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See the BSI Catalogue for details.
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Code of practice for Protective coating of iron and steel structures against corrosion

(Formerly CP 2008)

Code de bonne pratique pour l'enduisage des constructions en fer et en acier
pour la protection contre la corrosion

Richtlinie für Beschichtung von Eisen- und Stahlbauten zum
Schutz gegen Korrosion

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Amendment No. 2
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to BS 5493 : 1977

Code of practice for protective coating of iron and
steel structures against corrosion

Revised text

AMD 7898
November 1993

Foreword

In paragraph 3, line 6 delete the existing text and substitute 'omitted entirely and reference should be made to BS 7361 : Part 1.'

After paragraph 6 insert the following paragraph.

'BS 5493 has been amended to accord with current UK health and safety legislation, as a holding exercise pending changes in legislation resulting from EC Directives. References in BS 5493 to other British Standards have also been updated.'

AMD 7898
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Clause 1. Scope

Delete paragraph 3.

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Table 4B. Group B systems. Zinc coatings other than sprayed (as amended by Amendment No. 1)

Immediately following the title delete 'For continuously galvanized sheet (BS 2989) or electroplated sheet (BS 3083) see DD24.'

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Clause 11.1.2 Galvanizing (as amended by Amendment No. 1)

In paragraph 3, lines 4 and 5 delete '(with further reference in DD 24)'.

AMD 7898
November 1993

Clause 12.1.4 Compatibility

In line 12 delete 'CP 1021' and substitute 'BS 7361 : Part 1'.

AMD 7898
November 1993

Clause 13.4 Protection of steel by cement and allied products

In line 7 delete 'Codes of practice CP 110 and CP 114 to CP 117' and substitute 'All Parts of BS 8110 and BS 5950'.

AMD 7898
November 1993

Clause 14.3.1.5 Standards of blast cleaning

Delete the existing text and substitute the following.

'The four qualities of blast-cleaning given in BS 7079 : Part A1 are listed as follows:

- | | |
|------|--|
| Sa1 | Light blast-cleaning |
| Sa2 | Thorough blast-cleaning |
| Sa2½ | Very thorough blast-cleaning |
| Sa3 | Blast-cleaning to visually clean steel |

NOTE 1. The equivalent of the three qualities Sa2, Sa2½ and Sa3 in the Swedish Standard SIS 05 59 00 have similar designations.

BS 7079 : Part A1 should be referred to for the complete requirements for the preparation of steel substrates.

NOTE 2. Until further Parts of BS 7079 are published the methods of measuring cleanliness given in appendices F and G may be used.'

AMD 7898
November 1993

Clause 14.3.1.6 Surface profile

Delete lines 1 to 6 and substitute the following.

'The method of assessment of the abrasively blast-cleaned profile is given in BS 7079 : Parts C1 and C2 for qualities Sa2½ and Sa3. Three qualities of profile grades are given: fine, medium and coarse but for most protective coatings it is generally advantageous to'

AMD 7898
November 1993

Clause 16.2.1.2 Blast-cleaning for painting

In lines 3 and 12 delete 'BS 4232' and substitute 'BS 7079'.

AMD 7898
November 1993

Clause 53. Standards of preparation

In line 16 delete 'BS 4232 2nd quality' and substitute 'BS 7079 : Part A1, Sa2½'.

Delete the existing text and substitute the following.

NOTE 1. This section of the code gives recommendations for dealing with typical aspects of safety and health which arise in the work of coating iron and steel structures. It does not give complete coverage of all such aspects, because that is beyond the scope of this code. It is the duty of users of the code, in so far as they are responsible for safety and health, to ensure that all statutory requirements are met.

NOTE 2. The legislative references in clauses 56 and 57 provide a holding position in view of the impending changes in legislation resulting from European Directives. The Framework Directive which will be implemented by the Proposals for Health and Safety (General Provisions) Regulations and Approved Code of Practice and other directives stemming from this means that some of the legislative references (in clauses 56 and 57) may become obsolete.

56. Legislation

56.1 General. A number of Acts of Parliament contain provisions relevant to surface coating work and these should be taken into account when planning such work. The Acts should be studied directly for detail and coverage, together with any other legislation relevant to particular situations.

The Health and Safety at Work etc. Act 1974 imposes a general duty on employers to protect persons at work against risks to health or safety.

Note should be taken of The Control of Lead at Work Regulations 1980, The Control of Substances Hazardous to Health Regulations 1988 and the Approved Code of Practice 1988, and Carcinogenic Substances Approved Code of Practice 1988.

The Noise at Work Regulations 1989 deal with the legal obligations of employers to prevent damage to hearing.

56.2 Factories Act 1961. The provisions of the Factories Act 1961 and the Regulations and Orders made under the Factories Act remain in force but are now subject to the enforcement procedures of the Health and Safety at Work etc. Act 1974. The relevant provisions within the Factories Act itself include the following.

Section 131 'Prohibition of employment of women and young persons in painting buildings with lead paint'.

Section 132 'Prohibitions supplementary to sections 129 to 131'.

Relevant Orders and Regulations under the Factories Act include the following.

The Factories (Cleanliness of Walls and Ceilings) Order 1960 (S.I. 1974 as amended by S.I. 1974 No 427) which states the time limits for, and the methods of, cleaning and painting factory interiors.

The Construction (General Provisions) Regulations 1961 (S.I. 1580), which deal with the appointment of safety supervisors, ventilation, work adjacent to water, and the safe transport of materials.

The Construction (Working Places) Regulations 1966 (S.I. 94), which deal with scaffolding, slung scaffolding, bosun's chairs, etc.

The Construction (Health and Welfare) Regulations 1966 (S.I. 95), which deal with first aid, washing, toilet and messing facilities.

The Construction (Lifting Operations) Regulations 1961 (S.I. 1581).

The Protection of the Eyes Regulations 1974 (S.I. 1681 as amended by S.I. 1875 No. 303) which apply to all surface preparation (except sand papering) and spray painting.

Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (S.I. 917).

56.3 The Control of Pollution Act 1974. This Act covers environmental pollution such as noise and the disposal of toxic wastes.

57. Operational hazards

57.1 General. Some of the operations involved in the surface protection of a structure give rise to conditions that are potentially hazardous to the structure itself and/or surrounding property, whilst others pose hazards to the health and safety of the operatives.

Especially prevalent among these hazardous conditions are the fume and vapours which rise naturally by evaporation of solvents in some paints and strippers; and the pollutants which are induced by operations, such as:

- (a) fumes from lead-based paints when flame-cutting or flame-cleaning;
- (b) dust from lead-based paints when rubbed-down dry;
- (c) dust or fumes from some modern hard-setting paint;
- (d) fumes from heating cadmium-coated components.

Caution should always be exercised in any operation which generates dust or fumes.

The potential hazards of fumes are greatly increased in confined spaces where dust and fumes can accumulate and where there is little or no ventilation, for example, inside a tank or small room or between girders under a bridge deck. It should be remembered that similar conditions can also occur in the open air if the air is still and/or there is a ventilation trap. Such conditions usually necessitate the use of respirators supplying clean air and/or forced ventilation. Persons working in such conditions should be within sight of others outside the danger area. In these cases the advice of the Health and Safety Executive should be sought.

