

Guide to the Avoidance of Corrosion of Metal Gutter Systems

Introduction

The purpose of this guide is to create an improved awareness of how best to avoid the corrosion of metal gutter drainage systems that are installed in a wide variety of industrial, commercial and historic buildings. These buildings are distributed throughout the UK and therefore their drainage systems are exposed to rural, marine and industrial environments. If the life expectancy of any system is to be achieved then it is important that all those involved with their manufacture, installation and maintenance ensure that best practice is achieved at all times and preferably within the appropriate BS, EN specifications or those recommended by the manufacturer or supplier. In some cases the manufacturers have produced their own recommended model specifications to ensure that product performance is achieved. These model specifications are based on past and present field experience as well as the results of selected R&D investigations that have been carried out over many years.

Materials and Protection

The metals used in the manufacture of drainage systems, i.e. pipes and gutters are aluminium, cast iron, galvanised mild steel, mild steel and stainless steel. All are vulnerable to atmospheric corrosion when used in the unprotected state and therefore must be protected. The type of surface coatings used and recommended by the manufacturer has been selected after consultation with the coating industry. This has ensured that the most appropriate and cost effective protective coating systems are available, for example polyester powder coatings to BS 2997, organic epoxy coatings as well as plastic coatings such as polyvinyl chloride or fluoride, i.e. PVC, PVDF.

However when aluminium and stainless steel are selected for architectural decorative purposes their only protection from corrosion is by chemical treatment. For aluminium and stainless steel this is thickening their natural oxide film by anodising and passivation respectively. Further information on these types of finishes is available from The Aluminium Finishing Association and the Stainless Steel Advisory Service.

For all types of coatings, the surface condition of the substrate is critical in terms of coating performance and durability. Where on-site painting is required it is imperative that any surface preparation is carried out in accordance with BS 7773 Code of Practice for Cleaning and Preparation of Metal Surfaces. Further information on this topic is also available in the DTI publication, Guides to Good Practice in Corrosion Control - Surface Preparation for Coating.

Factors Contributing to Premature Failure.

Early or premature failure of a coating and subsequent corrosion of the substrate is often associated with the following factors: - mechanical damage during the handling, transportation, storage and installation of the gutters and drain pipes. Failure to not repair this damage immediately will result in corrosion problems in the future.

Handling and transportation problems can be avoided by following the guidelines recommended in the technical brochures issued by the manufacturer or adopting some of those outlined in the DTI Guides to Practice in Corrosion Control No`s 3 and 5. Gutter and pipes should be handled with care and loaded on transport vehicles using padded and covered cradles. Preferably all components should be separated by acceptable padding material to keep them separate from each other so that adjacent pipes or gutters do not touch.

Storage at Site

At site components should be stored horizontally and under cover to guard against unnecessary weathering or contamination by soil etc. Handle the pipes and gutters with care since these may have been delivered finished and ready for use, i.e. a polyester powder coating or galvanised, or in other cases they may have been factory coated but require to be finished, i.e. a factory primer as in the case of cast iron, mild steel or an uncoated galvanised surface.

Installation

The installation of these systems should comply and be in accordance with the recommendations outlined in the technical specifications provided by the manufacturer, supplier or the Architect responsible for the project. Some gutters may be used as walkways during and after construction and are therefore likely to be damaged. Best practice demands that the work is inspected by trained and approved personnel and should be regarded as an important part of the job. This ensures that coating damage, poor fixing, and incompatibility of materials is avoided. Fixings will suffer crevice corrosion if not attached correctly, pitting attack will develop where the coating has been damaged and galvanic or bimetallic corrosion will occur when the metals used are incompatible with each other. In particular it is important to ensure compatible screws and fixings are used at all times. Aluminium drainage systems should not be used with copper roofing.

When rainwater from the roof makes contact with an uninsulated aluminium drainage system the risk for galvanic corrosion to occur is high. This is due to the presence of copper ions in the water. Care is also required when drainage systems are in contact with non-metallic materials such as plastics, wood and concrete. These can release corrosive entities resulting in corrosion of the drainage system.

