Hot Dip Galvanizing Data Sheet GA

2.11 Threaded Fasteners

1. General

The terms 'spin galvanizing' or 'centrifuge galvanizing' are often used to describe the process for hot dipping threaded components and other small parts. The procedure is to immerse them into the molten zinc in a perforated basket which, after the coating has formed, is centrifuged at high speed so that the spinning action throws off the surplus zinc and ensures a clean profile.

The galvanized coating

Small components can be hot dip galvanized at conventional temperatures (approx. 450 – 460°C) or in ceramic lined galvanizing baths at higher temperatures (approx. 530 – 560°C) (fig. 1). When the articles are immersed in the galvanizing bath at conventional temperatures a series of zinc-iron alloy layers is formed with a metallurgical bond to the steel surface. These alloys are harder than mild steel and are covered by an outer layer of comparatively soft zinc which remains after the spinning operation. This structure is unique and gives the galvanized coating very good resistance to rough treatment – direct blows are cushioned by the outer layer of zinc and the hard alloy layers resist abrasion. The higher temperature galvanized coating consists entirely of zinc-iron alloy.

2. Standards and thicknesses

As a general rule, bolts down to 8 mm diameter can be galvanized and a wide range of threaded components can now be processed using special equipment (fig. 2).

For ISO metric fasteners, the galvanizing of one thread either internal or external requires an extra clearance of four times the coating thickness. For BSW and BSF threads the extra clearance needed is 4.33 times the coating thickness. In practice, it is normal for standard bolts from stock to be fully galvanized but for nuts to be galvanized as blanks and then tapped up to 0.4 mm oversize with the threads then lightly oiled. When assembled, the nut thread is protected by contact with the coating on the bolt. Even after many years of service, galvanized nuts can readily be unfastened even though the threads have never been galvanized. Further details of the dimensions, processing and performance of hot dip galvanized nuts and bolts is available from Galvanizers Association or your national Association.

The relevant British Standards for the protective coatings on threaded fasteners have been listed below. One difficulty arises because electroplating is often known – misleadingly – as electrogalvanizing. It is not, therefore, enough merely to specify 'galvanizing' if a long life is required. The specification should clearly state 'hot dip galvanized to British Standard 729' and the addition of a clause 'to be gal-

Fig. 1 : An automatic hot dip galvanizing plant for small components.

Fig. 2 : Galvanized fasteners for bolted connections.

British Standards for protective coatings on threaded fasteners

Cadmium plated	BS3382: Part 1	(over 12 mm diameter)	7.5 µm
Zinc plated	BS3382: Part 2	(over 12mm diameter)	7.5 µm
Sherardized	BS4921: Class 1		30 µm
	Class 2		15 µm
Galvanized	BS729: 1971 (1986)		43 µm

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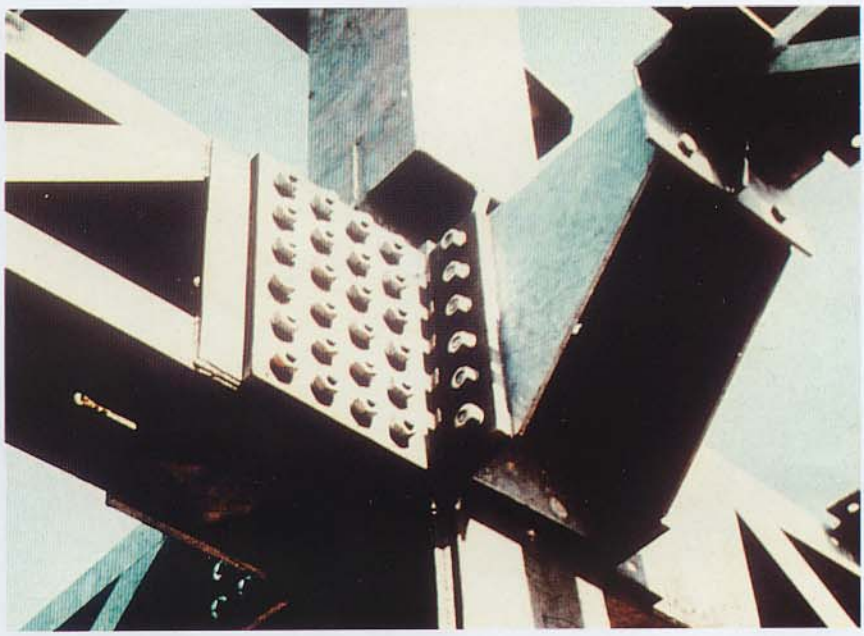

Fig. 3 : Hot dip galvanized high strength bolts in a bridge structure.

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3. Hot dip galvanized high strength bolts

General grade high strength bolts (ISO grade 8.8) to BS 4395: Part 1, (equivalent to ASTM A235) can be galvanized without difficulty but some authorities do not recommend galvanizing for ISO grade 10.9 (BS 4395: Part 2 or ASTM A490) but these are galvanized in the UK, Japan, Italy and France and are permitted in the German Standard DIN267. In North America, however, galvanizing is not recommended for the equivalent ASTM A490 bolts.

4. Friction grip connections

Hot dip galvanized nuts and bolts for high strength friction grip joints are used in a wide range of steel structures (fig. 3). Initially, the coefficient of friction between galvanized contact surfaces is low – an average of about 0.19. As slip commences, however, friction rapidly builds up and 'lock-up' occurs due to cold welding between the coated surfaces. If a small amount of slip can be tolerated it is therefore unnecessary to treat the surfaces but, if all slip must be avoided, the coefficient of friction can be raised by roughening the surface of the galvanized coating. Wire brushing will raise it to 0.35 and a figure of 0.5 can be achieved by a light grit blasting or by roughening with a pneumatic chisel hammer or needle gun. In the United States, galvanizing is one of the few coatings permitted on the contact surfaces in the specification for friction grip joints. This is approved by the Research Council for Riveted and Bolted Structural Joints of the Engineering Foundation.

The 'lock-up' effect described above can cause galling in the threads of galvanized fasteners used in friction grip connections and lubrication may be required in order that the required clamping force is developed. Beeswax has been found to be a most effective lubricant and molybdenum disulphide has also been specified for this purpose.

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