Exelon Generation

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10 CFR 50.55a

RS-13-060
RA-13-020
TMI-13-028

February 27, 2013

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

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Dresden Nuclear Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Limerick Generating Station, Units 1 and 2
Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Oyster Creek Nuclear Generating Station
Renewed Facility Operating License No. DPR-16
NRC Docket No. 50-219

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Proposed Alternative to Utilize Code Case N-786, "Alternative Requirements for Sleeve Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping Section XI, Division 1"

Reference: 1) Letter from J. I. Zimmerman (U.S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), ML12121A637, dated May 10, 2012

In accordance with 10 CFR 50.55a(a)(3)(ii), Exelon Generation Company, LLC (Exelon) is requesting a proposed alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," on the basis that compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Similar justification was provided for the Exelon fleet as discussed in the Reference 1 letter. Specifically, this proposed alternative concerns the use of repair sleeves in accordance with Code Case N-786, for mitigating damage caused from degradation mechanisms such as localized erosion, corrosion, cavitation, or pitting in Class 2 and 3 moderate-energy piping.

There are no commitments contained in this submittal.

We request your review and approval of this fleet request by February 27, 2014.

Respectfully,

Michael D. Jesse
Director – Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachments: 1) Proposed Alternative to Utilize Code Case N-786
2) Code Case N-786

cc: Regional Administrator - NRC Region I
Regional Administrator - NRC Region III
NRC Senior Resident Inspector - Braidwood Station
NRC Senior Resident Inspector - Byron Station

cc (Cont'd)
NRC Senior Resident Inspector - Clinton Power Station
NRC Senior Resident Inspector - Dresden Nuclear Power Station
NRC Senior Resident Inspector - LaSalle County Station
NRC Senior Resident Inspector - Limerick Generating Station
NRC Senior Resident Inspector - Oyster Creek Nuclear Generating Station
NRC Senior Resident Inspector - Peach Bottom Atomic Power Station
NRC Senior Resident Inspector - Quad Cities Nuclear Power Station
NRC Senior Resident Inspector - Three Mile Island Nuclear Station, Unit 1
NRC Project Manager - Braidwood Station
NRC Project Manager - Byron Station
NRC Project Manager - Clinton Power Station
NRC Project Manager - Dresden Nuclear Power Station
NRC Project Manager - LaSalle County Station
NRC Project Manager - Limerick Generating Station
NRC Project Manager - Oyster Creek Nuclear Generating Station
NRC Project Manager - Peach Bottom Atomic Power Station
NRC Project Manager - Quad Cities Nuclear Power Station
NRC Project Manager - Three Mile Island Nuclear Station, Unit 1

Attachment 1

Proposed Alternative to Utilize Code Case N-786

Request to Use Code Case N-786 in Accordance with 10 CFR 50.55a(a)(3)(ii)

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1. ASME Code Component(s) Affected:

All ASME 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 piping systems.

2. Applicable Code Edition and Addenda:

PLANT	INTERVAL	EDITION	START	END
Braidwood Station, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	July 29, 2008 October 17, 2008	July 28, 2018 October 16, 2018
Byron Station, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	January 16, 2006	July 15, 2016
Clinton Power Station, Unit 1	Third	2004 Edition	July 1, 2010	June 30, 2020
Dresden Nuclear Power Station, Units 2 and 3	Fifth	2007 Edition, through 2008 Addenda	January 20, 2013	January 19, 2023
LaSalle County Stations, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	October 1, 2007	September 30, 2017
Limerick Generating Station, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	February 1, 2007	January 31, 2017
Oyster Creek Nuclear Generating Station	Fifth	2007 Edition, through 2008 Addenda	January 15, 2013	January 14, 2023
Peach Bottom Atomic Power Station, Units 2 and 3	Fourth	2001 Edition, through 2003 Addenda	November 5, 2008	November 4, 2018
Quad Cities Nuclear Power Station, Units 1 and 2	Fifth	2007 Edition, through 2008 Addenda	April 2, 2013	April 1, 2023
Three Mile Island Nuclear Station, Unit 1	Fourth	2004 Edition	April 20, 2011	April 19, 2022

3. Applicable Code Requirement:

ASME Code, Section XI, IWA-4400 of 2001 Edition through 2003 Addenda, 2004 Edition, and 2007 Edition through 2008 Addenda provides requirements for welding, brazing, metal removal, and installation of repair/replacement activities.

