

## 1.3 Hot Dip Galvanizing of small Components

### Process

In principle small components can be hot dip galvanized using the process which is employed for galvanizing individual steel fabrications (see worksheet 1.2). However, it is difficult to handle small components in this type of operation and acceptable quality and finish is difficult to achieve. For this reason small components are hot dip galvanized in a variant of the standard galvanizing process. Consistent quality and coating thickness is achieved by centrifuging baskets of small components such as screws, nails, nuts and bolts after galvanizing (figure 1).

### Parameters of the process

Although the basic features of the hot dip galvanizing process for small components are the same as for larger components other operating parameters may be changed to achieve a consistent result. For example, small components will sometimes be galvanized at a higher temperature than is the case for larger individual parts. Galvanizing temperature may exceed 560 °C rather than 450 °C. Small components are centrifuged immediately after hot dip galvanizing to remove superfluous zinc and improve the uniform distribution of the zinc coating. It is usually necessary to cool the basket of components in a water bath following centrifuging to prevent the individual components sticking together. The most suitable temperature for the galvanizing bath or the requirements for centrifuging depend on the material or products being galvanized. The capacity of the centrifuge usually dictates the maximum size and weight of small parts to be treated and galvanizers will sometimes wish to discuss these aspects with their customers. Where the temperature of the zinc in the galvanizing bath is at the higher end of the range the steel bath normally used for containing the molten zinc is unsuitable and it is necessary to construct the galvanizing bath with a ceramic lining.

### What is meant by small components?

British Standard BS 729 also applies to hot dip galvanizing of small components with the exception of mechanical fasteners such as screws and nuts. British and other European Standards do not usually define the precise meaning of a small component but in practice "small components" is generally synonymous with centrifuged articles. British Standard 729 requires the zinc coating to be of a minimum average coating weight of 305 gm<sup>-2</sup> i.e. equivalent thickness of 43 microns on small components.

Small components must be manufactured from materials which are suitable for galvanizing (see worksheet 2.2) and their design must lend itself to the hot dip galvanizing process. It is also necessary to remember that the com-

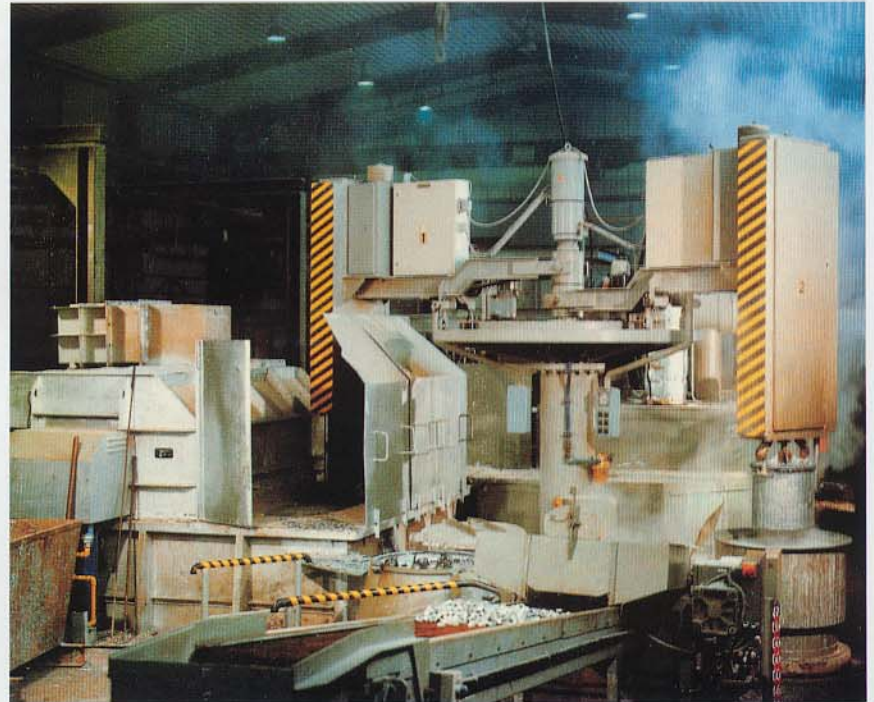


Fig. 1: Automated hot dip galvanizing plant for small parts (centrifuge or spin galvanizing).

ponents will be centrifuged after galvanizing and to make allowance for it. For example, centrifuging caps, tube bends and components with indentations may be difficult and in some circumstances impossible because the zinc will not be removed satisfactorily from hollow or re-entrant areas. Sometimes, parts which have overlapping surfaces may be difficult to process as the action of centrifuging may remove zinc from the joint, whereas it might have been expected that the zinc would totally enclose and seal the joint. However, because the surfaces are entirely coated with zinc there is no danger of corrosion at these points.

