Item 445

30. Galvanizing

1. DESCRIPTION

Galvanize or repair galvanizing on metal items.

2. MATERIALS

Provide galvanized metal items that meet the standards in Table 1.

Table 1

Galvanizing Standards

Item	Standard
Fabricated items, rolled, pressed, or forged steel shapes, plates, pipes, tubular items, and bars	ASTM A123
Steel or iron castings	ASTM A153, Class A
Bolts, nuts, screws, washers, and other miscellaneous hardware	ASTM A153, Class C or D or ASTM B695, Class 50
Miscellaneous fasteners	ASTM B633, Class Fe/Zn 8
Rail Elements for metal beam guard fence or bridge railing	AASHTO M 180
Permanent metal deck forms, supporting angles, and incidental items	ASTM A653, Coating Designation G165

3. CONSTRUCTION

3.1. **General**. Provide for proper filling, venting, and draining during cleaning and galvanizing if fabricated members or assemblies are required to be hot-dip galvanized. Provide drain holes or slots as required, except where prohibited by the Design Documents. Provide a surface finish on the thermal-cut surfaces when thermal cutting drain holes or slots in accordance with AWS D1.1 requirements for base metal preparation. Drain to the small end of the section if assembling tapered members using slip-joint splices. Ensure cleaning and galvanizing does not produce hydrogen embrittlement.

Remove weld flux, weld slag, and any other weld residue or impurities before galvanizing. Before galvanizing material 1/4 in. or greater in thickness:

- remove all sharp burrs and
- chamfer to approximately 1/16 in. all edges.

3.2. **Painting Galvanized Materials**. Provide a paint system if painting is specified on galvanized materials in accordance with DMS-8102 “Paint Systems for Galvanized Steel.” Follow all manufacturer instructions for surface preparation and application including the following:

3.2.1. **Surface Preparation**. Do not water-quench or chromate-quench galvanized surfaces to be painted. Prepare the surface in accordance with ASTM D6386. Apply coating within 12 hr. of cleaning. Re-clean the surface if more than 12 hr. elapse before initial painting.

3.2.2. **Coating Application**. Ensure the coating is smooth, even, continuous, and free of drips, runs, sags, holidays, wrinkles, or other coating defects. Ensure the coating has a uniform appearance within all portions of the painted piece and all related pieces and components of a project. Ensure all repairs are smooth, even, and visually match the remainder of the coated piece by use of feathering and other appropriate techniques to avoid sharp transitions.

3.3. **Galvanizing Weldments**. If problems develop during galvanizing of welded material, TxDOT may require a compatibility test of the combined galvanizing and welding procedures in accordance with Section 441.3.2.6., "Testing of Galvanized Weldments," and may require modification of one or both of the galvanizing and welding procedures.

3.4. **Workmanship**.

3.4.1. **Coverage**. Bare spots no more than 1/8 in. across are acceptable unless numerous. Repair larger bare spots in accordance with Section 445.3.5., "Repairs." Local runs or drips of zinc coating are acceptable unless they interfere with the intended use of the product. Carefully remove plainly visible excessive zinc accumulations.

3.4.2. **Adhesion**. Tap the coated area with a small hammer to test coating adhesion. The coating is acceptable if it is not brittle and does not scale or flake.

3.4.3. **Appearance**. Fabricate poles in accordance with this Item and the Design Documents. Alternate designs are not permitted.

3.4.3.1. **White Rust**. A white powdery residue indicates moisture. Remove heavy layers of white rust that have caused the coating to pit. Light coatings may remain. Remove white rust from articles that will be in direct contact with soil.

3.4.3.2. **Red Rust**. Red rust on galvanized items indicates uncoated areas. See Section 445.3.4.1., "Coverage," for acceptance criteria.

3.4.3.3. **Alligator Cracking or Spider Webbing**. The composition of the base metal may cause dark lines resembling alligator skin. (See Section 445.3.4.2., "Adhesion," to determine whether the coating is acceptable.)

3.4.3.4. **Dull Gray Coating**. The composition of the base metal can cause a dull gray color. (See Section 445.3.4.2., "Adhesion," to determine whether the coating is acceptable).

3.4.4. **Coating Thickness**. Galvanize to the thickness specified. Use Tex-728-I to determine coating thickness.

3.5. **Repairs**. Use zinc-based solders, sprayed zinc, or zinc-rich paints for repairs in accordance with this Section.

3.5.1. **Materials**.

3.5.1.1. **Zinc-Based Solders**. Solders used in rod form or as powders:

zinc-tin-lead alloys with liquidus temperatures in the range of 446°F to 500°F or
zinc-cadmium alloys with liquidus temperatures in the range of 518°F to 527°F.

3.5.1.2. **Sprayed Zinc (Metallizing)**. Zinc coating applied by spraying with droplets of molten metal using wire, ribbon, or powder processes.

3.5.1.3. **Organic Zinc-Rich Paints**. Zinc-rich paints based on organic binders that meet the requirements of DMS-8103, "Galvanizing Repair Paint." TxDOT maintains a list of approved repair paints for galvanized coatings.

3.5.2. **Repair Processes**.

3.5.2.1. **Zinc-Based Solders**. Remove moisture, oil, grease, dirt, corrosion products, and welding slag or flux from surfaces to be repaired. Clean surface to white metal by wire-brushing, light grinding, or mild blasting extending into the surrounding undamaged galvanized coating. Preheat cleaned areas to at least 600°F, but not more than 750°F. Wire-brush while heating and evenly distribute a layer of zinc solder. Flush the repaired area with water or wipe with a damp cloth to remove flux residue when repair is completed.

3.5.2.2. **Sprayed Zinc (Metallizing)**. Remove oil, grease, corrosion products, and any welding slag or flux from surfaces to be repaired, and ensure the surfaces are dry. Clean surface to white metal by wire-brushing, light grinding, or mild blasting extending into the surrounding undamaged galvanized coating. Apply coating by metal-spraying pistols fed with either zinc wire, ribbon, or powder. Provide a coating that is uniform and free of lumps, coarse areas, or loose particles.

3.5.2.3. **Organic Zinc-Rich Paints**. Remove oil, grease, corrosion products, and welding slag or flux from surfaces to be repaired, and ensure the surfaces are clean and dry. Clean surface to near-white metal by wire- brushing, light grinding, or mild blasting extending into the surrounding undamaged coating to provide a smooth repair. Spray or brush-apply the paint to the prepared area in accordance with the paint manufacturer's instructions to attain the required dry-film thickness. Provide multiple passes when using spray application.

3.6. **Repair Coating Thickness**. Measure thickness in the repaired area using Tex-728-I after completing repair and cooling or curing. The minimum thickness required is the same as that required for the specified galvanizing. However, if the repair uses zinc-rich paints, the minimum coating thickness is 50% higher than the specified galvanizing thickness but not greater than 4.0 mils.