4. Reason for Request:

In accordance with 10 CFR 50.55a(a)(3)(ii), Exelon Generation Company, LLC (Exelon) is requesting proposed alternatives from the requirement for replacement or internal weld repair of wall thinning conditions resulting from degradation in Class 2 and Class 3 moderate energy carbon steel piping systems in accordance with IWA-4000. Such degradation may be the result of mechanisms such as localized erosion, corrosion, cavitation, and pitting, but excluded are conditions involving any form of cracking. IWA-4000 requires repair or replacement in accordance with the Owner's Requirements and the original or later Construction Code.

One reason for this request is to permit installation of technically sound temporary repairs, in the form of Type A or partial-structural Type B reinforcing sleeves, to provide adequate time for evaluation, design, material procurement, planning and scheduling of appropriate permanent repair or replacement of the defective piping, considering the impact on system availability, maintenance rule applicability, and availability of replacement materials.

The other reason for this request is to permit installation of long-term repairs, in the form of full-structural Type B reinforcing sleeves, for locally degraded portions of piping systems. The design, construction, and inservice monitoring of such sleeves provide a technically sound equivalent replacement for the segment of degraded piping that is encompassed.

5. Proposed Alternative and Basis for Use:

Exelon proposes to implement the requirements of ASME Code Case N-786, "Alternative Requirements for Sleeve Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping Section XI, Division 1," for repair of degradation in Class 2 and 3 moderate energy carbon steel piping systems resulting from mechanisms such as localized erosion, corrosion, cavitation, or pitting, but excluding conditions involving any 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. Code Case N-786, which is included as part of this relief request, is attached.

This code case invokes the design requirements of the original Construction Code or ASME Code, Section III. Reconciliation and use of editions and addenda of ASME Section III will be in accordance with ASME Section XI, IWA-4220, and only editions and addenda of ASME Section III that have been accepted by 10 CFR 50.55a may be used. The Code of Record for the specific 10-year ISI interval at each nuclear unit as identified under Section 2 above, will be used when applying the various IWA paragraphs of Section XI unless specific regulatory relief to use other editions or addenda is approved.

The alternative repair technique described in Code Case N-786 involves the application of Type A and Type B full encirclement sleeve halves welded together with full penetration longitudinal seam welds to reinforce structural integrity in the degraded area. In the case of Type B reinforcing sleeves, the ends are also welded to the piping in order to restore pressure integrity. This repair technique will be utilized when it is determined that this repair method is suitable for the particular defect or degradation being resolved without flaw removal.

The Code Case requires that the cause of the degradation be determined and that the extent and rate of degradation in the piping 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 area of evaluation will be dependent on the degradation mechanism present. If the cause of the degradation is not determined, the maximum permitted service life of any reinforcing sleeve shall be the time until the next refueling outage.

"Full-structural Type B" means that the sleeve and attachment welds alone maintain full capability to withstand structural (mechanical) and pressure loading for which the piping is presently designed without need for additional support or reinforcement, and without reliance on any piping that is encased by the sleeve. Type A and partial-structural Type B sleeves rely on the encased underlying piping to provide some structural (mechanical) and/or pressure retaining integrity.

Type B reinforcing sleeves may be applied to leaking systems by installing a gasket or sealant between the sleeve and the pipe as permitted by the Code Case, and then clamping the reinforcing sleeve halves to the piping prior to welding. Residual moisture is then removed by heating prior to welding. If welding of any type of sleeve occurs on a wet surface, the maximum permitted life of the sleeve shall be the time until the next refueling outage.