57.2 Hazards to structure and surroundings. Any operation is hazardous if it involves naked flame or the production of sparks in a restricted area. In such a case, flammable vapours (arising naturally by evaporation of solvents or induced artificially by operations) can accumulate and create a risk of fire, which becomes a risk of explosion if the working space is confined or poorly ventilated. The risk of damage to the structure and surroundings in these conditions is apparent and paralleled by the risk of injury to people nearby. Therefore such hazards should be identified and suitable precautions taken.

57.3 Risk of injury

57.3.1 Eyesight. Many of the operations involved in surface preparation produce particles which can damage the eyes directly, and dust and some types of fumes, which can also cause eye afflictions. Eye protection is essential for operatives doing such work and for those nearby.

57.3.2 Hearing. Many of the operations involved in surface preparation give rise to a high level of noise. Further information is contained in the Health and Safety Executive leaflet, IND(G)75(L), Introducing the Noise at Work Regulations, a brief guide to the new requirements for controlling noise at workplaces, and in HSE Noise Guides 1 – 8.

See also BS 5228.

57.3.3 Respiratory system. Some of the operations of surface preparation and paint application give rise to dust or fumes which necessitate the provision of good ventilation and respiratory protection for operatives and those nearby. If other methods of controlling exposure are not possible, suitable respiratory protective equipment which is either type approved or conforms to a standard approved by HSE, should be worn. See also BS 2091, BS 4275 and HSE Guidance Notes EH 40, Occupational Exposure Limits, and EH 16, Isocyanates, toxic hazards and precautions.

Some fumes, notably from cellulosic materials, not only affect the respiratory system directly but can have further unpleasant effects on the gastric system.

Further advice can be obtained from the Health and Safety Executive.

58. General hygiene

The various materials encountered in dealing with old paint and applying the new paint include some that are potentially harmful, and it is therefore necessary to maintain a high level of personal hygiene. In particular, hands should be protected with silicone free barrier cream before work starts and impervious industrial gloves may be needed if heavy contamination of skin is likely. Afterwards hands and exposed areas of skin should be cleaned with an approved hand cleaner. Hands should not be cleaned with paint solvent or thinners.

Overalls worn for work should be removed before eating or going home and should be laundered at frequent intervals, and all possible steps should be taken to avoid paint getting on to the skin.

Some materials will require additional precautions and advice and these should be sought from the manufacturer.

When operatives are working in such conditions (for example, inside a box girder) that access to toilet facilities is not quick and easy, consideration should be given to the provision of toilet facilities nearer to the work site.'

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November 1993

Clause A.2.4 Protection against soil corrosion

In line 3 delete 'CP 1021' and substitute 'BS 7361 : Part 1'.

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November 1993

Clause A.2.5 Cathodic protection

In paragraph 3, line 2 delete 'CP 1021' and substitute 'BS 7361 : Part 1'.

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November 1993

Clause A.3.5.3 Concrete

In line 7 delete 'CP 110' and substitute 'all the Parts of BS 8110'.

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November 1993

Clause A.3.7.5 Cathodic protection

In line 2 delete 'CP 1021' and substitute 'BS 7361 : Part 1'.

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Appendix F. Methods for control of preparation (by blast-cleaning)

Delete lines 3, 4 and 5 and substitute the following.

'... chosen. Specifications for blast-cleaning are given, together with representative photographic examples, in Swedish Standard SIS 05 59 00 and BS 7079 : Part A1, but these can be used for site control only if ...'.

In paragraph 2, line 13 delete 'BS 4232, 2nd quality' and substitute 'BS 7079 : Part A1, Sa2½

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Index (as amended by Amendment No. 1)

Delete references to BS 3083, BS 4232, CP 110, CP 114, CP 115, CP 116, CP 117, CP 1021 and DD 24.

Insert the following references in the appropriate place.

BS 2091 cited	Section six
BS 4275 cited	Section six
BS 5950 cited	13.4
BS 7079 cited	14.3.1.5; 14.3.1.6; 16.2.1.2; 53;
	Appendix F
BS 7361 : Part 1 cited	Foreword, 12.1.4; A.2.4; A.2.5; A.3.7.5
BS 8110 cited	13.4; A.3.5.3

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Standards publications referred to (as amended by Amendment No. 1)

Delete references to BS 3083, BS 3900 : Part A4, BS 4232, CP 110, CP 114, CP 115, CP 116, CP 117, CP 1021, CP 2010 and DD 24.

Insert the following references in the appropriate place.

BS 2091	Specification for respirators for protection against harmful dusts, gases and scheduled agricultural chemicals
BS 4275	Recommendations for the selection, use and maintenance of respiratory protective equipment
BS 5950	Structural use of steelwork in building
BS 7079	Preparation of steel substrates before application of paints and related products
	Part A1 Specification for rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
	Part C1 Specification for surface profile comparators for the assessment of abrasive blast-cleaned surfaces
	Part C2 Method for the grading of surface profile of abrasively blast-cleaned steel using a comparator
BS 7361	Cathodic protection
	Part 1 Code of practice for land and marine applications
BS 8110	Structural use of concrete

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Foreword

This code of practice was originally published, under the number CP 2008, in 1966; in accordance with BSI policy whereby codes of practice are now published in the general series of British Standards, this revision is published as BS 5493. The code was originally drawn up to assist those responsible for the choice or application of measures to protect iron and steel from corrosion.

Since that time developments have taken place in both the methods and processes concerned with the protection of steel from corrosion, and this new edition has been prepared to take account of these changes.

The total content of the code has been reduced, the format has been revised, and much of the explanatory matter that appeared in the original code has been omitted but essential background information has been included in the appendices. The section on cathodic protection has been omitted entirely following the publication of CP 1021. Sections on specifications and inspection have been included and this reflects the importance attached to these matters as a means of achieving the full potential of protective coatings in practice.

A new feature of this code is the inclusion of reference numbers for complete protective systems and also for their component parts. This should be of particular

assistance to users where coatings or materials do not comply with the relevant British Standards. Although some compositional requirements of the coating materials are included, these are not sufficiently detailed to provide more than a general indication of the characteristics of the coatings, and are not intended to be used as standards.

The treatments suggested represent the minimum acceptable standard of good practice for important steel structures. In some buildings and structures of less importance lower standards of protection may be acceptable but the reduction of initial costs will generally result in higher maintenance costs. Where steelwork is fully encased, e.g. in concrete, the standard of protection will generally be lower than that recommended here.

Protective processes are constantly being developed and improved, the recommendations in the code cannot, therefore, be final and are not intended to discourage the use of other measures and materials where they can be shown to be equivalent to or better than those recommended here.

British Standard Code of practice for Protective coating of iron and steel structures against corrosion

Section one. General

1. Scope

This code classifies recommended methods of protection against corrosion of iron and steel structures exposed to environments commonly encountered. It describes the various methods in detail and gives guidance on how to specify a chosen protective system, how to ensure its correct application, and how it should be maintained.

The code does not include specific recommendations for ships, vehicles, offshore platforms, specialized chemical equipment, or cladding materials; nor does it include detailed recommendations for plastics coatings or cement-mortar linings.

For steel of 5 mm thickness or less the recommendations of DD 24 may be preferred.

For some situations, weathering steel may be an alternative to ordinary structural steel with applied coatings.

No detailed recommendations on the use of weathering steels are given in this code and when their use is contemplated, advice should be sought from the steel industry.

