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Standard Specification for Design and Fabrication of Flue Gas Desulfurization System Components for Protective Lining Application[1]

This standard is issued under the fixed designation D4618; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Editorial changes were made throughout in October 2010.

1. Scope

1.1 This specification covers the design and fabrication of metal components for flue gas desulfurization (FGD) equipment, including absorbers, tanks, chimney liners, ductwork and associated equipment that are to be lined for corrosion or abrasion resistance, or both.

1.2 *Limitations:*

1.2.1 This specification is intended only to define the design considerations for successful application and performance of protective linings for FGD system components.

1.2.2 It does not cover structural performance of FGD components.

1.2.3 It does not cover use of metallic linings.

1.3 This specification represents the minimum requirements for lining work. In cases in which the manufacturer's instructions and recommendations differ from this specification, these differences shall be resolved before fabrication is started.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Design/Engineering Requirements

2.1 *Rigidity:*

2.1.1 The components shall be designed so that the interior metal surfaces are sufficiently rigid for the intended lining materials. Manufacturer's recommendations for maximum strains or deflection limits for the lining material shall be followed.

2.1.2 The weight of the lining system shall be considered in the structural design of the component.

2.1.3 The design shall consider the effects of pressure, wind, seismic and other design loads.

2.1.4 Vibration may cause flexing or high surface strains on the lining. This is of particular concern to rigid lining materials and shall be minimized.

2.1.5 Special consideration shall be given to all conditions of potentially excessive strain such as unsupported bottom areas, oil-canning, out of roundness, sidewall-to-bottom joints, and so forth.

2.1.5.1 Where a component is on a concrete foundation, grouting shall be done if necessary to correct unsupported bottom areas.

2.1.5.2 Sand fill shall not be used for bottom support unless provisions are made to ensure that the sand cannot be lost as a result of erosion.

2.2 *Accessibility:*

2.2.1 All interior surfaces of the components shall be designed to be readily accessible for welding, grinding, surface preparation, and lining application.

2.2.2 The minimum manway size for a working entrance during lining application shall be 36 in. (900 mm) in diameter or 24 in. (600 mm) width by 36 in. (900 mm) height.

2.2.2.1 Closed components shall have a minimum of two manways, one near the top and one near the bottom, preferably located 180° apart to facilitate adequate ventilation for workers.

2.2.2.2 Additional or larger openings may be required to facilitate ventilation and material handling. The lining material applicator should be consulted for specific requirements.

2.3 *Shell Penetrations:*

2.3.1 Openings such as, inlets, manholes, and outlet nozzles shall be flush with the interior wall.

2.3.1.1 Inlet nozzles may extend into vessels if incoming fluids will be detrimental to lining materials.

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2.3.2 Any exterior or interior connection shall be flanged to facilitate lining.

2.3.3 The maximum length of flanged nozzles, 4 in. (100 mm) and greater in diameter, shall not exceed the dimensions in Table 1.

2.3.3.1 Only 4 in. (100 mm) diameter and larger nozzles shall be used for maximum reliability of the lining system.

2.3.3.2 As an alternative to lined nozzles, compatible prefabricated, reinforced plastic, ceramic or alloy metal inserts (sleeves) may be used if they offer superior corrosion and abrasion protection. Lining shall overlap onto prefabricated liners.

2.3.3.3 If an insert is used as an alternate, the lining shall overlap unto the insert or some other means of ensuring an adequate seal should be provided.

2.3.4 Lining thickness may dictate changes in nozzle dimensions to achieve design flow rates.

2.4 *Appurtenances inside Components:*

2.4.1 The requirements in Sections 2 and 3 apply to any appurtenances that are being lined and installed inside a lined component, such as agitators, anti-swirl baffles, gauging devices, internal piping, ladders, and support brackets.

2.4.2 If appurtenances inside the component cannot be lined, they shall be made of corrosion-resistant materials. If alloys are used, the lining shall carry over the welded area onto the alloy a minimum of 3 in. (76 mm). Some linings may require special designs to protect the edge of the lining. If bolted connections are used, dielectric insulation shall be provided.

2.4.3 Heating elements shall be attached with a minimum clearance of 6 in. (150 mm) from the surface of the lined component. Greater clearance may be required to protect the lining from excessive temperature conditions depending on the temperature of the element.