A baseline thickness examination will be performed for completed full-structural Type B reinforcing sleeves, attachment welds, and surrounding areas, followed by thickness monitoring during the first two refueling outages after installation and at least every fourth refueling outage thereafter.

Partial-structural Type B reinforcing sleeves and Type A reinforcing sleeves completely encompass the degraded areas. These sleeves are designed to accommodate predicted maximum degradation and must be removed at the next refueling outage. Accordingly, the Code Case does not require inservice monitoring for these sleeves. However, because of NRC concerns discussed in the May 10, 2012, NRC Safety Evaluation Report for the Exelon Generation Company, LLC sites concerning the approval to apply Code Case N-789 (ML12121A637), the following condition shall apply to the application of Code Case N-786:

> Type A reinforcing sleeves and partial-structural Type B reinforcing sleeves shall be visually observed at least once per month to monitor for evidence of leakage. If the areas containing these sleeves are not accessible for direct observation, then monitoring will be accomplished by visual assessment of surrounding areas or ground surface areas above such sleeves on buried piping, or monitoring of leakage collection systems, if available.

When used on buried piping, the area of full-structural Type B reinforcing sleeves will need to be physically accessible for the examinations required by the Code Case, which could necessitate installation of removable barriers at the repair location in lieu of backfilling the pipe at that location. For Type A and partial-structural Type B reinforcing sleeves installed on buried piping, the monitoring will be based on visual assessment as discussed above.

Type A reinforcing sleeves and partial-structural Type B reinforcing sleeves shall have a maximum permitted service life of the time until the next refueling outage, when a permanent repair or replacement must be performed. Neither the Type A nor the partial-structural Type B reinforcing sleeve may remain in service beyond the end of the next refueling outage after they are installed, unless specific regulatory relief is obtained. This means that if such a repair is performed in mid-cycle (e.g., one month before the scheduled refueling outage) the reinforcing sleeve would be removed no later than the upcoming refueling outage (e.g., in one month) unless specific regulatory relief is obtained. Even if removal during the next scheduled refueling

outage becomes challenging (e.g., it is installed on a system required to be functional during the refueling outage), it would still need to be removed when the system is not required to be functional and prior to the conclusion of the next scheduled refueling outage after it was installed.

A similar situation exists with common cooling lines that require a dual unit outage in order to remove them from service. Unless a full-structural Type B reinforcing sleeve is installed, specific regulatory approval would need to be obtained in order to defer removal of a Type A or partial-structural Type B reinforcing sleeve beyond the next upcoming refueling outage of either unit.

Full-structural Type B reinforcing sleeves will be removed and an IWA-4000 repair or replacement will be performed prior to the time that inservice monitoring indicates that structural integrity could be impaired based on measured degradation between monitoring activities. Additional requirements for design, installation, examination, pressure testing, and inservice examination of reinforcing sleeves are provided in Code Case N-786.

All other ASME 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.

Based on the above, the use of Code Case N-786 for full-structural Type B reinforcing sleeves and for Type A and partial-structural Type B reinforcing sleeves will apply when compliance with the specified Code requirements of ASME Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Code Case N-786 was approved by the ASME Board on Nuclear Codes and Standards on March 24, 2011; however, it has not been incorporated into NRC Regulatory Guide 1.147 "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," and thus is not available for application at nuclear power plants without specific NRC approval. Therefore, Exelon requests use of the alternative repair techniques described in the Code Case via this relief request.

6. Duration of Proposed Alternative:

The proposed alternative is for use of the Code Case for the remainder of each plant's 10-year inspection interval as specified in Section 2. Installation of reinforcing sleeves in accordance with this request cannot take place after the end of the 10-year ISI interval for the unit. Any Type A and partial-structural Type B reinforcing sleeves installed before the end of the 10-year inservice inspection interval will be removed during the next refueling outage, even if that refueling outage occurs after the end of the 10-year ISI interval.