2. References

The code makes frequent reference to Swedish Standard SIS 05 59 00 'Pictorial surface preparation standards for painting steel surfaces', which may be purchased through the British Standards Institution.

The titles of the other standards publications referred to in this code are listed on the inside back cover.

Bibliographical references are listed in appendix J.

3. Use of the code

3.1 General. The most frequent use of this code is likely to be made when choosing and specifying a protective system for a new or proposed structure. For such a use the basic procedures are as follows.

- (a) Identify the environment with the help of table 1.
- (b) Decide on the life requirement and select suitable systems (from the relevant part of table 3).
- (c) Compare these systems (with the assistance of the detailed information in table 4) and select the preferred system.
- (d) Define the system as completely as possible using table 4 and specify with the assistance of section three.

These four fundamental procedures may be subdivided into more precise steps according to:

- (1) the severity of the environment, its local variations and any special conditions;
- (2) the size and nature of the structural contract; and
- (3) the experience and technical expertise of the user of the code (see 3.2 and 3.3).

The code allocates key reference letters to the principal groups of protective systems (see tables 2 and 3). Some users of the code may be tempted to specify a protective system by quoting only the system reference (third column

of table 3) and on rare occasions this minimum reference may suffice for a specification, but in most cases it would leave a very wide choice of components and combinations to be selected. It would therefore usually be wiser to select more exactly (from the relevant part of table 4) the products to be used and to ensure that they are agreed by all parties concerned (see note following table 4F, part 4).

Although the correct selection of a protective system and the correct specification of materials and methods are both essential, they do not, by themselves, ensure the adequate performance of the chosen system. The recommendations given in sections four, five and six are equally important to the full realization of a successful corrosion protection scheme.

3.2 Use by the experienced specifier. A specifier who is experienced in the technology of protection against corrosion will need little guidance on how to find the information required in the code. Nevertheless, the list of questions given in clause 4 may be a useful guide.

Attention is drawn especially to section three because it is very important that decisions and requirements in a complex specification be stated clearly and completely.

3.3 Use by the non-technical specifier. A specifier with limited knowledge or experience of corrosion protection will probably seek expert advice on any but the simplest of projects, but may and should study the code carefully with a view to using it in one of the following ways.

- (a) To distinguish between the problems that do and do not have simple solutions.
- (b) To consider factors (see clause 4) that will provide evidence of the advantage of one type of system over another for specific requirements.
- (c) To check that a protective system or specification offered by a supplier fulfils the requirements of the code.
- (d) To select, in accordance with 3.1(a) and (b) above, a number of systems that meet the assessed environmental conditions and the life requirements and then to use clauses 10 to 13 to narrow the choice before seeking quotations.

Attention is drawn to the step-by-step approach in appendix H.

The non-technical specifier may find in the code some unfamiliar terminology. Most of the technical terms used are defined in BS 2015.

3.4 Specification requirements. Attention is drawn particularly to clause 15 covering the need to specify, fully and coherently, all the required operations. The lives to first maintenance indicated in table 3 will be achieved only by ensuring that the materials conform to the specification and that the application, handling and inspection procedures given in sections three and four are followed. Nevertheless, the details given in this code (or in any standard) are often insufficient to set a quality standard and when a specifier finds this to be the case he should require the suppliers of coatings and other materials to provide appropriate performance data.

Section two. Factors influencing the choice of protective systems

4. General

4.1 Recognition of the problem. The design of structures is based largely on data and functional requirements which can be quantified. On the other hand the selection of a protective system involves qualitative judgement on the relative importance of many factors that can vary widely according to the type of structure, its function, its general location, its immediate environment, and any changes (natural or otherwise) that may occur in its environment. There are other factors affecting the selection (such as required life to first maintenance, thickness of coatings, etc.) which may appear to be quantitative, but should be viewed with caution, because in practice, the degree of variation may differ between one coating system and

another, and between one proprietary material and another within an individual system.

Costs may vary considerably even for the same coating system, and great care is necessary to ensure that quotations for apparently identical products or services do in fact cover the same materials or application with the same degree of consistency and control. Appendix E deals with the overall economic assessment of costs.

Some of the critical conditions and circumstances that have to be taken into account before selecting a protective system are listed below in question form. Not every question will be relevant for a particular application and the importance of each relevant question may vary. The order of relevant questions may have to be changed because some answers might be modified in the light of answers to later questions. The list should therefore be studied as a whole before the questions are considered in detail.

4.2 Questions related to design, use and site requirements

4.2.1 Function

- (a) What is the main function of the structure?
- (b) What are the secondary functions of the structure?

4.2.2 Life

- (a) For how long is it required to fulfil this function?
- (b) What is the life to first maintenance? (It may not be possible to decide this until further questions have been answered.)

4.2.3 Environment

- (a) What is the general (atmospheric) environment at the site of the structure?
- (b) What localized effects exist or are to be expected (e.g. fumes from chimneys)?
- (c) What other factors may affect the structure (e.g. surface temperature and abrasion)?

4.2.4 Appearance

- (a) What is the structure required to look like (colour and finish)?
- (b) Is the final coat to be applied on site?

4.2.5 Special properties

- (a) What special properties are required of the coating (e.g. coefficient of friction)?

4.2.6 Maintenance

- (a) What access is there going to be for effective maintenance?
- (b) What is the possibility of effective maintenance?

4.2.7 Health and safety

- (a) Are any problems to be taken into account during initial treatment?
- (b) Are any problems to be taken into account during maintenance treatment?

4.2.8 Tolerance

Does the coating need to be tolerant of:

- (a) indifferent surface preparation
- (b) indifferent application techniques
- (c) departures from specification?

Sources of information

Design remit

Design remit
Design remit, clauses 6 and 7, table 3

Considerations of use and geography,
clause 5, table 1
Table 1

Table 1

Design remit
Depends on coating system selected,
24.1 and consideration of (a) above

Design remit, clauses 7 and 8

Consider design remit and site, 47.2
and A.3.6.6.

Section six. Consider design and site

Clauses 9 and 17
Discretion and experience
Clause 17, discretion and experience

4.3 Questions relating to coating systems	Source of information
4.3.1 Coating systems	Clauses 10, 11, 12 and 24.1 Consult suppliers, 21.1 12.1.4
(a) What coating systems are suitable? (b) Are these systems readily available? (c) Are the system elements mutually compatible? (d) Can the coats be applied by: brush roller airless spray other? (describe)	} 22.2
4.3.2 Coating facilities	} Clauses 9 and 10.4 Consult suppliers, 11.1.2 Clause 22 Experience
(a) Are the coating facilities readily available: (1) for factory application (2) for site application? (b) Do they cover all sizes and shapes of fabrication? (c) Do they permit speedy application? (d) Do the facilities permit work to adequate standards?	} Clauses 7 and 8
4.3.3 Compatibility with engineering and metallurgical features	} 10.2, 11.2.1 and 16.2.3
(a) Is the design and jointing of the structure compatible with the preferred coating technique? (b) Does surface preparation (blasting, pickling) or application of coating affect the mechanical properties of the steel in any way that matters? (c) Is the system compatible with cathodic protection?	} Consult specialist
4.3.4 Delays	} 10.5 and 22.2.6, consult specialist
What delays should be allowed between:	
(a) fabrication and first protective coating; (b) application of primer and undercoat; (c) application of undercoat and finishing coat; (d) final shop coat and erection; (e) erection and final treatment?	
4.3.5 Transport, storage, and handling	} Clauses 12.1.6 and 24
How well does the coating withstand:	
(a) excessive or careless handling; (b) abrasion and impact; (c) early stacking; (d) exposure to sea water during transit?	
4.3.6 Experience	} Case histories
(a) What is known of the consistent performance of the coating?	
4.3.7 Export	} Full consideration of environment during transport, storage, and use
(a) What special precautions should be taken when the steelwork is exported?	
4.3.8 Maintenance	} Section five
(a) Is the deterioration of the coating rapid and serious if maintenance is delayed?	
4.3.9 Costs	} Cost analysis of previous contracts; appendix E; consult suppliers and contractors
(a) What are the approximate costs of:	
(1) the basic system; (2) any additional items; (3) transport; (4) access?	
(b) What are the approximate costs of maintenance?	} Cost analysis of previous maintenance; appendix E; consult suppliers and contractors

The manner in which this list of questions can assist in choosing a protective system is demonstrated in appendix H.

