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L-14-267

10 CFR 50.55a

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
10 CFR 50.55a Request Number BV3-N-789

In accordance with the provisions of 10 CFR 50.55a(a)(3)(ii), the FirstEnergy Nuclear Operating Company (FENOC) hereby requests Nuclear Regulatory Commission (NRC) approval to use American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Case N-789, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1," as an alternative to ASME Code Section XI, Paragraph IWA-4400. Details of the proposed alternative are described in Enclosure A.

FENOC requests approval of the proposed alternative by August 31, 2015. A copy of ASME Code Case N-789 is provided as Enclosure B for information.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330) 315-6810.

Sincerely,

E. A. Larson

Eric A. Larson

Enclosures:
A. Beaver Valley Power Station, 10 CFR 50.55a Request BV3-N-789, Revision 0
B. ASME Code Case N-789, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1"

cc: NRC Region I Administrator
NRC Senior Resident Inspector
NRC Project Manager
Director BRP/DEP
BRP/DEP Site Representative

Enclosure A

Beaver Valley Power Station
10 CFR 50.55a Request BV3-N-789, Revision 0

(5 pages follow)

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(ii)

--Hardship or Unusual Difficulty
without Compensating Increase in Level of Quality or Safety--

1. ASME Code Components Affected:

American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Class 2 and 3 moderate energy carbon steel raw water piping systems.

2. Applicable Code Edition and Addenda:

ASME Code Section XI, 2001 Edition through 2003 Addenda is the applicable code edition and addenda for Beaver Valley Power Station, Unit No. 1 (BVPS-1) and Beaver Valley Power Station, Unit No. 2 (BVPS-2) current 10-year inservice inspection intervals.

3. Applicable Code Requirement:

ASME Code, Section XI, IWA-4400 provides requirements for welding, brazing, metal removal, and installation of repair/replacement activities.

4. Reason for Request:

Background Information

ASME Code requirements necessitate replacement or internal weld repair of wall thinning conditions resulting from degradation in Class 2 and Class 3 moderate energy carbon steel raw water piping systems. Such degradation may be the result of mechanisms such as erosion, corrosion, cavitation, and pitting. The repairs or replacements shall be in accordance with the Owner's requirements and the original or later Construction Code.

Other alternative repair methods, such as local weld overlays, are not always practicable because of wall thinness and moisture concerns.

Hardship or Unusual Difficulty

Implementing the applicable ASME Code requirements to accomplish a repair or replacement during plant operation at power would necessitate isolating the degraded portion of the system. Isolating a portion of the system would increase plant risk by rendering a safety system unavailable as compared to maintaining the system online to continue to provide redundant system function. This evolution also may require a plant shutdown. In addition, permanent repairs or replacements often require significant time for evaluation, design, material procurement, planning, scheduling, and implementation. The primary reason for this request is to permit installation of a technically sound

temporary repair to provide adequate time for implementing an appropriate permanent repair or replacement during a refueling outage.

5. Proposed Alternative and Basis for Use:

Proposed Alternative

FirstEnergy Nuclear Operating Company (FENOC) proposes to use the requirements of ASME Code Case N-789, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1," for temporary repair of degradation in Class 2 and 3 moderate energy raw water piping systems resulting from mechanisms such as erosion, corrosion, cavitation, or pitting, but excluding conditions involving flow-accelerated corrosion, corrosion-assisted cracking, or any other form of cracking. These types of defects are typically identified by small leaks in the piping system or by pre-emptive non-code required examinations performed to monitor the degradation mechanisms.

ASME Code Case N-789, provided as Enclosure B, was approved on June 25, 2011 by the ASME Board on Nuclear Codes and Standards; however, it has not been incorporated into Nuclear Regulatory Commission (NRC) Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Code Section XI Division 1." As such, ASME Code Case N-789 is not available for application at nuclear power plants without specific NRC approval. Therefore, FENOC requests NRC approval of the proposed alternative to implement this repair technique.

Basis for Use

ASME Code Case N-789 applies to Class 2 and 3 moderate energy (that is, less than or equal to 200 degrees Fahrenheit and less than or equal to 275 pounds per square inch gauge pressure maximum operating conditions) carbon steel raw water piping. ASME Code Case N-789, footnote 1, states that:

> Raw water is defined as water such as from a river, lake, or well or brackish/salt water - used in plant equipment, area coolers, and heat exchangers. In many plants it is referred to as "Service Water."

