



Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies¹

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1. Scope

1.1 Steel assemblies and subassemblies fabricated by welding, such as composite structural members, sash, weldments, etc., that are to be hot-dip galvanized after fabrication, are subject to warpage and distortion of the material due to the heating and cooling incidental to the galvanizing operation, particularly when it is necessary for the assembly to be dipped more than once to cover the entire surface.

1.2 This specification is applicable in either inch pounds or SI units. Inch pounds and SI units are not necessarily exact equivalents. Within the text of this specification and where appropriate, SI units are shown in parentheses.

2. Referenced Documents

2.1 ASTM Standards:

A 143 Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement²

A 385 Practice for Providing High-Quality Zinc Coatings (Hot-Dip)²

3. Factors in Warpage and Distortion

3.1 One of the most commonly distorted and warped members of assemblies is that of sheets or plates from No. 20 gage [0.812 mm] to ¼ in. [6.35 mm] in thickness which are assembled by welding or riveting to bar-size shapes, angles, channels, tees, etc.

3.2 Warpage is accentuated by the use of nonsymmetrical sections such as channels. In nearly every case, regardless of size, channels require straightening after galvanizing. This is not true of an I-beam, pipe, H-column, or any other section that is symmetrical about both its major axes. Channels and other nonsymmetrical sections should be avoided for the framework of a sheet metal assembly that is to be hot-dip galvanized whenever it is possible to use symmetrical shapes or sections.

3.3 The use of wide radii bends in corners is recommended. In the case of sheet metal, the product which has a right-angle bend in the sheet metal itself will remain flatter and be freer from distortion if the radius of the bend is as large as practicable.

3.4 Certain welding practices, weld sizes and configurations, and thickness differences between welded components can introduce imbalanced stresses into the weldments. If these stresses are combined with other stresses during hot-dip galvanizing, the stress relieving effect of galvanizing may permit distortion to occur.

3.5 When two pieces of steel are seal welded in an overlapping joint, the overlapping section must be properly vented per Practice A 385. If the overlapped area is not properly vented or if it is incorrectly sealed, the pressure from the expansion of the trapped gases in the overlapped area can distort the two pieces of steel that are welded together and, in the worst case, can cause an explosion underneath the zinc bath surface destroying the parts and causing a potential safety problem at the hot-dip galvanizing facility.

4. Suggested Corrections for Panel Fabrication

4.1 The angles selected should be in as perfect alignment as it is practical to obtain.

4.2 The angles should be placed in position without clamping or pulling prior to welding so that the corners of abutting edges will lie in position without restraint. Clamps may be applied to prevent shifting or movement during the welding operation.

4.3 The stiffening angles should be placed in position and held down to prevent their being moved when in contact with the electrode during the welding operation. In welding any intermediate lengths along one side of a common member, care should be taken to prevent warpage of the common member due to the application of high heat on the same side at various intervals along its length.

4.4 All edges of tightly contacting surfaces should be completely sealed by welding unless the area exceeds the recommended size detailed in Practice A 385. This will prevent the rusting of the surfaces that are so connected that molten zinc cannot circulate through the crevices to galvanize the contacting surfaces.

4.5 The sheet steel should not be welded to the angle steel

¹ This practice is under the jurisdiction of ASTM Committee A05 on Metallic Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.13 on Structural Shapes and Hardware Specifications.

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² *Annual Book of ASTM Standards*, Vol 01.06.