### Appearance and surface quality

The action of centrifuging removes almost all of the pure zinc layer which is coated on top of the alloy layers and so small components which have been centrifuged usually have thinner coatings than components which have been hot dip galvanized and not centrifuged. As a result, the zinc coating on components which have been centrifuged does not have the shiny silver appearance which is familiar in components which have been individually galvanized. The surface of the zinc coating on small components tends to be light

to dark grey in appearance. The difference in appearance is entirely aesthetic and does not in any way affect the quality of corrosion protection afforded by hot dip galvanizing. The appearance of the zinc coating is primarily dependant on the steel composition and type of component and cannot be changed by the galvanizer. Occasionally, small centrifuged components which have been cold pressed or cold drawn may exhibit some reduction in the extent of adherence of the zinc coating to the steel surface.

### Fasteners

As a general rule, bolts down to M8 threads can readily be galvanized and threaded components up to 4 m long and thread diameters up to 90 mm have been processed. Special arrangements can often be made to galvanize components outside this range.

For hot dip galvanized bolts and nuts, it is normal for standard bolts from stock to be galvanized; the nuts are galvanized as blanks and then tapped up to 0.4 mm oversize with the threads lightly oiled. When assembled the nut thread is protected by contact with the coating on the bolt. Galvanized bolts and nuts can readily be unfastened even after many years of service.

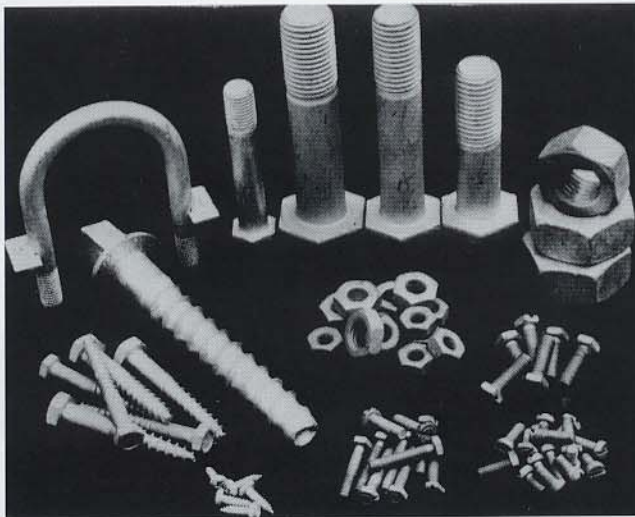
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### High strength friction grip bolts

General grade high strength friction grip bolts to BS 4395: Part 1 or ASTM A235 can be galvanized without difficulty but some authorities do not recommend galvanizing for ISO Grade 10.9 (BS 4395: Part 2, ASTM A490).

On installation galvanized high strength friction grip bolts should be lubricated to prevent galling of the threads. Beeswax and molybdenum disulphide have been found to be useful in this respect.

**Fig. 2: Typical centrifuged small parts.**



**Fig. 3: Hot dip galvanized high strength fasteners used in the structural steelwork of a television transmitter mast.**



### Nails, panel pins, washers and hooks

Numerous types and sizes of hot dip galvanized nails and panel pins are available. It sometimes happens that, despite all precautions, numbers of these very small parts become welded together during the galvanizing process. Customers should agree with the galvanizer the permissible number of pieces stuck together before the work is undertaken.

### Other fabricated small components

Many items of this type can be found and they arise in a wide variety of shapes and sizes. Typical examples might include clamps, hinges, hasps and clips. Here too, the materials used and the design of the component must be suitable for hot dip galvanizing.

### Chains

Chains are commonly centrifuged after hot dip galvanizing in order to ensure a uniform zinc coating and to prevent welding of the individual links. However, the ability of the galvanizer to accept chains may be limited by capacity of the centrifuge and the weight of the chains. Heavy lengthy chains are sometimes too large to be centrifuged and in such circumstances the conventional process must be used.

#### Literature:

- [1] BS 729: 1971 (1986) Hot Dip Galvanizing Coating On Iron & Steel Articles.
- [2] Hot Dip Galvanizing Nuts And Bolts (by Galvanizers Association)
- [3] Galvanizing in Action: Fasteners (by Galvanizers Association)
- [4] Zinc Handbook (by F. C. Porter, pages 224 - 227)

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