7. Precedent:

A similar Exelon relief request, for Code Case N-789 (Reinforcing Pads for Class 2 and Class 3 Moderate Energy Raw Water Systems) was approved by NRC Safety Evaluation dated May 10, 2012, ADAMS Accession No. ML12121A637.

Attachment 2

Code Case N-786

Approval Date: March 24, 2011

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

Case N-786
Alternative Requirements for Sleeve Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping 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 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 IWA-4400, 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 piping experiencing internal wall thinning from localized erosion, corrosion, and cavitation or pitting may have the wall thickness reinforced by applying full-circumferential reinforcing sleeves to the outside surface of the piping in accordance with the following requirements. Excluded from these provisions are conditions involving any form of cracking.

1 GENERAL REQUIREMENTS

(a) Installation of the reinforcing sleeve shall be 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 sleeve necessary to satisfy the requirements of 3 is greater than 1.4 times the nominal thickness for the size and schedule of the piping, this Case may not be used.

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

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

2 INITIAL EVALUATION

(a) The material beneath the surface to which the reinforcing sleeve is to be applied shall be ultrasonically measured to establish the existing wall thickness and the extent and configuration of degradation to be reinforced. The adjacent area shall be examined to verify that the repair will encompass the entire unacceptable area, and that the adjacent base material is of sufficient thickness to accommodate the attachment welds at the edges of the sleeve.

(b) The cause and rate of degradation shall be determined. The extent and rate of degradation in the piping shall be evaluated to ensure that there will be no other unacceptable locations within the surrounding area that could affect the integrity of the reinforced areas for the life of the repair. The dimensions of the surrounding area to be evaluated shall be determined by the Owner, based on the type and rate of degradation present.

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

3 DESIGN

3.1 Types of Reinforcing Sleeves

(a) Type A reinforcing sleeves as shown in Fig. 1 may be used for structural reinforcement of thinned areas which are not expected to penetrate the wall and cause leakage. The piping longitudinal stresses shall meet the requirements of the Construction Code. Type A reinforcing sleeves shall have a maximum service life of the time until the next refueling outage.[1]

(b) Type B reinforcing sleeves as shown in Fig. 2 may be used for pressure plus full- or partial-structural reinforcement of thinned areas that penetrate, or are expected to penetrate the wall and cause leakage.

(1) Full-structural reinforcement is designed to accommodate pressure plus axial and circumferential design loadings at the location for the design life of the repair without taking credit for any portion of the degraded segment. Full-structural reinforcement sleeves shall be removed and the piping repaired or replaced in accordance with IWA-4000 no later than the end of the design life of the repair.

[1] If a Type A or partial-structural Type B reinforcing sleeve is installed during a refueling outage, the maximum permitted service life is one fuel cycle, until the next refueling outage.