5. Environment

5.1 Classification of types. Table 1 gives details of the most common types of environment (exterior atmospheres, including the problems of sheltered conditions, building interiors, sea water, fresh water, soil) and of special situations requiring additional or priority treatment (high temperatures, refrigerated surfaces, fungal and bacterial growth, chemicals, abrasion or impact, local mining and encasement in concrete).

The definitions of environment and recommendations for coatings are primarily related to conditions in the United Kingdom. However, much overseas construction is supplied by and controlled from the United Kingdom.

It should be noted therefore, that subtropical and especially tropical environments can be much more corrosive than those in Britain, because of the much higher and wider range of temperature, rainfall and humidity. The surface temperature of a structure can, after heavy rain, quickly reach 70 °C or 80 °C, and humidities at or close to 100 % can persist for long periods. The salinities of both fresh and salt waters can be much higher because of the high evaporation rates of ground water; and high water temperature promotes rapid growth of corrosive bacteria. It should also be borne in mind that when coated or uncoated goods are shipped from a temperate climate into or through a tropical climate, the environmental conditions during transport may be much more aggressive than those in which the coatings are intended to serve. For all these reasons, specialist advice should be sought when considering protective schemes in such environments.

5.2 Identification of relevant types. When selecting a protective system, identification of the environment should be allowed for by answering the following questions.

- (a) What is the nature of the general environment?
- (b) Will the environment change markedly after completion of the structure or in the foreseeable future?
- (c) Is there local pollution, e.g. sulphur dioxide, which could make the environment more corrosive than is at first apparent?
- (d) Should the worst environment be allowed for when determining protective systems or should the project be divided into different parts from an environmental standpoint?
- (e) What special situations apply, e.g. watersplash and residual pools, vulnerability of posts to traffic near ground level or floor levels?

6. Life required of coating

6.1 Definition. Most structures are designed for a specific functional life. In the rare cases where access for repair or maintenance of the coatings is impossible, the initial protective coating will be required to have the same life as the structure. More usually, however, the life requirement of the initial protective coating is based on the time which can elapse before major or general maintenance of the coating becomes necessary. That time is known as the 'life to first maintenance' and its values, related to types of environment and coating systems, are given in table 3, which also indicates which systems have special maintenance requirements.

Section five of the code gives details of conditions of coating which indicate that maintenance is due.

6.2 Categories

6.2.1 Life to first maintenance. The following ranges of life are used in table 3.

Very long	typically 20 years or more
Long	typically 10 to 20 years
Medium	typically 5 to 10 years
Short	typically less than 5 years

It should be noted however, that there may be wide variability in the environment and in the application of the coating system which may shorten or lengthen the expected maintenance-free life. However, when maintenance is due after 20 years or more on 'very long life' systems in the more unfavourable combinations of circumstances, the coating may have deteriorated to such an extent that it may be necessary to blast-clean and recoat the steelwork (see clause 55). On structures with a design life of more than 50 years it is advisable to inspect the coatings earlier than the date scheduled for maintenance. It can then be decided if maintenance work should be put in hand earlier than the scheduled date in order to preserve the integrity of the coating that was applied initially.

Mechanical damage to coatings during handling, transport and erection is not considered in table 3 but is discussed in clause 24 and table 8 (section four).

6.2.2 Life between subsequent maintenances. After galvanized or metal-sprayed structures have been painted, subsequent maintenance will be of the paint scheme. Well maintained painted structures may have longer lives between maintenance operations as the total intact paint film becomes thicker.

6.3 Assessment of life requirement. It may be necessary to assess the life of each part of a structure separately (see 5.2(d) and (e) and 15.6). For each assessment (whether or not more than one is required) the following points should be taken into account.

- (a) Required life of structure.
- (b) Decorative aspects; the decorative life of a coating is not usually as long as the protective life.
- (c) Irreversible deterioration if scheduled maintenance is delayed.
- (d) Difficulty or ease of access for maintenance (see clause 7).
- (e) Technical and engineering problems in maintenance.
- (f) Minimum acceptable period between maintenances.
- (g) Total maintenance costs, including shut-down of plant, closure of roads, access costs, etc.

7. Design of the structure

The design of the structure may influence the choice of protective system. It may be appropriate and economic to modify the design (see BS 4479) to suit the preferred protective system. The following points should be borne in mind when designing.

- (a) Easy access for protection and maintenance should be provided and, wherever possible, pockets and recesses in which water and dirt may collect should be avoided. Corrosive chemicals, including de-icing salts, should be directed away from structural components, e.g. by drainage tubes.

Table 1. Environments and special situations

Environment			Special situations requiring priority consideration*		
Category	Description	Relevant part of table 3	Category	Description	Relevant part of table 3
Exterior exposed	Rain washed surfaces	Part 1	Mines	Typically coal mines. Warm humid conditions. Water present (pH 2.5 to 11) and sometimes saline	Part 12
Non-polluted inland	Most rural and suburban areas with low sulphur dioxide, acid, alkali and salt pollution. NOTE. Some apparently non-industrial areas may be polluted from distant sources, according to prevailing wind and topography		Encasement in concrete	Alkaline concrete away from atmosphere, but carbonation occurs close to surface and in cracks	Part 14
Polluted inland	Airborne sulphur dioxide, or other pollution from industrial or domestic sources	Part 2	Refrigerated surfaces	Surfaces near to refrigeration systems subject to ice formation and condensation	Part 15
Non-polluted coastal	As non-polluted inland with salt detectable. Typically nearer to coast than a distance which may be as little as 0.25 km or as much as 3 km, according to prevailing wind and topography (but with frequent salt spray, treat as sea water splash zone)	Part 4	High-temperature surfaces	The temperature aspect is usually of greater importance than the general atmosphere. Thermal shock may need to be considered	Part 11
Polluted coastal	As polluted inland with salt detectable. Typically nearer to coast than a distance which may be as little as 0.25 km or as much as 3 km, according to prevailing wind and topography (but with frequent visual salt spray, treat as sea water splash zone)	Part 3	Chemicals	Specific corrosion hazards from both liquid and vapour	Part 16
Exterior sheltered	As above except not washed by rain, badly ventilated, and normally subject to condensation, e.g. under-sides of bridges	Part 5	Acids and alkalis	Usually solvents and petroleum products with dissolution effect on many organic coatings	Part 17
Interior	Inside buildings which may or may not be heated	Part 6	Neither acidic nor alkaline		
Normally dry	Allows for some condensation and for exterior conditions during erection, e.g. warehouses		Road (de-icing) salts	Salts containing chlorides used to suppress ice formation, particularly on highways	Part 18
Frequently damp and wet	Substantial condensation, e.g. swimming baths	Part 7	Abrasion and impact	Additional consideration in some applications	Part 19
Non-saline water	Potable and non-potable water. Applicable to river installations, sewage-treatment tanks, water tanks, and domestic water systems	Part 8	Fungi and bacteria	Additional consideration in some applications	
Sea water	Sea and other saline waters and estuary water	Part 10			
Immersed	Permanent immersion, e.g. submerged structures, offshore drilling rigs				
Splash zone	Wind and water area of floating and tidal structures, e.g. wharfs, piers, sea walls or frequent salt spray	Part 9			
Soil	Earth, sand, rock, etc. Mainly buried structures, e.g. pipelines and exteriors of tunnels and underground storage tanks	Part 13			

*Some environments are so highly corrosive that special high duty coatings not detailed in this code may be required.