The alternative repair technique described in ASME Code Case N-789 involves the application of a metal reinforcing pad welded to the exterior of the piping system that either restores pressure integrity or reinforces the weakened area and restores pressure integrity. The Code case requires the design and examinations to comply with the Construction Code or ASME Code Section III. Reconciliation and use of editions and addenda of ASME Code Section III will be in accordance with ASME Code Section XI, Paragraph IWA-4220. If an edition of ASME Code Section III other than the Construction Code is applied, it will have been accepted by the NRC in accordance with 10 CFR 50.55a. The edition of ASME Code Section XI applicable to the BVPS-1 and BVPS-2 current 10-year inservice inspection intervals, as defined in Section 2, applies to the repair.

The reinforcing pad may be either a pressure pad or a structural pad. Pressure pads are designed to retain pressure and may be used only where the piping is predicted to retain full structural integrity until the next refueling outage assuming a corrosion rate of either 2 times the actual measured corrosion rate in that location, or 4 times the estimated maximum corrosion rate for the system. Structural pads are designed for pressure plus structural reinforcement and may be used where the piping is predicted not to retain full structural integrity until the next refueling outage. In this context, "full structural integrity" means the piping maintains full capability to withstand structural (mechanical) loading for which it is designed without need for additional support or reinforcement. The appropriate repair technique will be determined based on the characterization of the degradation.

Following discovery of a through-wall flaw, the flaw will be characterized to determine the cause of the degradation. Additionally, the surrounding areas will be examined to bound the degraded area and ensure no other unacceptable locations exist which could affect the integrity of the repaired piping. The area of the reinforcing pad will be determined based on the identified degraded area. Corrosion rates will be established based on the estimated maximum corrosion rate for the system. The development of a corrosion rate based on actual thickness measurements of the degraded area is not feasible due to the time constraints associated with an emergent repair or replacement.

The established corrosion rate will be conservatively multiplied by the safety factor of four established in the Code case to ensure the design of the reinforcing pad (for example, thickness and weld size) will provide a structural or pressure boundary, as appropriate, until the next refueling outage. If the established corrosion rates are less than the actual corrosion, the short duration of the repair, along with the applicable corrosion rate safety factor and inservice monitoring defined in the Code case, provide reasonable assurance that the structural integrity and leakage integrity will be maintained during the one-cycle of application.

When welding a reinforcing pad to a leaking area, precautions will be taken as necessary, such as installation of a gasket or sealant beneath the pad, to prevent welding on wet surfaces.

Baseline thickness examinations will be performed for completed structural pads, attachment welds (except for the tapered edges), and the surrounding areas, followed by monthly thickness monitoring for the first three months, with subsequent monitoring frequency based on the results of this monitoring, but at a minimum frequency of quarterly. For structural pads on buried piping, provisions will be made for access during plant operation in order to perform these examinations.

In order to verify the leak tightness of the pressure pad, areas containing pressure pads shall be visually observed at least once per month to monitor for evidence of leakage. If the areas containing pressure pads are not accessible for direct observation, then

monitoring will be accomplished by visual assessment of surrounding areas or ground surface areas above pressure pads on buried piping, or monitoring of leakage collection systems, if available.

For all reinforcing pads, regardless of when during an operating cycle they are installed, the repair will be considered to have a maximum service life of the time until the end of the next refueling outage, and by that time a permanent repair or replacement must be performed. Detailed requirements for design of reinforcement pads, installation, examination, pressure testing and inservice monitoring are provided in ASME Code Case N-789.

Based on the above, the use of ASME Code Case N-789 for temporary repairs is justified, since compliance with the requirements of ASME Code Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety. All other ASME Code Section XI requirements for which relief was not specifically requested and authorized by the NRC staff will remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

6. Duration of Proposed Alternative:

The duration of the proposed alternative extends to the end of the first refueling outage following the end of both the BVPS-1 fourth 10-year inservice inspection interval (that began on April 1, 2008), and the BVPS-2 third 10-year inservice inspection interval (that began on August 29, 2008).