FIG. 1 TYPE A REINFORCING SLEEVE

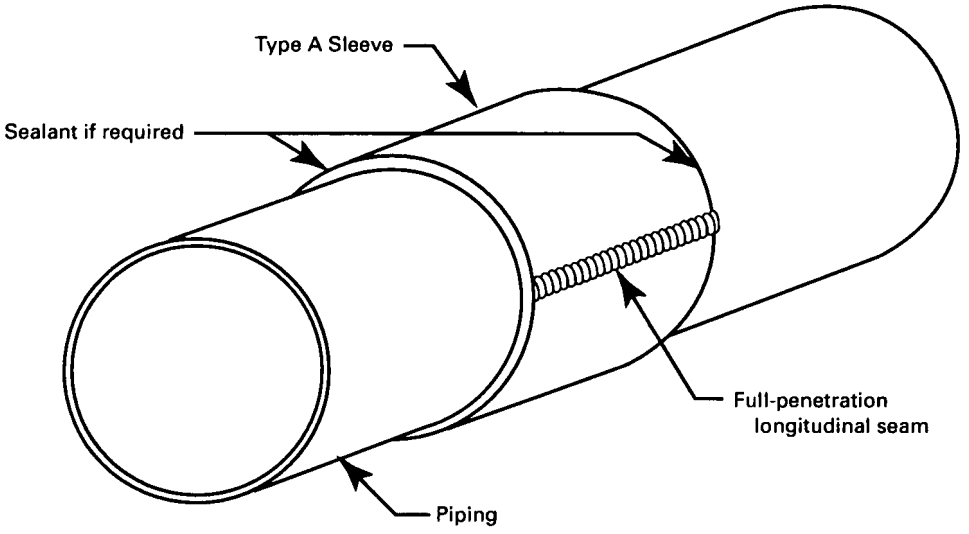
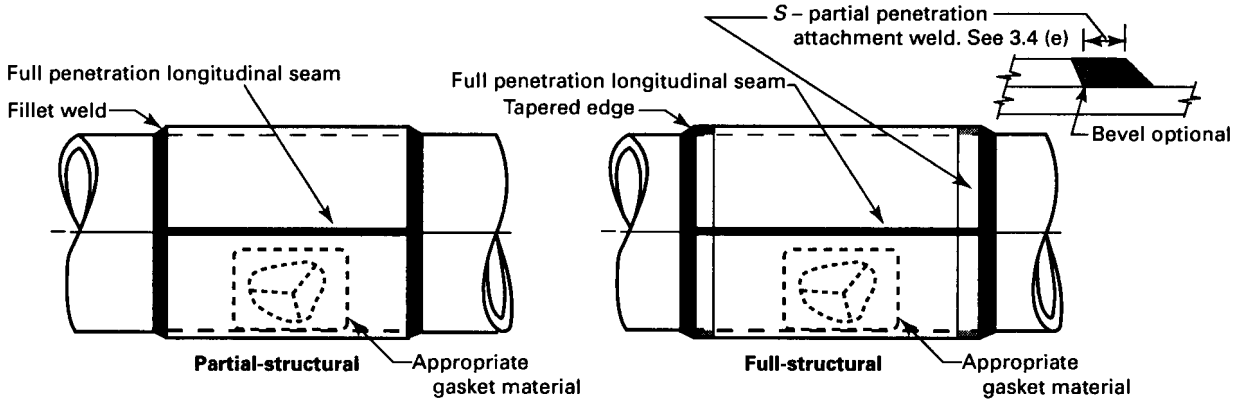


FIG. 2 TYPE B REINFORCING SLEEVES



(2) Partial-structural reinforcement is designed to accommodate design loadings at the segment being reinforced, taking partial credit for the degraded segment after factoring in predicted degradation over the life of the repair. Partial credit is considered taken if the design relies on any portion of the segment of piping beneath the sleeve, other than the base metal beneath the attachment welds, to provide structural or pressure integrity. Partial-structural reinforcing sleeves shall have a maximum service life of the time until the next refueling outage.

3.2 General Design Requirements — Type A and B Sleeves

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

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

(c) The minimum width of reinforcing sleeves shall be 4 in. (100 mm).

(d) The thickness of the reinforcing sleeve shall be sufficient to maintain required thickness for the predicted life of the repair.

(e) The following factors shall be considered, as applicable, in the design and application of the sleeves:

(1) all loading the sleeve is expected to encounter

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

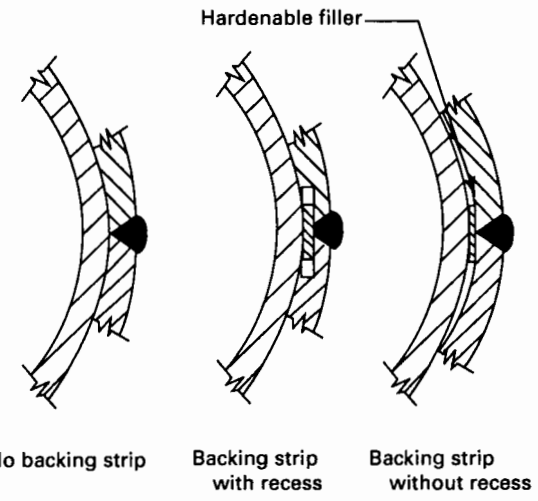
(3) stress concentrations caused by installation of the reinforcing sleeve or resulting from existing and predicted piping internal surface configuration

