordance with the guidance of NRC GL 91-18, a relief request would be necessary to allow continued operation with the through-wall flaw identified on October 16, 1999.

In subsequent conversations with the NRC staff, WCNOC was requested, in lieu of a relief request, to submit a request to use an alternative to 10 CFR 50.55a(g)(4) that would allow early implementation of Code Case N-513. This code case provides evaluation criteria for temporary acceptance of flaws, including through-wall flaws, in moderate energy Class 3 piping, for a limited time, without repair or replacement. The use of this code case would obviate the need to obtain relief from the code requirements. Revisions to NRC Regulations approving the use of Code Case N-513 for evaluation of flaws in Class 3 moderate energy piping were published in the Federal Register (64FR51369) on September 22, 1999. This rulemaking will be effective on November 22, 1999.

Wolf Creek has completed an evaluation of the flaw identified on October 16, 1999, in accordance with the criteria of Code Case N-513. That evaluation, as well as the one performed in accordance with the evaluation criteria in NRC GL 90-05, demonstrated that the piping maintains structural integrity with the identified flaw.

Basis for Alternative

As noted above, on September 22, 1999, the NRC published a revision to 10 CFR 50.55a. Included in this revision is a new regulation [10 CFR 50.55a (b)(2)(xiii)] which states:

> "Flaws in Class 3 Piping." Licensees may use the provisions of Code Case N-513, 'Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping,' Revision 0...Licensees choosing to apply Code Case N-513 shall apply all of its provisions subject to the following:
>
> (A) When implementing Code Case N-513, the specific safety factors in paragraph 4.0 must be satisfied.
> (B) Code Case N-513 may not be applied to:
> (1) Components other than pipe and tube, such as pumps, valves, expansion joints and heat exchanges;
> (2) Leakage through a flange gasket;
> (3) Threaded connections employing nonstructural seal welds for leakage prevention (through seal weld leakage is not a structural flaw, thread integrity must be maintained; and
> (4) Degraded Socket welds."

The statements of consideration for this rule indicate:

> "These code cases were developed to address criteria for temporary acceptance of flaws (including through-wall leaking) of moderate energy Class 3 piping where a Section XI Code repair may be impractical for a flaw detected during plant operation (i.e., a plant shutdown would be required to perform the Code repair)... The use of Code Case N-513, with the limitations, ... will obviate the need for licensees to request approval for deferring repairs; thus saving NRC and licensee resources."

Code Case N-513 provides suitable criteria for evaluation and acceptance of operation with flaws (including through-wall leaking flaws) associated with moderate energy Class 3 piping. Paragraph (a)(3) of 10 CFR 50.55a states:

> "Proposed alternatives to the requirements of paragraphs (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that (i) The proposed alternatives would provide an acceptable level of quality and safety, or...."

The criteria in Code Case N-513, with the provisions noted in the rulemaking published in the Federal Register on September 22, 1999, provide an acceptable level of quality and safety with respect to the acceptance of flaws in moderate energy Class 3 piping. Therefore, WCNOC proposes that the NRC approve our request to use Code Case N-513 prior to November 22, 1999, with the provisions noted in the proposed rule. This action would obviate the need for relief associated with continued operation of WCGS Unit 1 with the flaw detected on October 16, 1999.

LIST OF COMMITMENTS

The following table identifies those actions committed to by Wolf Creek Nuclear Operating Corporation (WCNOC) in this document. Any other statements in this submittal are provided for information purposes and are not considered to be commitments. Please direct questions regarding these commitments to Mr. Michael J. Angus, Manager Licensing and Corrective Action at Wolf Creek Generating Station, (316) 364-4077.

COMMITMENT	**Due Date/Event**
None	NA

Approval Date: August 14, 1997
See Numerical Index for expiration and any reaffirmation dates.

Case N-513
Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping
Section XI, Division 1

Inquiry: What rules may be used for temporary acceptance of flaws, including through-wall flaws, in moderate energy Class 3 piping, without repair or replacement?

Reply: It is the opinion of the Committee that the following rules may be used to accept flaws, including through-wall flaws, in moderate energy Class 3 piping, without repair or replacement for a limited time, not exceeding the time to the next scheduled outage.

1.0 SCOPE

(a) These requirements apply to the ASME Section III, ANSI B31.1, and ANSI B31.7 piping, classified by the Owner as Class 3.

(b) The provisions of the Case apply to Class 3 piping whose maximum operating temperature does not exceed 200°F and whose maximum operating pressure does not exceed 275 psig.