ASME Code Case N-789 reinforcing pads (structural or pressure) installed before the end of the 10-year inservice inspection interval are removed before the end of the refueling outage following their installation, even if that refueling outage occurs after the end of the 10-year interval.

7. Precedents:

The NRC approved a similar request to use ASME Code Case N-789 for the 10 nuclear plant sites licensed to Exelon Generation Company, LLC. The NRC letter approving the alternative is referenced below.

NRC Letter to Exelon Nuclear, Subject: [Associated plant names listed below] - Request to Use American Society of Mechanical Engineers Boiler and Pressure Vessel Code Case N-789, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1," [Associated TAC numbers listed below], dated May 10, 2012.
(Accession No. ML 12121A637)

Plant Names: Braidwood Station, Unit Nos. 1 and 2; Byron Station, Unit Nos. 1 and 2; Clinton Power Station, Unit No.1; Dresden Nuclear Power Station, Unit Nos. 2 and 3; Lasalle County Station, Units Nos. 1 and 2; Limerick Generating Station, Unit Nos. 1 and 2; Oyster Creek Nuclear Generating Station; Peach Bottom Atomic Power

Station, Unit Nos. 2 and 3; Quad Cities Nuclear Power Station, Unit Nos. 1 and 2; and Three Mile Island Nuclear Station, Unit No. 1

TAC Nos.: ME7303, ME7304, ME7305, ME7306, ME7307, ME7308, ME7309, ME7310, ME7311, ME7312, ME7313, ME7314, ME7315, ME7316, ME7317, ME7318, and ME7319)

Docket Nos.: STN 50-456, STN 50-457, STN 50-454, STN 50-455, 50-461,50-237, 50-249,50-373,50-374,50-352,50-353,50-219, 50-277, 50-278, 50-254, 50-265, and 50-289)

Enclosure B

ASME Code Case N-789, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1"

(5 pages follow)

Approval Date: June 25, 2011

Code Cases will remain available for use until annulled by the applicable Standards Committee.

Case N-789
Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service
Section XI, Division 1

Inquiry: As an alternative to replacement or internal weld repair in accordance with IWA-4400, what requirements may be applied for wall reinforcement of Class 2 and 3 moderate-energy carbon steel raw water[1] piping systems that have experienced internal wall thinning from localized erosion, corrosion, and cavitation or pitting?

Reply: It is the opinion of the Committee that, in lieu of meeting IWA-4400, areas of Class 2 and 3 moderate-energy [i.e., less than or equal to 200°F (93°C) and less than or equal to 275 psig (1.9 MPa) maximum operating conditions] carbon steel raw water piping experiencing internal wall thinning from localized erosion, corrosion, and cavitation or pitting may have the wall reinforced by applying reinforcing pads to the outside surface of the piping in accordance with the following requirements. Excluded from these provisions are conditions involving flow-accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking.

1 GENERAL REQUIREMENTS

(a) Application of the reinforcing pad shall be performed in accordance with a Repair/Replacement Plan satisfying the requirements of IWA-4150.

(b) The design, materials, and installation shall meet the requirements of the Construction Code and IWA-4000, except as stated in this Case.

(c) If the minimum required thickness of reinforcing pad necessary to satisfy the requirements of 3 is greater than the nominal thickness for the size and schedule of the piping, this Case shall not be used.

[1] Raw water is defined as water such as from a river, lake, or well or brackish/salt water; used in plant equipment, area coolers, and heat exchangers. In many plants it is referred to as "Service Water."

(d) Additional reinforcement or repair is not permitted on top of an existing reinforcing pad.

(e) Reinforcing pads, including those installed during a refueling outage, shall not remain in service beyond the end of the next refueling outage.

(f) This Case may only be applied to piping not required to be ultrasonically examined for inservice inspection.

2 INITIAL EVALUATION

(a) The material beneath the surface to which the reinforcing pad is to be applied and the adjacent area shall be ultrasonically measured to establish the existing wall thickness and the extent and configuration of degradation to be corrected by the reinforcing pad.