- (b) Certain areas may, after erection, be inaccessible for maintenance and so may require a coating system designed to last for the total life of the structure.
- (c) Some structural sections may be more suited to some coating systems than others; e.g. hollow sections can be more easily wrapped than structural shapes.
- (d) The method or size of fabrication may preclude or limit some coating systems.
- (e) The absence of sharp edges facilitates the even application of paints which might recede from arrises.
- (f) If materials are chosen which may give serious bimetallic corrosion problems additional measures are necessary. (See PD 6484.) The effect of contact with other building materials should be considered (see clause 28).
- (g) Electrical continuity in some exposed steel structures can be important. If continuity is not otherwise provided, copper tapes may have to be bonded to the steel parts to bridge the discontinuity (e.g. lightning conductors) but this creates a risk of bimetallic corrosion. Metal coatings retain electrical continuity and most paint coatings provide electrical resistance.

8. Fabrication

8.1 General. Full protection applied in the shop immediately after fabrication normally results in a longer life of the protective system. However, damage during transportation and erection may subsequently necessitate widespread repair or touch-up of coatings, so specifiers may prefer to leave a final coat or coats of a multi-coat system for application on site. This may, however, delay site work, e.g. removal of scaffolding. When the final cost of paint is applied on site the specifier should choose a system that is tolerant of delay (with possible contamination) at this stage. The specification should state clearly who is to be responsible for quality control at each stage in the fabrication and processing.

8.2 Faying surfaces of friction-grip joints.* The faying surfaces of friction-grip bolted joints (see BS 3294 and BS 4604) require special attention. If left bare, all points where moisture could gain access should be effectively sealed. The alternative is to protect the faying surfaces, but in this case the effect of the protective schemes on the slip factor has to be closely investigated, and their behaviour under static, dynamic and sustained loading should be considered. If adequate test results are not available they should be obtained. Consideration should also be given to possible losses of pre-tension arising from the behaviour of protective coatings on fasteners and in friction-grip joints. Sprayed aluminium or zinc, hot-dip galvanizing, paints of the zinc silicate type, or special paints with abrasive additions may be considered. Most organic-based protective coatings, including strippable coatings, oils, and waxes, would greatly reduce the slip factor below the acceptable values for properly prepared steel.

*The term 'faying surfaces of a friction-grip joint' means surfaces which, when in contact with one another, transmit a load across the interface by friction.

†These contain fluxes which should be removed.

8.3 Fasteners. Fasteners which are exposed after assembly, such as steel pipe- and cable-hangers, are zinc- or aluminium-coated, or blast-cleaned and primed before welding-on (if not blast-cleaned with the structure). Fixing nuts and bolts may be galvanized (see BS 729), sherardized (see BS 4921), or electroplated (see BS 3382 and table 4). An adequate thickness of zinc should be specified, and when the zinc coating on fasteners (applied by galvanizing, electroplating or sherardizing) is too thin for the life requirement, further coatings should be applied on surfaces exposed after assembly as follows.

- (a) Zinc-dust paints: to total thickness suggested by figure 1 for appropriate environment and life to first maintenance.
- (b) Other coatings: to thickness that will offer protection equivalent to that given to the main structure.

8.4 Procedure for welds. As-rolled steel may be blast-cleaned and protected with blast-primers before fabrication and welding (see table 4A). This prevents the serious development of rust, which would be difficult to remove after fabrication. The use of steel that has rusted heavily during storage is best avoided for the same reason. When welding metal-coated or zinc-dust-painted steel, it is sound practice first to remove the coating near the weld area, or mask-off the weld area before coating. Most painted steel can be cut and welded satisfactorily provided that the coating thickness is less than 25 µm, but welds that are likely to be heavily stressed should be examined by the engineer for porosity.

After welding, scale and heat-damaged coatings should be removed by local blast-cleaning and the areas renovated by re-applying the original coating (if possible). Galvanized or metal-sprayed surfaces may be made good by:

- (a) metal-spraying on site;
- (b) application of zinc-rich paints to reinstate the original dry-film thickness; or
- (c) application of low-melting-point zinc alloys heated by torch to a pasty condition†.

To avoid the need for early maintenance of site welds on painted structures they should be blast-cleaned before protection.

9. Facilities for application of coatings

Surface preparation (see clause 14) is normally done by the contractor applying the coating. If blast-cleaning is not available and it is necessary to use a surface-preparation method that is inferior to blast-cleaning, it is advisable to choose a paint which is compatible with that surface preparation; the advantages of some chemical resistant paints are lost if they are applied over inadequately prepared surfaces.

When programming the work, factors to be considered include the following.

- (a) The sequence of operations (e.g. blast-cleaning before fabrication is normally cheaper than blast-cleaning after fabrication).

- (b) The application time (e.g. length of a drying or curing time for coating).
- (c) Methods of application (e.g. airless spray, air spray, or brush). (See clause 22.)
- (d) The possible advantage or disadvantage of applying the final coat(s) on site (see clauses 8.1, 12 and 24). Some coatings (e.g. galvanizing*) cannot be applied on site.

*Galvanizing facilities are listed in the Galvanizers Directory, issued by the Galvanizers Association, 34 Berkeley Square, London, W1X 6AJ.

10. Classification and characteristics of protective coatings

10.1 Classification. The first stage of classification separates all protective coatings into 'metallic' and 'non-metallic'. (Metallic zinc-rich coating materials are treated as paints in this code (see 12.1).) The next stage of classification groups the principal types of coatings in the manner shown in table 2. Each group is given a key reference letter (from the sequence B to M) which will be used for identification throughout the code, especially in tables 3 and 4. The letter A is not used in table 2 but is used as the key reference letter for blast primers in tables 3 and 4.

Throughout the remainder of the code, the key reference letter is prefixed by the letter S when a complete protection system is the subject of the reference.

To identify the components within a system the key reference letter is amplified by one of the following suffix letters:

- P to denote first treatment or primer (AP to denote blast primer);

- U to denote undercoat(s); and
F to denote finishing or top coat.

Numbers following the alphabetical reference indicate more specific alternatives within the general type. For example:

SB3 denotes a complete system (S) of zinc coating (B), being the third (3) alternative of the four systems listed in table 4B.

FF4A denotes a drying-oil-type (F) finishing coat (second F), in the fourth (4) group of alternatives listed in the last part of table 4F, and sub-group A for white and tints. It is not itself a system.