(c) The following flaw evaluation criteria are permitted for pipe and tube. The flaw evaluation criteria are permitted for adjoining fittings and flanges to a distance of $(R_o t)^{1/2}$ from the weld centerline.

(d) The provisions of this Case demonstrate the integrity of the item and not the consequences of leakage. It is the responsibility of the Owner to demonstrate system operability considering effects of leakage.

2.0 PROCEDURE

(a) The flaw geometry shall be characterized by volumetric inspection methods or by physical measurement. The full pipe circumference at the flaw location shall be inspected to characterize the length and depth of all flaws in the pipe section.

(b) Flaw shall be classified as planar or nonplanar.

(c) When multiple flaws, including irregular (compound) shape flaws, are detected, the interaction and combined area loss of flaws in a given pipe section shall be accounted for in the flaw evaluation.

(d) A flaw evaluation shall be performed to determine the conditions for flaw acceptance. Section 3.0 provides accepted methods for conducting the required analysis.

(e) Frequent periodic inspections of no more than 30 day intervals shall be used to determine if flaws are growing and to establish the time at which the detected flaw will reach the allowable size. Alternatively, a flaw growth evaluation may be performed to predict the time at which the detected flaw will grow to the allowable size. When a flaw growth analysis is used to establish the allowable time for temporary operation, periodic examinations of no more than 90 day intervals shall be conducted to verify the flaw growth analysis predictions.

(f) For through-wall leaking flaws, leakage shall be observed by daily walkdowns to confirm the analysis conditions used in the evaluation remain valid.

(g) If examinations reveal flaw growth rate to be unacceptable, a repair or replacement shall be performed.

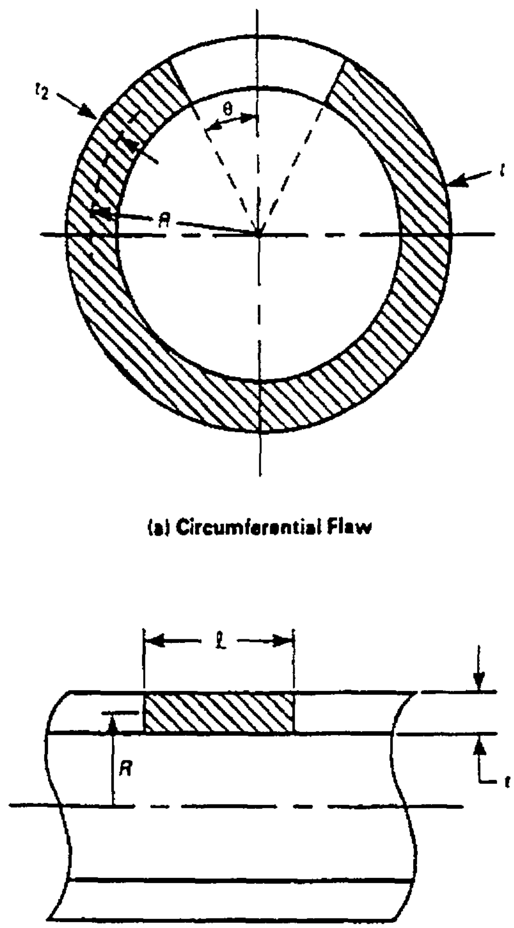
(h) Repair or replacement shall be performed no later than when the predicted flaw size from either periodic inspection or by flaw growth analysis exceeds the acceptance criteria of Section 4.0, or the next scheduled outage, whichever occurs first. Repair or replacement shall be in accordance with IWA-4000 or IWA-7000, respectively, in Editions and Addenda prior to the 1991 Addenda; and, in the 1991 Addenda and later, in accordance with IWA-4000.

(i) Evaluations and examination shall be documented in accordance with IWA-6300. The Owner shall document the use of this Case on the applicable data report form.

3.0 FLAW EVALUATION

(a) For planar flaws, the flaw shall be bounded by a rectangular or circumferential planar area in accordance with the methods described in Appendix C or Appendix H. IWA-3300 shall be used to determine when multiple proximate flaws are to be evaluated as a single flaw. The geometry of a through-wall planar flaw is shown in Fig. 1.

(b) For planar flaws in austenitic piping, the evaluation procedure in Appendix C of Section XI, Division 1, shall be used. Flaw depths up to 100% of wall



(a) Circumferential Flaw

(b) Axial Flaw

FIG. 1 THROUGH-WALL FLAW GEOMETRY

thickness may be evaluated. When through-wall circumferential flaws are evaluated, the formulas for evaluation given in Articles C-3320 of Appendix C may be used, with the flaw penetration (a/t) equal to unity.