(4) effects of welding on any interior coating

(5) differential thermal expansion between reinforcing sleeve, the attachment welds, and the pipe

(6) potential for loose debris in the system from continued degradation of the reinforced area of the piping

FIG. 3 TYPE A AND B SLEEVE LONGITUDINAL SEAMS



(f) Longitudinal seam welds shall be full penetration. Backing may be applied to prevent burn-through of the pipe. If full contact between sleeve and pipe is required, any backing shall be recessed into the underside of the sleeve, or hardenable filler shall be used to fill the void, as indicated in Fig. 3.

(g) Longitudinal seam joint efficiency of 0.8 shall be used, except that 100% joint efficiency is permitted if the longitudinal seam is volumetrically examined.

(h) Fatigue evaluation shall be performed if required for the original pipe, or if thermal gradients exceed 100°F (56°C), or if lesser thermal gradients will occur during more than 200 heatup and cool-down cycles over the life of the repair.

(i) If flexibility analysis was required by the original Construction Code, the effect of the reinforcement shall be reconciled with the original analysis.

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

(k) The predicted maximum degradation of the carrier base metal and reinforcing sleeve over the design life of the reinforcement shall be based on in-situ inspection and established data for similar base metals.

(l) Weld seams encompassed by the sleeve shall be ground flush. Alternatively, bulges may be rolled or formed in the sleeves to accommodate such obstructions. Refer to Fig. 4.

(m) Sleeves shall closely match the outside surface of the carrier piping. If required by design, gaps shall be filled with hardenable filler.

(n) Hardenable filler shall be suitable for the system operating conditions, and shall be compatible with the sleeve, weld metal, piping, and any exterior coating that is not removed from the piping.

3.3 Specific Requirements — Type A Sleeves

Type A sleeves in moist environments shall have edges sealed, but not seal welded, to prevent moisture intrusion and corrosion.

3.4 Specific Requirements — Type B Sleeves

(a) If permitted by the design, suitable gasket material may be applied inside the sleeve to prevent moisture during welding (see Fig. 2).

(b) Hardenable filler and gasket material shall be compatible with the system fluid.

(c) Partial-structural sleeves shall be designed to withstand the design pressure.

(d) Partial-structural sleeves may be attached by fillet welds in accordance with the requirements of 3.2(a).

(e) Unless otherwise established by analysis in accordance with the requirements of 3.2(a), the sleeves shall be attached by partial-penetration welds (see Fig. 5) that extend for a distance of at least s in each axial direction beyond the area predicted, over the design life of the repair, to infringe upon the required thickness.[2]

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

where

$R = D/2$ = outer radius of the component
S = 1 in. (25 mm), minimum
t_{nom} = nominal wall thickness of the component

The thickness of the partial-penetration attachment welds shall equal the thickness of the sleeve, and the outer edges of the welds shall be tapered to the piping surface at a maximum angle ("α" in Fig. 5) of 45 deg.

(f) If flexibility analysis was required by the original Construction Code, and unless a lower stress intensification factor (SIF or i) is established, an SIF (i) of 2.1 shall be applied for attachment fillet welds and tapered edges of partial-penetration attachment welds on straight pipe and at adjacent welds. Also, a stress multiplier of 1.7 shall be applied to the SIF (i) for sleeves enclosing standard elbows, and an SIF (i) of 2.1 shall be applied for sleeve attachments on tees and branch connections provided the toe of the fillet or tapered edge is not less than 2.5 $\sqrt{Rt_{nom}}$ from any branch reinforcement. (See Fig. 5.)