The further alphabetical suffix that appears after some of the numbers indicates still further sub-classification, as in the example FF4A above. Use of the designation FF4 would imply any or all of the referenced products in the relevant product section.

For some of the applications there are several systems that offer acceptable protection, so choice has to be guided by other characteristics. These include availability, convenience of application, ease of inspection and control, ease of maintenance, and economy in use for the specific structures and situations involved. The following general considerations are supplemented by more specific information in tables 3 and 4 and clauses 11 and 12.

Metallic coatings are usually supplied under technical names which are generally related to the techniques of application, such as galvanizing, sprayed-metal (frequently known as metal spray), etc. On the other hand, non-metallic coatings are usually supplied as proprietary products. The products within each sub-classification group may have slightly different compositions and properties

Table 2. Principal types of coating systems (see 10.1)

Key reference letter	Type	Characteristic constituents	Reference to table 4	Clause reference
B	Zinc coating (except sprayed-metal): bare or painted	Zinc and/or zinc-iron alloy	4B	11.1
C	Sprayed-metal: bare, sealed or painted	Zinc or aluminium metal	4C	11.2
D	Organic zinc-rich	Zinc and organic binder	4D	12.2
E	Inorganic zinc-rich	Zinc and silicate binder	4E	12.2
F	Drying-oil type	Drying oil, urethane oil, alkyd, modified alkyd, phenolic varnish, or epoxy ester plus pigment	4F	12.3
G	Silicone alkyd	Silicone-modified alkyd plus pigment	4G	12.3
H	One-pack chemical-resistant	Chlorinated rubber or vinyl copolymer resin plus pigment	4H	12.4
J	One-pack chemical-resistant and type F primer	Epoxy ester or alkyd primer with chlorinated-rubber finish†	4J, 4F	12.4 12.3
K	Two-pack chemical-resistant	Epoxy or polyurethane resin (including modification with coal tar) plus pigment	4K	12.5
L	Two-pack chemical-resistant overcoated with type H travel coat and finish	Epoxy resin overcoated with chlorinated rubber plus pigment	4L	12.5
M	Bitumens	Coal tar or mineral bitumen with or without pigment, coal tar enamel	4M	12.6

†Moisture-curing polyurethanes and high-molecular-weight linear epoxy resins (see appendix B), which are both one-pack chemical-resistant materials, are not included in the product sections of table 4 because of limited experience in their use. Where these materials are considered the specifier should, as with all newer materials, refer to suppliers for recommended systems and conditions of use.

Table 3. Recommendations for protective coating systems for specific environments

Introduction

The following lists of systems, classified by environment and typical time to first maintenance, indicate the options open to the specifier. The recommended treatments listed for longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives. The recommendations indicate minimum requirements to ensure protection; thus combinations of metallic zinc or aluminium with paint are limited to sealed, sprayed-metal or metal with relatively thin paint coatings, although it is recognized that, for decorative purposes, additional paint coatings will often be specified.

It is impossible to achieve an exactly uniform thickness of any type of coating. The term 'nominal thickness' is used in the heading to the fourth column of this table and elsewhere throughout the code to indicate an *aim* in such a manner that the permissible variation from that aim can be usefully specified. The manner of specifying the permissible variation is described in clause 19.

Table 3. Part 1. Exterior exposed non-polluted inland atmosphere

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Galvanize	SB1	(85 min.)	a, b, c, d
	Unsealed sprayed aluminium	SC2A	150	d, f
	Unsealed sprayed zinc	SC2Z	150	a, c, d, f
	Sealed sprayed aluminium	SC5A	100	d, e, f
	Sealed sprayed zinc	SC6Z	150	d, e, f
Long (10 to 20)	Galvanize plus paint	SB8	(85 min. + 30 min.)	h, i
	Unsealed sprayed aluminium	SC1A	100	d, f
	Unsealed sprayed zinc	SC1Z	100	a, c, d, f
	Sealed sprayed zinc	SC5Z	100	d, e, f
	Sprayed aluminium plus paint	SC9A	100 + (30 to 100)	e, i
	Sprayed zinc plus paint	SC9Z	100 + (30 to 100)	e, i
	Organic zinc-rich	SD3	100	g
	Inorganic zinc-rich	SE2	100	g
	Silicone alkyd over two-pack chemical-resistant	SG1	245	
	One-pack chemical-resistant	SH6	270	
Medium (5 to 10)	Organic zinc-rich	SD2	75	g
	Drying-oil type	SF7	165 to 190	
	One-pack chemical-resistant	SH3	150	
Short (less than 5)	Drying-oil type	SF2	120 to 150	j
	Drying-oil type	SF5	85 to 105	j

NOTE. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 2. Exterior exposed polluted inland

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Galvanize (silicon in steel)	SB3	210	a, b, c, d
	Unsealed sprayed aluminium	SC2A	150	d, f
	Unsealed sprayed zinc	SC3Z	250	a, c, d, f
	Sealed sprayed aluminium	SC6A	150	d, e, f
	Sealed sprayed zinc	SC6Z	150	d, e, f
Long (10 to 20)	Galvanize	SB2	140	a, b, c, d
	Galvanize plus paint	SB9	(85 min. + 60 min.)	h, i
	Unsealed sprayed aluminium	SC1A	100	d, f
	Unsealed sprayed zinc	SC2Z	150	a, c, d, f
	Sealed sprayed aluminium	SC5A	100	d, e, f
	Sealed sprayed zinc	SC5Z	100	d, e, f
	Sprayed aluminium plus paint	SC10A	100 + (60 to 100)	e, i
	Sprayed zinc plus paint	SC10Z	100 + (60 to 100)	e, i
	Organic zinc-rich	SD5	150	
	Inorganic zinc-rich	SE3	150	
	Silicone alkyd over two-pack chemical-resistant	SG2	345	
	One-pack chemical-resistant	SH7	300	
	Two-pack chemical-resistant	SK3	270	
	One-pack chemical-resistant over two-pack chemical-resistant	SL6	335	
Medium (5 to 10)	Galvanize	SB1	(85 min.)	a, b, c, d
	Galvanize plus paint	SB8	(85 min. + 30 min.)	h, i
	Unsealed sprayed zinc	SC1Z	100	a, c, d, f
	Organic zinc-rich	SD3	100	g
	Inorganic zinc-rich	SE2	100	g
	Drying-oil type	SF8	190 to 230	
	One-pack chemical-resistant	SH4	200	
	Two-pack chemical-resistant	SK2	240	
	One-pack chemical-resistant over two-pack chemical-resistant	SL2	235	
Short (less than 5)	Drying-oil type	SF3	170 to 190	j
	Drying-oil type	SF6	130 to 150	
	One-pack chemical-resistant	SH2	220	j

NOTE. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 3. Exterior exposed polluted coastal atmosphere