When through-wall axial flaws are evaluated, the allowable flaw length is:

$$\ell_{all} = 1.58\sqrt{Rt}\left[\left(\frac{\sigma_f}{(SF)\sigma_h}\right)^2 - 1\right]^{1/2} \qquad (1)$$

$$\sigma_h = pD_o/2t \qquad (2)$$

$$\sigma_f = (S_y + S_u)/2 \qquad (3)$$

where

p = is pressure for the loading condition
D_o = is pipe outside diameter
σ_f = is the flow stress
S_y = is the code yield strength
S_u = is the code tensile strength and
SF = is the safety factor as specified in C-3420 of Appendix C

Material properties at the temperature of interest shall be used.

(c) For planar flaws in ferritic piping, the evaluation procedure in Article H-7000 of Appendix H, Section XI, Division 1, shall be used. Flaw depths up to 100% of wall thickness may be evaluated. When through-wall flaws are evaluated, the formulas for evaluation given in Articles H-7300 and H-7400 of Appendix H may be used, but with values for F_m, F_b, and F applicable to through-wall flaws. Relations for F_m, F_b, and F that take into account flaw shape and pipe geometry (R/t ratio) shall be used. The appendix to this Code Case provides equations for F_m, F_b, and F for a selected range of R/t. Geometry of a through-wall crack is shown in Fig. 1.

(d) For nonplanar flaws, the pipe is acceptable when the remaining pipe thickness (t_p) is greater than or equal to the minimum wall thickness t_{min}):

$$t_{min} = \frac{pD_o}{2(S + 0.4p)} \qquad (4)$$

where

p = is the maximum operating pressure at flaw location
S = is the allowable stress at operating temperature

Where appropriate, bending load at the flaw location shall be considered in the determination of t_{min}. When t_p is less than t_{min}, an evaluation shall be performed as given below. The evaluation procedure is a function of the depth and the extent of the affected area as illustrated in Fig. 2.

(1) When the width of wall thinning that exceeds t_{min}, W_m, is less than or equal to 0.5 $(R_o t_{min})^{1/2}$, where R_o is the outside radius and W_m is defined in Fig. 2, the flaw can be classified as a planar flaw and evaluated under 3(a) through 3(c) above. When the above requirement is not satisfied, (2) shall be met.

(2) When the transverse extent of wall thinning that exceeds t_{min}, $L_{m(t)}$, is not greater than $(R_o t_{min})^{1/2}$, t_{aloc} is determined from Curve 1 of Fig. 3, where $L_{m(t)}$