(b) The cause and rate of degradation shall be determined. If the cause is determined to be flow-accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking, this Case shall not apply. The extent and rate of degradation in the piping shall be evaluated to ensure that there are no other unacceptable locations within the surrounding area that could affect the integrity of the repaired piping. The dimensions of the surrounding area to be evaluated shall be determined by the Owner, considering the type of degradation present.

(c) The effects of the repair on the piping and any remaining degradation shall be evaluated in accordance with IWA-4311.

3 DESIGN

3.1 Types of Reinforcing Pads

(a) Reinforcing pads may be used for pressure only or for pressure plus structural reinforcement of thinned areas including areas that do, or are expected to, penetrate the piping wall.

(1) Pressure pads are designed to retain pressure, and may be used only where the piping is predicted to retain full structural integrity until the next refueling outage assuming a corrosion rate of either 2 times the actual measured corrosion rate in that location, or 4 times the estimated maximum corrosion rate for the system.

(2) Structural pads are designed for pressure plus structural reinforcement and may be used where the piping

is predicted not to retain full structural integrity until the next refueling outage.

3.2 General Design Requirements — Pressure and Structural Pads

(a) The design of reinforcing pads shall be in accordance with the applicable requirements of the Construction Code or Section III (NC-3100, ND-3100 and NC-3600, ND-3600 including Appendix II).

(b) The reinforcing pad shall be sized to encompass the unacceptable area with the attachment welds located on adjacent base material of sufficient thickness to accommodate the design stresses.

(c) The plate for the reinforcing pad shall be rolled or otherwise formed to fit the contour of the piping to achieve proper weld fit-up.

(d) The thickness of the reinforcing pad shall be sufficient to maintain required thickness until the next refueling outage.

(e) The tensile strengths of the plate and weld filler metal for the reinforcing pad shall be at least that specified for the base metal to which it is applied.

(f) The predicted maximum degradation of the reinforced piping until the next refueling outage shall be included in the design. The predicted degradation of the piping shall be based on in-situ inspection of, and established data for, similar base metals in similar environments. If the reinforcing pad is predicted to become exposed to the raw water, the predicted degradation of the reinforcing pad shall be based upon established data for base metals or weld metals with similar chemical composition to that used for the reinforcing pad.

(g) Material for reinforcing pads shall be ferritic, with welds of compatible weld filler metal.

(h) The following factors shall be included, as applicable, in the design and application of the pad:

(1) shrinkage effects, if any, on the piping

(2) stress concentrations caused by installation of the reinforcing pad or resulting from existing and predicted piping internal surface configuration

(3) effects of welding on any interior coating

(4) added weight of the pad with respect to any design analyses that could be affected

(i) If flexibility analysis was required by the original Construction Code, the effect of the reinforcing pad shall be reconciled with the original analysis. For rectangular-shaped reinforcing pads on piping designed to NC-2650, ND-3650 and aligned parallel or perpendicular to the axis of the piping, unless a lower stress intensification factor [SIF or (i)] is established, an SIF (i) of 2.1 shall be applied for reinforcing pads on straight pipe and adjacent welds. Also, a stress multiplier of 1.7 shall be applied to the SIF (i) for standard elbows, and an SIF (i) of 2.1 shall be applied for tees and branch connections when the toe of the attachment weld is not less than 2.5 $\sqrt{Rt_{nom}}$ from any branch reinforcement in Fig. 1.

(j) Corners of reinforcing pad plates shall be rounded with radii not less than the reinforcing pad thickness, and the toes of attachment welds at the corners shall have 1 in. (25 mm) minimum radius.

(k) The distance between toes of attachment welds and other attachments or branch reinforcement (Figs. 1 and 2) shall not be less than the following equation:

$$d = 2.5\sqrt{Rt_{nom}}$$

where

d = minimum distance between toes of fillet welds of adjacent fillet welded attachments
R = the outer radius of the piping
t_{nom} = nominal thickness of the piping

(l) When permitted by the design, suitable gasket material may be applied inside the pad to prevent moisture during welding (see Figs. 1 and 2).

3.3 Specific Design Requirements — Pressure Pads

Pressure pads shall meet the requirements of 3.2, Fig. 2, and the following:

(a) Fillet-welded pressure pads shall be designed to withstand the membrane strain of the piping in accordance with the requirements of the Code specified in 3.2(a) such that the following criteria are satisfied:

(1) The allowable membrane stress is not exceeded in the piping or the pad.

