

# DR. GASK GALV

## I JUST DISCOVERED A SMALL, BARE SPOT ON AN I-BEAM. HOW LARGE A BARE SURFACE AREA CAN I REPAIR? WHAT ARE SOME OF THE ADVANTAGES AND DISADVANTAGES OF THE DIFFERENT REPAIR METHODS DESCRIBED IN ASTM A 780?

Occasionally, the galvanized coating can have small bare spots or other minor imperfections. Galvanized steel can also be damaged in the field as a result of mishandling during shipping or from post-galvanizing operations. Regardless of how the coating is damaged, repairs of those areas are necessary. The size of the bare area will determine whether the material can be touched-up or must be re-galvanized. According to ASTM A 123, there are limitations on the size and total area of bare spots that can be touched-up and repaired using ASTM A 780 methods.

In ASTM A 123, paragraph 6.2.1 limits any single area to "1 inch (25 mm) or less in its narrowest dimension." This seems like a strange limit but the intent is to allow repair of long, thin bare areas that could be two pieces sticking together and not large square or round bare patches from poor cleaning techniques. Paragraph 6.2.2 limits the total area subject to renovation on a part to "1/2 of 1% of the surface area to be coated on that article, or 36 in<sup>2</sup> (22,500 mm<sup>2</sup>) per ton of piece weight, whichever is less."

ASTM A 780 discusses three different methods of repairing damaged or uncoated areas. The three methods are zinc-based solders made specifically for the purpose of repairing, zinc-rich paint, and sprayed zinc (metallizing). In determining the method to use in repairing the galvanized coating, several factors should be considered.

- ◆ Ease of application of product (repair method)
- ◆ Thickness control
- ◆ Corrosion resistance
- ◆ Abrasion resistance
- ◆ Adherence to the steel
- ◆ Appearance next to the galvanized steel

### *Zinc-Based Solders*

There are several different types of zinc-based solders on the market that are made specifically to cover bare areas on parts that have been hot-dip galvanized. The process of applying zinc-based solders involves cleaning the surface to be coated and preheating to at least 600 F (315 C), being careful not to overheat the surface or burn the surrounding galvanized coating. The zinc-based solder is then melted onto the bare area by rubbing it along the cleaned, preheated area. After the solder solidifies, the result is an even layer of zinc alloy. If flux is used, the

flux residue must be removed after the repair is completed. According to ASTM A 123 the repaired area should meet the same minimum thickness requirement as the remainder of the part.

Zinc-based solders provide adequate barrier and sacrificial protection against corrosion. The adhesion of the zinc-based solder coating to the base steel is very good. The coating color left on the surface of the steel is also comparable to the galvanized coating. A disadvantage is the difficulty in applying the zinc-based solder. The effectiveness of the zinc-based solder is dependent on the ability of the applicator to uniformly heat the affected area to a suitable temperature without oxidizing the base steel.

Another disadvantage is applying the coating to the desired thickness. The coating can be thin and can lead to decreased abrasion resistance. The last disadvantage is in the surface area that can be repaired. Using zinc-based solders for repair is limited by the size and geometry of the exposed steel area.

### *Zinc-Rich Paints*

Zinc-rich paints are based on organic binders, pre-mixed and formulated specifically for use on steel surfaces. The zinc-rich paint can contain no less than 65% zinc dust by weight in the dried film, according to ASTM A 780. The corrosion resistance and service performance of paint systems are dependent on the extent of surface preparation and the skills of the individual applicators. The surface of the steel should be clean, dry, and free of oil, grease, and preexisting paint or corrosion by-products. The paint should be applied in accordance with the manufacturer's recommendations and the paint should be allowed adequate time to cure between applications.

Zinc-rich paints have the advantage over the other two methods for being the easiest to apply. The size and geometry of the exposed steel that needs to be treated do not limit zinc-rich paint applications. The adhesion of the zinc-rich paint to the bare steel is good; however, some paint films have a tendency to flake when impacted, particularly where very thick coatings have been applied. Zinc-rich paints provide good barrier protection but low sacrificial protection to corrosion. There are several disadvantages to using zinc-rich paints. This method often forms a coating that does not have good abrasion resistance. Zinc-rich paints also need relatively thick coatings to provide satisfactory protection from damage and corrosion. Coatings of adequate thickness (50% greater than the minimum thickness for the rest of the galvanized article, per ASTM A 123) are usually produced by applying several layers of zinc-rich paint. The color of the zinc-rich paint often does not match the galvanized steel.

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This can be remedied by top-coating the touched-up area with aluminum paint for matching newly galvanized steel.

## *Zinc Metallizing*

Zinc metallizing involves spraying zinc on the surface to be repaired with droplets of molten metal, using wire, ribbon or powder processes. The surface area should be clean, dry, and free of oil, grease and corrosion products. The sprayed zinc coating should be applied as soon as possible after surface preparation and before visible deterioration of the surface has occurred. The surface of the sprayed zinc coating should be of uniform texture, free of lumps, coarse areas and loosely adherent particles.

Zinc metallizing provides the best overall performance as a touch-up and repair product. However, this method also has its advantages and disadvantages. The biggest advantage is that zinc metallizing provides excellent barrier and sacrificial protection. Zinc metallizing also has great adhesion to the bare steel. Zinc metallizing has the highest abrasion resistance of the three repair procedures, although it is still less than half that of a hot-dip galvanized coating. This method is the best match to the overall performance of the hot-dip galvanized coating. The biggest disadvantage is that special equipment is needed to spray the metallic zinc, and additional in-plant ventilation is needed to handle zinc fumes generated during spraying. This equipment would be difficult to transport for field repair.

Choosing the type of touch-up and repair method is dependent upon which advantages are the most important. The following table summarizes the information discussed about the three different methods.

Method	Advantages	Disadvantages
c-Based Solder	<ul style="list-style-type: none"> <li>♦ Barrier &amp; sacrificial protection</li> <li>♦ Good adhesion</li> <li>♦ Best color match to galvanized steel</li> </ul>	<ul style="list-style-type: none"> <li>♦ Difficulty in application</li> <li>♦ Low abrasion resistance</li> <li>♦ Thin coatings tend to be produced</li> <li>♦ Thick coatings are needed to satisfy ASTM A 123</li> </ul>
c-Rich Paint	<ul style="list-style-type: none"> <li>♦ Easy to apply</li> <li>♦ Barrier protection</li> <li>♦ No limit in coverage area</li> <li>♦ Good adhesion at times</li> </ul>	<ul style="list-style-type: none"> <li>♦ Limited sacrificial protection</li> <li>♦ Low abrasion resistance</li> <li>♦ Tend to flake with thick coatings</li> <li>♦ Need thick coatings to satisfy ASTM A 123</li> <li>♦ Color does not match</li> </ul>
c Metallizing	<ul style="list-style-type: none"> <li>♦ Barrier &amp; sacrificial protection (best overall)</li> <li>♦ Good adhesion</li> <li>♦ Good abrasion resistance</li> <li>♦ No limit in coverage area</li> </ul>	<ul style="list-style-type: none"> <li>♦ Extensive equipment needed in application</li> </ul>