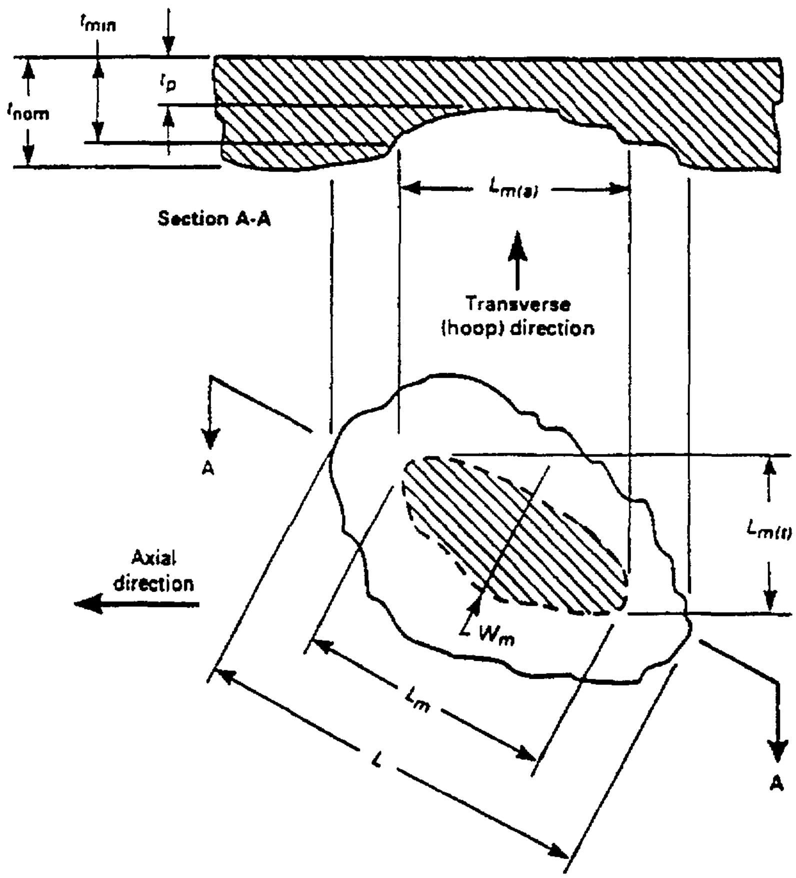


FIG. 2 ILLUSTRATION OF NONPLANAR FLAW DUE TO WALL THINNING

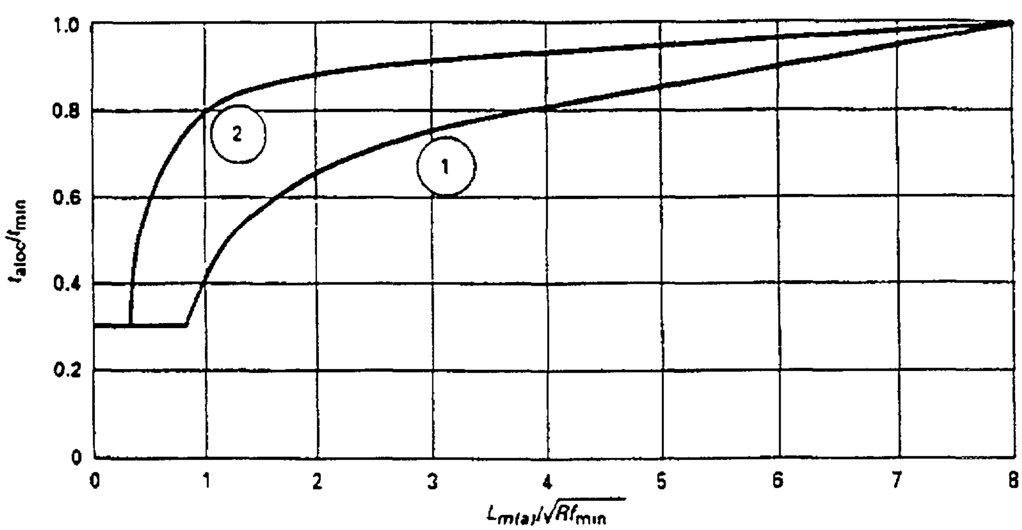


FIG. 3 ALLOWABLE WALL THICKNESS AND LENGTH OF LOCALLY THINNED AREA

is defined in Fig. 2. When the above requirement is not satisfied, (3) shall be met.

(3) When the maximum extent of wall thinning that exceeds t_{min}, L_m, is less than or equal to 2.65 $(R_o t_{min})^{1/2}$ and t_{nom} is greater than $1.13 t_{min}$, t_{aloc} is determined by satisfying both of the following equations:

$$\frac{t_{aloc}}{t_{min}} \geq \frac{1.5\sqrt{R_o t_{min}}}{L}\left[1 - \frac{t_{nom}}{t_{min}}\right] + 1.0 \qquad (5)$$

$$\frac{t_{aloc}}{t_{min}} \geq \frac{0.353 L_m}{\sqrt{R_o t_{min}}} \qquad (6)$$

When the above requirements are not satisfied, (4) shall be met.

(4) When the requirements of (1), (2) and (3) above are not satisfied, t_{aloc} is determined from Curve 2 of Fig. 3. In addition, t_{aloc} shall satisfy the following equation:

$$\frac{t_{aloc}}{t_{min}} \geq \frac{\left[0.5 + \left(\frac{t_{nom}}{t_{min}}\right)\left(\frac{\sigma_b}{S}\right)\right]}{1.8} \qquad (7)$$

where σ_b is the nominal pipe longitudinal bending stress resulting from all primary pipe loadings.

(e) For nonferrous materials, nonplanar and planar flaws may be evaluated following the general approach of (a) through (d) above. For ductile materials, the approach given in (b) may be used; otherwise, the approach given in (c) and (d) should be applied. Safety factors provided in Section 4.0 shall be used. It is the responsibility of the evaluator to establish conservative estimates of strength and fracture toughness for the piping material.

4.0 ACCEPTANCE CRITERIA

The piping containing a circumferential planar flaw is acceptable for continued temporary service when flaw evaluation provides a safety margin, based on load, of a factor of 2.77 for Level A and B and 1.39 for Level C and D service loading conditions. Piping containing a nonplanar flaw is acceptable for continued temporary service if $t_p \geq t_{aloc}$, where t_{aloc} is determined from Section 3(d).

Lower safety factors may be used, provided that a detailed engineering evaluation of continued operation demonstrates that lower safety factors are justified.