(2) The strain in the pad does not result in fillet weld stresses exceeding allowable stresses for such welds.

(b) Design as a reinforced opening in accordance with the Construction Code shall satisfy 3.3(a).

(c) As an alternative to 3.3(a), pressure pads may be designed as structural pads in accordance with 3.4 or as prequalified designs in accordance with 3.5.

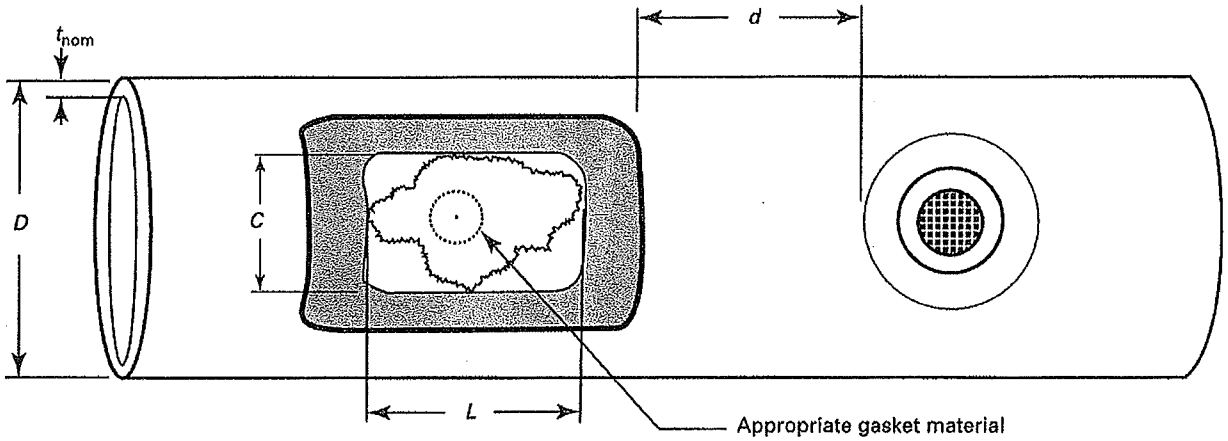
3.4 Specific Design Requirements — Structural Pads

Structural pads shall meet the requirements of 3.2, Fig. 1, and the following:

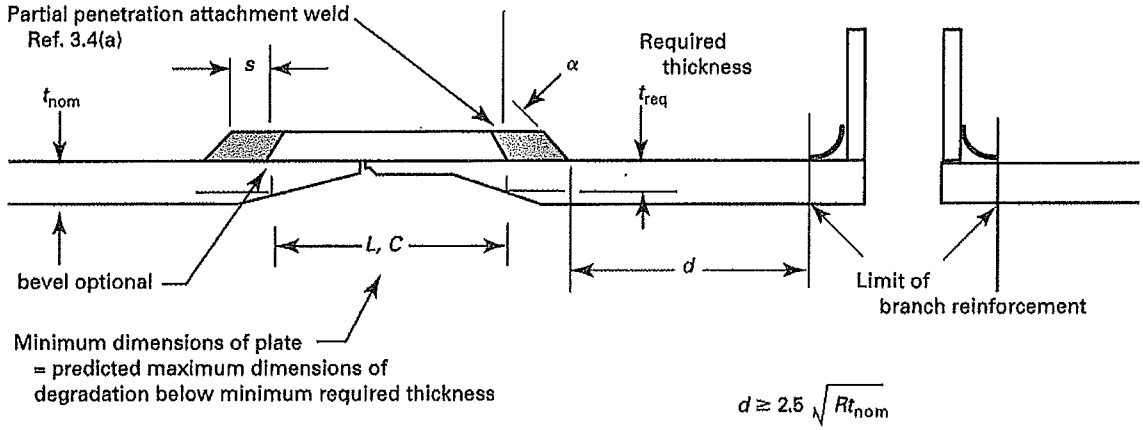
(a) Unless otherwise established by analysis in accordance with the requirements of 3.2(a), structural pads shall be attached by partial penetration attachment welds (see Fig. 1) that extend for a distance of at least s in each direction beyond the area predicted, by the next refueling outage, to infringe upon the required thickness.[2]

[2] Design thickness as prescribed by the Construction Code.