2.4.4 Special precautions shall be taken in lined components where severe abrasion/impingement damage may occur. Precautionary design measures, such as wear plates, brick liners or added coating thickness, shall be considered when necessary.

2.5 *Structural Reinforcement Members and Supports:*

2.5.1 Structural reinforcement members (stiffeners) should be installed on the vessel exterior wherever necessary. However, if such members are installed internally they shall be fabricated of simple closed shapes such as round bars, pipe, or box beams for ease of applying the lining material.

2.5.2 The use of box beams or pipe for internal supports is recommended. The use of angles, channels, I-beams and other complex shapes shall be avoided wherever possible. If they must be installed internally, these members shall be fully seal welded and the edges ground to a ⅛ in. (3 mm) minimum radius.

2.5.3 If closed chambers are formed with internal box beams or pipes, they shall be vented to the vessel exterior at the lowest point, so that pressures are not developed during operation and possible curing procedures and so that corrosion, caused by localized lining failures, can be observed early.

TABLE 1 Maximum Length of Nozzles

Nominal Nozzle Size, in. (mm)	Maximum Nozzle Length—Shell to Face of Flange, in. (mm)
4 (100)	8 (200)
6 (150)	12 (300)
8–24 (200–600)	16 (400)
26–36 (600–900)	24 (600)
Over 36 (900)	any length

3. Fabrication

3.1 *Welds:*

3.1.1 All internal welds to be lined shall be continuous without imperfections such as weld slag, weld spatter, rough surfaces, undercutting, high peaks, porosity, sharp corners, sharp edges, and inadequate thickness. Imperfections shall be corrected (see Fig. 1).

3.1.2 The degree of weld preparation before lining depends on the type of lining to be applied. The lining manufacturer shall be consulted for specific requirements for weld preparation during the design of the component and before start of fabrication.

3.1.3 Use of weld display samples before and after grinding may be of help to the component fabricator in supplying

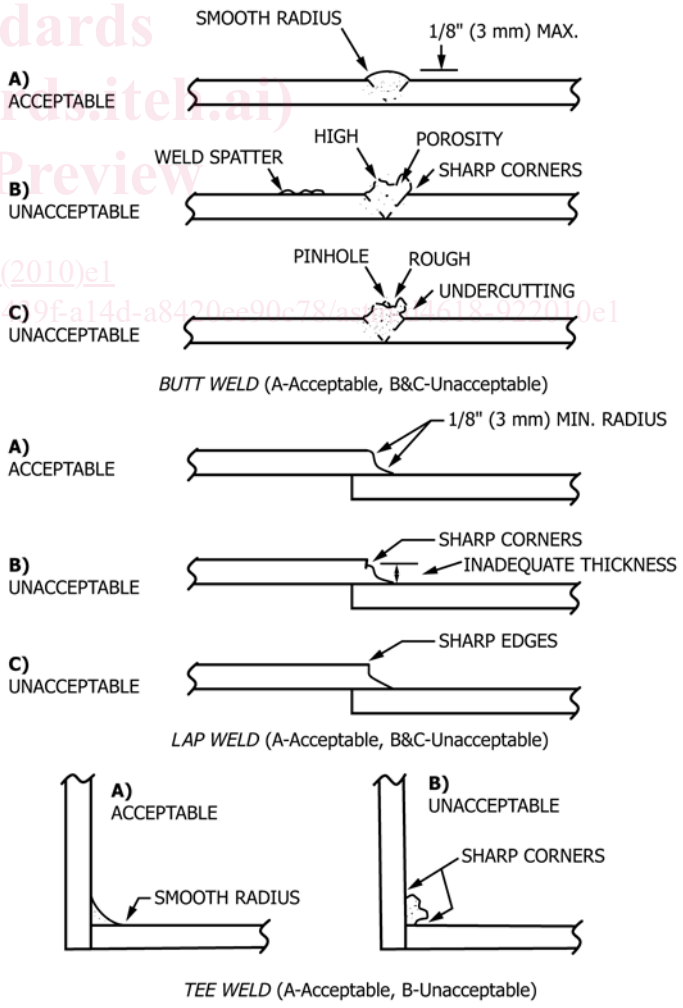

FIG. 1 Weld Fabrication for Lining Application