5.0 AUGMENTED EXAMINATION

An augmented volumetric examination or physical measurement to assess degradation of the affected system shall be performed as follows:

(a) From the engineering evaluation, the most susceptible locations shall be identified. A sample size of at least five of the most susceptible and accessible locations, or, if fewer than five, all susceptible and accessible locations shall be examined within 30 days of detecting the flaw.

(b) When a flaw is detected, an additional sample of the same size as defined in 5(a) shall be examined.

(c) This process shall be repeated within 15 days for each successive sample, until no significant flaw is detected or until 100% of susceptible and accessible locations have been examined.

6.0 NOMENCLATURE

c = half crack length

D_o = outside pipe diameter

F = nondimensional stress intensity factor for through-wall axial flaw under hoop stress

F_b = nondimensional stress intensity factor for through-wall circumferential flaw under pipe bending stress

F_m = nondimensional stress intensity factor for through-wall circumferential flaw under membrane stress

ℓ = total crack length = 2c

ℓ_{all} = allowable axial through-wall length

L = maximum extent of a local thinned area with $t < t_{nom}$

L_m = maximum extent of a local thinned area with $t < t_{min}$

$L_{m(a)}$ = axial extent of wall thinning below t_{min}

$L_{m(t)}$ = circumferential extent of wall thinning below t_{min}

p = maximum operating pressure at flaw location

R = mean pipe radius

R_o = outside pipe radius

S = allowable stress at operating temperature

S_u = code specified ultimate tensile strength

S_y = code specified yield strength

t = wall thickness

t_{aloc} = allowable local thickness for a nonplanar flaw that exceeds t_{min}

t_{min} = minimum wall thickness required for pressure loading

t_{nom} = nominal wall thickness

t_p = minimum remaining wall thickness

W_m = maximum extent of a local thinned area perpendicular to L_m with $t < t_{min}$

λ = nondimensional half crack length for through-wall axial flaw

σ_f = material flow stress

σ_h = pipe hoop stress due to pressure

σ_b = nominal longitudinal bending stress for primary loading without stress intensification factor

Θ = half crack angle for through-wall circumferential flaw

APPENDIX I
RELATIONS FOR F_m, F_b, AND F FOR THROUGH-WALL FLAWS

I-1.0 DEFINITIONS

For through-wall flaws, the crack depth (a) will be replaced with half crack length (c) in the stress intensity factor equations in Articles H-7300 and H-7400 of Section XI, Appendix H. Also, Q will be set equal to unity in Article H-7400.

I-2.0 CIRCUMFERENTIAL FLAWS

For a range of R/t between 5 and 20, the following equations for F_m and F_b may be used:

$$F_m = 1 + A_m (\Theta/\pi)^{1.5} + B_m (\Theta/\pi)^{2.5} + C_m (\Theta/\pi)^{3.5}$$

$$F_b = 1 + A_b (\Theta/\pi)^{1.5} + B_b (\Theta/\pi)^{2.5} + C_b (\Theta/\pi)^{3.5}$$

where

Θ = Half crack angle = c/R

R = Mean pipe radius

t = Pipe wall thickness

and

$$A_m = -2.02917 + 1.67763\ (R/t) - 0.07987\ (R/t)^2 + 0.00176\ (R/t)^3$$

$$B_m = 7.09987 - 4.42394\ (R/t) + 0.21036\ (R/t)^2 - 0.00463\ (R/t)^3$$

$$C_m = 7.79661 + 5.16676\ (R/t) - 0.24577\ (R/t)^2 + 0.00541\ (R/t)^3$$

$$A_b = -3.26543 + 1.52784\ (R/t) - 0.072698\ (R/t)^2 + 0.0016011\ (R/t)^3$$

$$B_b = 11.36322 - 3.91412\ (R/t) + 0.18619\ (R/t)^2 - 0.004099\ (R/t)^3$$

$$C_b = -3.18609 + 3.84763\ (R/t) - 0.18304\ (R/t)^2 + 0.00403\ (R/t)^3$$

Equations for F_m and F_b are accurate for R/t between 5 and 20 and become increasingly conservative for R/t greater than 20. Alternative solutions for F_m and F_b may be used when R/t is greater than 20.

I-3.0 AXIAL FLAWS

For internal pressure loading, the following equation for F may be used:

$$F = 1 + 0.072449\lambda + 0.64856\lambda^2 - 0.2327\lambda^3 + 0.038154\lambda^4 - 0.0023487\lambda^5$$

where

$\lambda = c/(Rt)^{1/2}$

c = half crack length

The equation for F is accurate for λ between 0 and 5. Alternative solutions for F may be used when λ is greater than 5.