Information and guidelines on how best to avoid some of these problems is provided in the respective technical brochures issued by the industry as well as in BS publication. I.e. PD 6484 1979, Commentary on Corrosion at Bimetallic contacts and its alleviation and the DTI Guides to Good Practice in Corrosion Control - Bimetallic Corrosion, Corrosion of Metals by Wood, Corrosion Control Check List.

Life Expectancy of Drainage Systems.

All drainage systems will be subjected to the effects of rural, industrial, and marine environments. Hence they are subjected to corrosion by direct contact with rainwater

of different degrees of acidity and/or alkalinity and which may also contain other corrosive entities such as dissolved gases, chloride or metallic species such as copper. The Millennium Corrosivity Map for the UK and Ireland 1998-2000 available from the Galvanisers Association, (www.galvanizing.org.uk) is a useful general geographic guide and quotes rates of corrosion for zinc. Rates of corrosion for bare aluminium; zinc and mild steel are also given in a Table on page 4 of the DTI publication entitled Corrosion Control Check List. Meteorological data on geographic rainfall intensity published in the National Annex to EN 12056 when used in combination with the Millennium Corrosion Map should help to establish guidelines on corrosion rates versus rainfall intensity.

The success or failure of stainless steel depends on several factors. This material is vulnerable to atmospheric corrosion when the surface is covered with deposits of dirt, chloride and sulphate. These usually initiate localised pitting corrosion that is difficult to control. Like the other materials of construction it is also vulnerable to crevice and bimetallic corrosion.

Maintenance of Drainage Systems

The long-term performance of drainage systems can only be realised as when they are supported by planned maintenance schemes. Regular cleaning and inspection of the installation to remove build-up of debris irrespective of its source, nature or chemistry must be carried out if the life expectancy is to be achieved. Such schemes provide data, which will assist the end user to identify and confirm the on-set of any deterioration to the protective coating and subsequent corrosion sites. Fixings can be checked to ensure they are secure and polyester powder coated finishes cleaned to remove built up grime and dirt. This is particularly necessary in the case of stainless steel. Detailed maintenance procedures for most drainage systems are available from the respective manufacturers and suppliers.

Reference Standards

An extensive list of National and European Standards are available to the industry, architects and the end user. Most are listed in the reference documents highlighted in the text. Other sources include the technical brochures available from the main manufacturers of drainage equipment.

Training and Education

Training and Continuing Professional Development is a major requirement if Good Practice and Standards are to be achieved and maintained. The Royal Institute of British Architects, and the Construction Industry CPD Certification Service provide CPD seminars. The Institute of Corrosion, Institute of Metal, Mining and Minerals and several other professional organisations provides similar course in Corrosion Education.

Additional Reference Reading and Further Sources of Information.

Additional reference reading.

Materials Optimizer Fulmer Research Institute Slough 1974

Basic Corrosion Technology for Scientists and Engineers. 2nd Edition, Einar Mattson,
Institute of Metals, Mining and Minerals.

Finishing Aluminium - A Guide for Architects.

Further Sources of Information

BSSA
Broomgrove
59 Clarkehouse Road
Sheffield S10 2LE United Kingdom
44 (0)114 267 1260

Paint Research Association
14 Castle Mews
High St
Hampton TW12 2NP
Tel 020 8487 0800 www.pra-world.com

Building Research Advisory Service
Bucknalls Lane
Watford WD25 9XX
Tel 01923 664000 www.bre.co.uk

Galvanizers Association
Wren`s Court
58 Victoria Road
Sutton Coldfield
West Midlands B27 1SY
Tel 0121 355 8838 Fax 0121 355 8727

Aluminium Federation Ltd
National Metalforming Centre
47 Birmingham Rd
West Bromwich
West Midlands B70 6PY
Tel 0121 6016263 www.alfed.org.uk

Lifetime Management of Materials Advisory Service
National Physical Laboratory
Teddington
Middlesex
Tel 020 8943 6142 www.npl.co.uk/lmm

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