FIG. 1 STRUCTURAL PAD



C = predicted circumferential growth of degradation
L = predicted axial growth



$$d \geq 2.5\sqrt{Rt_{nom}}$$

$$s \geq 0.75\sqrt{Rt_{nom}}$$

where

R = outer radius of the component
s = 1 in. (25 mm) minimum
t_{nom} = nominal wall thickness of the component

(b) The thickness of the partial penetration attachment welds shall equal the thickness of the pad and the edges of the welds shall be tapered to the piping surface at a maximum angle ("α" in Fig. 1) of 45 deg.

(c) Final configuration of the structural pad including attachment welds shall permit the examinations and evaluations required herein, including any required preservice or inservice examinations of encompassed or adjacent welds.

(d) Except for the tapered edges, the structural pad plate and attachment welds shall have a uniform thickness.

3.5 Prequalified Design

Application of structural pads on straight pipe, standard elbows, and associated welds shall be exempt from the requirements of 3.2(a), provided all of the following conditions are satisfied.

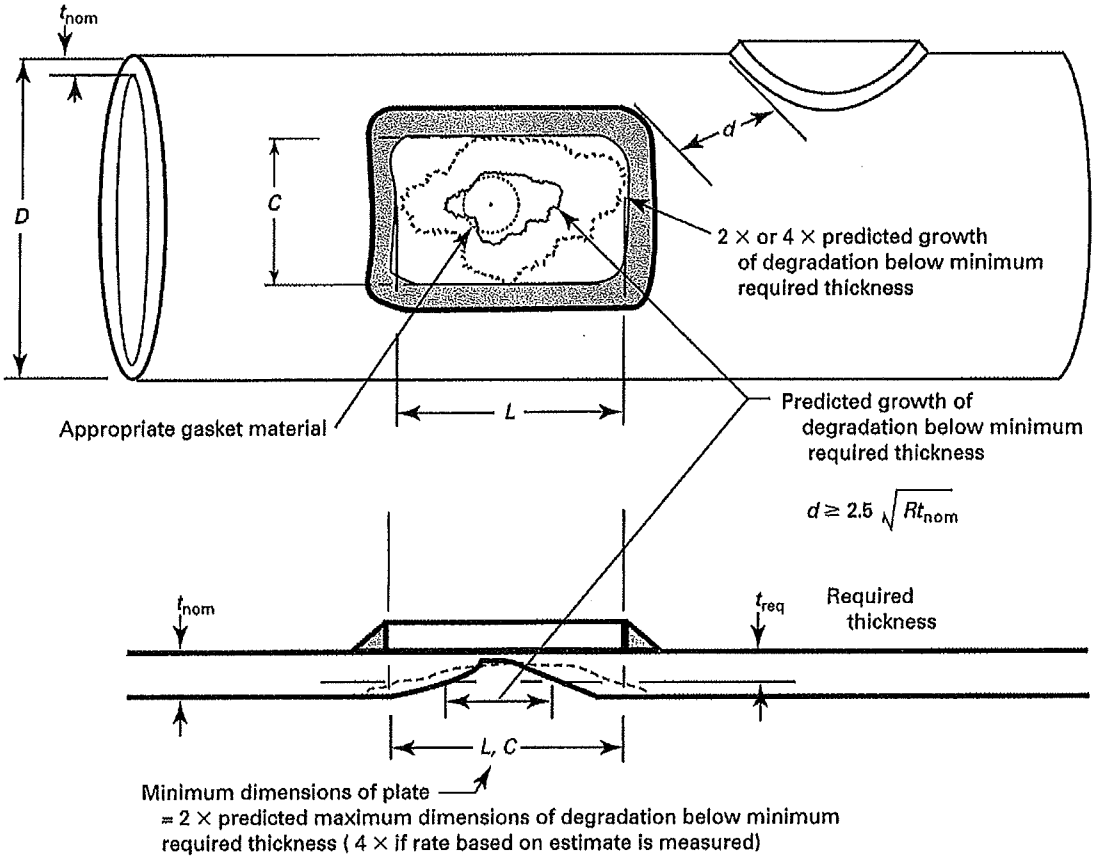
(a) All other requirements of 3.1, 3.2, and 3.4 are satisfied.