4 WATER-BACKED APPLICATIONS

(a) Manual welding of reinforcing sleeves on water-backed piping shall use the SMAW process and low-hydrogen electrodes.[3]

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

[3] Testing has shown that piping with areas of wall thickness less than the diameter of the electrode may burn through during welding on water-backed piping.

FIG. 4 BULGE TO ACCOMMODATE GIRTH WELD

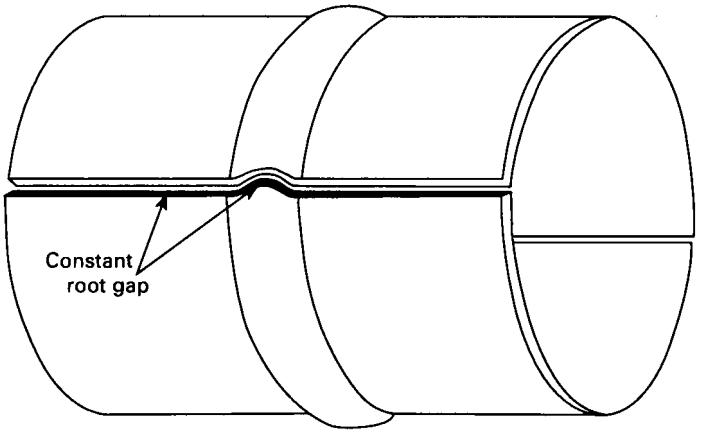
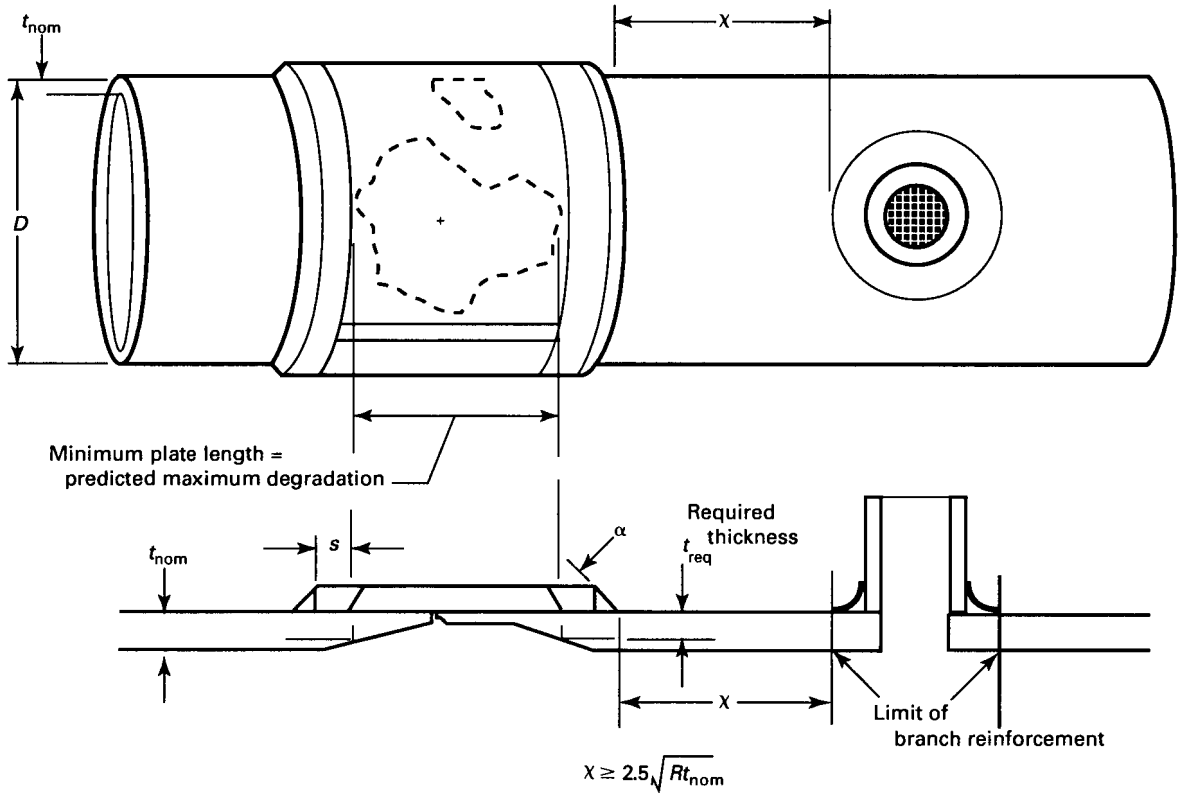


