Case N-786-3
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 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 wall thinning from localized erosion, corrosion, and cavitation or pitting?

**Reply:** It is the opinion of the Committee that, in lieu of IWA-4400,¹ 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 wall thinning from localized erosion, corrosion, and cavitation or pitting (collectively referred to herein as corrosion) 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.

(f) This Case may not be applied to pumps, valves, expansion joints, vessels, heat exchangers, tubing, flanges, socket welded or threaded joints, or branch connection welds.

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, including at least 0.75√Řnom of base metal beyond the toe of partial penetration attachment welds, 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. Surrounding areas showing signs of degradation shall be identified and included in the Owner's plan for thickness-monitoring inspections of full-structural reinforcing sleeves [see 8(c)]. 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 Figure 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

---

¹ The references to Section XI in this Case refer to the 2015 Edition. For use of this Case with other Editions and Addenda, refer to the Guide-line for Cross-Referencing Section XI Cases, Table 1.
Case N-786-2
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 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 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 wall thinning from localized erosion, corrosion, and cavitation or pitting (collectively referred to herein as corrosion) 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 in-service inspection.

3 DESIGN

3.1 Types of Reinforcing Sleeves.

(a) Type A reinforcing sleeves as shown in Figure 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

---

1 The references to Section XI in this Case refer to the 2015 Edition. For use of this Case with other Editions and Addenda, refer to the Guideline for Cross-Referencing Section XI Cases, Table 1.

The Committee's function is to establish rules of safety, relating only to pressure integrity, governing the construction of boilers, pressure vessels, transport tanks and nuclear components, and in-service inspection for pressure integrity of nuclear components and transport tanks, and to interpret these rules when questions arise regarding their intent. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks and nuclear components, and the in-service inspection of nuclear components and transport tanks. The user of the Code should refer to other pertinent codes, standards, laws, regulations or other relevant documents.

1 (N-786-2) NC - SUPP. 2