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Galvanize (silicon in steel)	SB3	210	a, b, c, d
	Unsealed sprayed aluminium	SC3A	250	d, f
	Unsealed sprayed zinc	SC4Z	350	a, c, d, f
	Sealed sprayed aluminium	SC6A	150	d, e, f
	Sealed sprayed zinc	SC7Z	250	d, e, f
Long (10 to 20)	Galvanize	SB2	140	a, b, c, d
	Galvanize plus paint	SB9	(85 min. + 60 min)	h, i
	Unsealed sprayed aluminium	SC2A	150	d, f
	Unsealed sprayed zinc	SC3Z	250	a, c, d, f
	Sealed sprayed aluminium	SC5A	100	d, e, f
	Sealed sprayed zinc	SC6Z	150	d, e, f
	Sprayed aluminium plus paint	SC10A	100 + (60 to 100)	e, i
	Sprayed zinc plus paint	SC10Z	100 + (60 to 100)	e, i
	Silicone alkyd over two-pack chemical-resistant	SG2	345	
	Two-pack chemical-resistant over zinc silicate	SE4	275	
	One-pack chemical-resistant	SH7	300	
	Two-pack chemical-resistant	SK3	270	
	One-pack chemical-resistant over two-pack chemical-resistant	SL6	335	
Medium (5 to 10)	Galvanize	SB1	(85 min.)	a, b, c, d
	Galvanize plus paint	SB8	(85 min. + 30 min.)	h, i
	Unsealed sprayed zinc	SC2Z	150	a, c, d, f
	Sealed sprayed zinc	SC5Z	100	d, e, f
	Organic zinc-rich	SD3	100	g
	Inorganic zinc-rich	SE2	100	g
	Drying-oil type	SF8	190 to 230	
	One-pack chemical-resistant	SH4	200	
	Two-pack chemical-resistant	SK2	240	
	One-pack chemical-resistant over two-pack chemical-resistant	SL2	235	
Short (less than 5)	Drying-oil type	SF3	170 to 190	j
	Drying-oil type	SF6	130 to 150	
	One-pack chemical-resistant	SH2	220	j

NOTE. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 4. Exterior exposed non-polluted coastal atmosphere

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Galvanize	SB2	140	a, b, c, d
	Unsealed sprayed aluminium	SC2A	150	d, f
	Unsealed sprayed zinc	SC3Z	250	a, c, d, f
	Sealed sprayed aluminium	SC6A	150	d, e, f
	Sealed sprayed zinc	SC6Z	150	d, e, f
Long (10 to 20)	Galvanize	SB1	(85 min.)	a, b, c, d
	Galvanize plus paint	SB9	(85 min. + 60 min.)	h, i
	Unsealed sprayed zinc	SC2Z	150	a, c, d, f
	Sealed sprayed aluminium	SC5A	100	d, e, f
	Sealed sprayed zinc	SC5Z	100	d, e, f
	Sprayed aluminium plus paint	SC9A	100 + (30 to 100)	e, i
	Sprayed zinc plus paint	SC9Z	100 + (30 to 100)	e, i
	Organic zinc-rich	SD3	100	g
	Inorganic zinc-rich	SE2	100	g
	Drying-oil type	SF8	190 to 230	
	Silicone alkyd over two-pack chemical-resistant	SG1	245	
	One-pack chemical-resistant	SH6	270	
	One-pack chemical-resistant over two-pack chemical-resistant	SL3	295	
Medium (5 to 10)	Unsealed sprayed zinc	SC1Z	100	a, c, d, f
	Organic zinc-rich	SD2	75	g
	Inorganic zinc-rich	SE1	75	g
	Drying-oil type	SF7	165 to 190	
	One-pack chemical-resistant	SH3	150	
Short (less than 5)	Organic zinc-rich	SD1	50	g
	Drying-oil type	SF2	120 to 150	j
	Drying-oil type	SF5	85 to 105	
	One-pack chemical-resistant	SH1	160	j

NOTE. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 5. Exterior sheltered atmosphere

For galvanizing, sprayed-metal (preferably sealed), and zinc-rich coatings the recommendations are the same as for the relevant fully exposed condition, but when 'dead' pockets of air occur, the thickness of bare or sealed metallic zinc coatings should be increased by about 25 %. Combinations of metal and paint are not

usually to be recommended (see note (i)).

Paint systems should be at least as good as for the relevant fully exposed conditions with preference for the more water-resistant systems, e.g. system types H, J, K, L, and, where fully protected from sunlight, M.

Table 3. Part 6. Interior (of buildings) normally dry

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Galvanize	SB1	(85 min.)	a, b, c, d
	Unsealed sprayed aluminium	SC1A	100	d, f
	Unsealed sprayed zinc	SC1Z	100	a, c, d, f
Long (10 to 20)	Galvanize plus paint	SB8	(85 min. + 30 min.)	h, i
	Sprayed aluminium plus paint	SC9A	100 + (30 to 100)	e, i
	Sprayed zinc plus paint	SC9Z	100 + (30 to 100)	e, i
	Organic zinc-rich	SD2	75	g
	Inorganic zinc-rich	SE1	75	g
	Drying-oil type or coal tar epoxy	SF7 + SK6	(165 to 190) + 250	
	One-pack chemical-resistant over two-pack chemical-resistant	SL2	235	
Medium (5 to 10)	Organic zinc-rich	SD1	50	g
	Drying-oil type	SF2	120 to 150	j
	Drying-oil type	SF5	85 to 105	
Short (less than 5)	Drying-oil type	SF1	100	j
	Drying-oil type	SF4	70	

NOTE 1. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

NOTE 2. The above recommendations take into account situations where the steelwork, although fully enclosed inside a building, may be subject to conditions of external exposure during construction, e.g. where the erection of cladding is unduly delayed. Furthermore, these recommendations indicate typical lives to first maintenance under such conditions, and provided that signs of corrosion are not apparent during the delay period no further serious corrosion is likely to occur that could result in a shortening of the typical life to first maintenance.

When it can be assured that there will be no delay between coating the steelwork and its enclosure within the building, and when the design is such as to ensure dry conditions without local or general condensation or ingress of water, then the above-mentioned recommendations are likely to be conservative and the time to first maintenance can be extended.

Under dry conditions, the loss of steel by corrosion is slight, so provided that the steelwork inside a building remains dry and no breakdown of the coating is likely to occur prior to enclosure of the steelwork within the building, the coating requirement may be determined by experience of the conditions and by the nature of the construction.

Under these conditions, the above treatments would generally result in times to first maintenance being longer than those quoted.

See also clause 8.

Table 3. Part 7. Interior of building, frequently damp or wet

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Galvanized	SB1	(85 min.)	a, b, c, d
	Unsealed sprayed aluminium	SC1A	150	d, f
	Unsealed sprayed zinc	SC2Z	150	a, c, d, f
	Sealed sprayed aluminium	SC5A	100	d, e, f
	Sealed sprayed zinc	SC5Z	100	d, e, f
Long (10 to 20)	Galvanize plus paint	SB8	(85 min. + 30 min.)	h, i
	Unsealed sprayed aluminium	SC2A	100	d, f
	Unsealed sprayed zinc	SC1Z	100	a, c, d, f
	Sprayed aluminium plus paint	SC9A	100 + (30 to 100)	e, i
	Sprayed zinc plus paint	SC9Z	100 + (30 to 100)	e, i
	Organic zinc-rich	SD5	150	g
	Inorganic zinc-rich	SE3	150	g
	Two-pack chemical-resistant over zinc silicate	SE6	275	
	One-pack chemical-resistant	SH7	300	
	Two-pack chemical-resistant	SK3	270	
	Coal tar epoxy	SK6	250	
	One-pack chemical-resistant over two-pack chemical-resistant	SL3	295	
Medium (5 to 10)	Organic zinc-rich	SD3	100	g
	Inorganic zinc-rich	SE2	100	g
	One-pack chemical-resistant	SH5	220	
	Two-pack chemical-resistant	SK2	240	
	Coal tar epoxy	SK6	250	
	One-pack chemical-resistant over two-pack chemical-resistant	SL2	235	
Short (less than 5)	One-pack chemical-resistant	SH2	220	j
	One-pack chemical-resistant over drying-oil type primer	SJ1	170	j
	Two-pack chemical-resistant	SK1	170 to 180	
	Coal tar epoxy	SK5	150	