FIG. 5 DESIGN DETAILS — TYPE B FULL-STRUCTURAL SLEEVES



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

5 INSTALLATION

(a) The circumference of the base material in the area to be welded or to provide backing for welding shall be cleaned to bare metal. The entire area shall be cleaned, if required for application of hardenable filler.

(b) The sleeve shall be fitted tightly around the pipe. Preheating the sleeve to achieve a shrink fit, or use of mechanical or hydraulic clamping, draw bolts, or other devices may be used to ensure fit.

(c) If hardenable filler is used, it may be applied prior to sleeve installation or pumped into the annulus between the sleeve and base metal after the sleeve is in place. If pumped into the annulus, provisions shall be made to prevent over-pressurization and intrusion of the hardenable filler into the system.

(d) Means shall be provided to isolate or divert leakage to eliminate moisture during welding. If welding is performed on a wet surface, the maximum permitted life of the reinforcing sleeve shall be the time until the next refueling outage.

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

(f) Fillet weld leg length shall be increased by the amount of fit-up gap. Care shall be exercised to avoid sharp discontinuities that could cause stress risers at the toes of fillet welds or tapered edges of partial-penetration attachment welds.

(g) Provision for venting during the final closure weld or pressure testing shall be made if necessary.

(h) The surfaces of all welds 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) All welds 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 examined ultrasonically to verify and record baseline wall thickness.

(c) Longitudinal seam welds in the sleeve shall be ultrasonically or radiographically examined in accordance with the Construction Code or Section III if longitudinal seam welds in the piping require volumetric examination. If the design does not permit a joint efficiency of 0.8, Class 3 longitudinal seam welds may be examined in accordance with 6(d), in lieu of volumetric examination.

(d) Partial-penetration attachment welds (Fig. 2) shall be volumetrically examined when full-penetration girth welds in the carrier piping are required by the Construction Code to be volumetrically examined. Where configuration does not permit meaningful volumetric examination, and for Class 3 longitudinal seam welds requiring volumetric examination [see 6(c)], the first layer, each ½ in. thickness of weld deposit, and final surface shall be examined in accordance with 6(a), in lieu of volumetric examination.

(e) When 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 service life of the reinforcing sleeve, 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-5300, ND-5300). Any volume of the piping beneath the reinforcing sleeve that is taken credit for in the design shall satisfy the volumetric acceptance criteria of NC-5320 and ND-5320 or NC-5330 and 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 EXAMINATION

(a) Preservice and inservice examination of Type B full-structural reinforcing sleeve welds shall be performed in accordance with IWC-2000, IWD-2000, as required. [See 1(e).]

(b) The Owner shall prepare a plan for thickness monitoring of full-structural reinforcing sleeves and their attachment welds, using ultrasonic or direct thickness measurement, to verify that minimum design thicknesses as required by the Construction Code or Section III are not violated in the sleeve or at the attachment welds including the underlying base metal over the life of the reinforcement. The frequency and method of monitoring shall be determined based on an evaluation of the degradation mechanism. Monitoring activities shall be performed during the first two refueling outages after installation, and at least every fourth refueling outage thereafter.

(c) If the cause of the degradation is not determined, the maximum permitted service life of any reinforcing sleeve shall be the time until the next refueling outage.