(b) The axial length of structural pad plus width of partial penetration attachment welds shall not exceed the greater of 6 in. (150 mm) or the outside diameter of the piping.

(c) The finished structural pad shall be circular, oval, or rectangular in shape.

(1) The maximum dimension compensated by a circular structural pad shall not exceed two-thirds of the nominal outside diameter of the piping.

FIG. 2 PRESSURE PAD



(2) Rectangular structural pads shall be aligned parallel with or perpendicular to the axis of the piping.

(3) For oval structural pads, the end radii shall not be less than $0.75\sqrt{Rt_{nom}}$, and the axis of the structural pad shall be aligned parallel with or perpendicular to the axis of the piping.

4 WATER-BACKED APPLICATIONS

(a) Attachment welds on water backed piping shall be applied using the SMAW process with low-hydrogen electrodes.

(b) For piping materials other than P-No. 1, Group 1, the surface examination required in 6 shall be performed no sooner than 48 hr after completion of welding.

5 INSTALLATION

(a) The base material in the area to be welded shall be cleaned to bare metal.

(b) Weld metal shall be deposited using a groove – welding procedure qualified in accordance with Section IX and the Construction Code.

(c) Provisions for venting during the final closure weld, or for pressurizing for leak-testing, shall be included, if necessary.

(d) The surface of the attachment weld shall be prepared, if necessary, by machining or grinding to permit performance of surface and volumetric examinations required by 6. For ultrasonic examination, a surface finish of 250 RMS or better is required.

6 EXAMINATION

(a) The completed attachment weld shall be examined using the liquid penetrant or magnetic particle method and shall satisfy the surface examination acceptance criteria for welds of the Construction Code or Section III (NC-5300, ND-5300).

(b) Except for the tapered edges, partial penetration attachment welds, including the piping base metal upon which they are applied, shall be ultrasonically measured to verify acceptable wall thickness.

(c) Partial penetration attachment welds shall be volumetrically examined when full penetration girth welds in the piping are required by the Construction Code to be

volumetrically examined. Where configuration does not permit meaningful volumetric examination, the first layer, each ½ in. (13 mm) thickness of weld deposit, and the final surface shall be examined in accordance with 6(a) in lieu of volumetric examination.

(d) If volumetric examination is required, the full volume of the attachment weld, excluding the tapered edges, but including the volume of base metal required for the intended life of the reinforcing pad, shall be examined in accordance with the Construction Code or Section III, using either the ultrasonic or radiographic method, and shall, to the depth at the surface of the piping, satisfy the acceptance criteria for weldments of the Construction Code or Section III (NC-5320, ND-5320 or NC-5330, ND-5330). Any volume of the piping beneath the reinforcing pad that is credited in the design shall satisfy the volumetric acceptance criteria of Section III (NC-5320, ND-5320 or NC-5330, ND-5330), as applicable.

7 PRESSURE TESTING

In lieu of IWA-4540, a system leakage test of the repair/replacement activity shall be performed in accordance with IWA-5000 prior to, or as part of, returning to service.

8 INSERVICE MONITORING

(a) Upon completion of the repair, inspections shall be performed for structural pads, using ultrasonic or direct thickness measurement, to record the thickness of the plate, the thickness at the attachment welds, including the underlying base metal, and to the extent examinable in a 3 in. (75 mm) wide band, surrounding the repair, as a baseline for subsequent monitoring of the repair.

(b) The Owner shall prepare a plan for additional thickness monitoring for structural pads using ultrasonic or direct thickness measurement to verify that minimum design thicknesses, as required by the Construction Code or Section III, are maintained until the next refueling outage. The monitoring shall be monthly for the first quarter and the subsequent frequency shall be based on the results of the monitoring activities, but at least quarterly.

(c) If the results of the monitoring program identify leakage or indicate that the structural margins required by 3 will not be maintained until the next refueling outage, additional repair/replacement activities not prohibited by 1(d) shall be performed prior to encroaching upon the design limits.

(d) Reinforcing pads shall not remain in service beyond the end of the next refueling outage.