NOTE. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 8. Non-saline water (for potable water see note (n))

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Galvanize	SB2	140	b, c, d, m
	Sealed sprayed aluminium	SC6A	150	e, l, m
	Sealed sprayed zinc	SC6Z	150	e, l, m
Long (10 to 20)	Galvanize	SB1	(85 min.)	m
	Galvanize plus bitumen (BS 3416)	SB9	(85 min. + 40)	See table 4M
	Sealed sprayed aluminium	SC5A	100	e, l, m
	Sealed sprayed zinc	SC6Z	150	e, l, m
	Sprayed aluminium plus paint	SC9A	100 + (30 to 100)	e, l, m
	Sprayed zinc plus paint	SC9Z	100 + (30 to 100)	e, l, m
	Organic zinc-rich	SD5	150	
	Inorganic zinc-rich	SE3	150	
	One-pack chemical-resistant over two-pack chemical-resistant over zinc silicate	SE6	275	
	Two-pack chemical-resistant	SK4	320	
	Coal tar epoxy	SK8	450	
	Hot-applied bitumen	BS 4147	Various	See table 4M
	Coal tars	BS 4164	Various	See table 4M
Medium (5 to 10)	Organic zinc-rich	SD3	100	
	Inorganic zinc-rich	SE2	100	
	One-pack chemical-resistant	SH7	300	
	Two-pack chemical-resistant	SK2	240	
	Coal tar epoxy	SK7	350	
	Bitumen	BS 3416	Various	See table 4M

NOTE. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 9. Sea water splash zone, or frequent salt spray

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Sealed sprayed aluminium	SC6A	150	d, e, f
	Sealed sprayed zinc	SC7Z	250	d, e, f
Long (10 to 20)	Galvanize plus coal tar epoxy	SB1 + SK5	(85 min. + 150)	i
	Galvanize (silicon in steel)	SB3	210	a, b, c, d
	Galvanize plus paint	SB9	(85 min. + 60 min.)	i
	Unsealed sprayed zinc	SC3Z	250	a, c, d, f
	Sealed sprayed zinc	SC6Z	150	d, e, f
	Sprayed aluminium plus paint	SC10A	100 + (60 to 100)	e, i
	Sprayed zinc plus paint	SC10Z	100 + (60 to 100)	e, i
	One-pack chemical-resistant over two-pack chemical-resistant over zinc silicate	SE7	475	
	Coal tar epoxy	SK8	450	
	One-pack chemical-resistant over two-pack chemical-resistant	SL5	440	
Medium (5 to 10)	Galvanize	SB2	140	a, b, c, d
	Unsealed sprayed zinc	SC2Z	150	a, c, d, f
	Sealed sprayed aluminium	SC5A	100	d, e, f
	Sealed sprayed zinc	SC5Z	150	d, e, f
	One-pack chemical-resistant over two-pack chemical-resistant over zinc silicate	SE6	275	
	One-pack chemical-resistant	SH6	270	
	Coal tar epoxy	SK7	350	
	One-pack chemical-resistant over two-pack chemical-resistant	SL4	345	
Short (less than 5)	Galvanize	SB1	(85 min.)	a, b, c, d
	Unsealed sprayed zinc	SC1Z	100	a, c, d, f
	Two-pack chemical-resistant	SK2	240	
	One-pack chemical-resistant over two-pack chemical-resistant	SL2	235	

NOTE. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 10. Sea water, immersed

Typical time to first maintenance (years)	General description	System reference (table 4)	Total nominal thickness (µm)	Notes (see the end of this table)
Very long (20 or more)	Sealed sprayed aluminium	SC6A	150	d, e, f
	Sealed sprayed zinc	SC7Z	250	d, e, f
Long (10 to 20)	Galvanize plus coal tar epoxy	SB1 + SK5	(85 min. + 150)	a, b, c, d a, c, d, f d, e, f e, i e, i
	Galvanize (silicon in steel)	SB3	210	
	Unsealed sprayed zinc	SC3Z	250	
	Sealed sprayed zinc	SC6Z	150	
	Sprayed aluminium plus paint	SC10A	100 + (60 to 100)	
	Sprayed zinc plus paint	SC10Z	100 + (60 to 100)	
	One-pack chemical-resistant over two-pack chemical-resistant over zinc silicate	SE7	475	
	Coal tar epoxy	SK8	450	
Medium (5 to 10)	Galvanize	SB2	140	a, b, c, d a, c, d, f d, e, f a, c, d, f
	Unsealed sprayed zinc	SC2Z	150	
	Sealed sprayed aluminium	SC5A	100	
	Sealed sprayed zinc	SC5Z	100	
	One-pack chemical-resistant over two-pack chemical-resistant over zinc silicate	SE6	275	
	One-pack chemical-resistant	SH7	300	
	Coal tar epoxy	SK7	350	
Short (less than 5)	Galvanize	SB1	(85 min.)	a, b, c, d a, c, d, f
	Unsealed sprayed zinc	SC1Z	100	
	One-pack chemical-resistant	SH5	220	
	Coal tar epoxy	SK6	250	

NOTE 1. Note (k), at the end of table 3, refers to anti-fouling paints.

NOTE 2. Treatments listed for the longer lives will always protect for shorter-period requirements and are frequently economical also for these shorter lives.

Table 3. Part 11. High temperature surfaces

The coatings that protect structural steel against corrosion may also need to be heat-resistant. Resistance to heat is influenced mainly by the nature of the temperature cycle, the maximum service temperature and its duration. Furthermore, the behaviour of the coating will vary considerably according to whether or not the surface remains dry (even when cold). When warm, the presence of hot gases will have specific effects.

Only general recommendations can be given and specialist advice should always be sought.

For temperatures up to 200 °C, sealed sprayed aluminium (SC6A) or sealed sprayed zinc (SC6Z) may be considered for long or even very long life to first maintenance, depending on the circumstances. A special silicone alkyd over a zinc silicate primer system (SG1 type but thinner) may be considered for medium lives. The paint coating should be less than 100 µm for radiators, etc. Colours are usually satisfactory but for higher temperatures the aluminium version is recommended (see table 4F, part 4, product section F5). Where silicones cannot be tolerated, a silicone-free aluminium paint may be specified; advice should be sought from paint suppliers. The maintenance period is related to the operating temperature. Certain drying-oil types of coating (e.g. SF1 or SF4) will give short-term protection but selection of the paint requires specialist advice.

For temperatures up to about 550 °C aluminium (175 µm nominal thickness) is suitable as sprayed.

Arc-sprayed aluminium should preferably be specified where there may be cyclical temperature fluctuations. The sprayed aluminium may also be silicone-sealed (SC6AH) and, for temperatures typically about 250 °C, silicone-sealed sprayed aluminium SC6AH can have a very long life (20 or more years).

The zinc silicate systems are also recommended; system SE1, for example, may, in some circumstances, last for up to 10 years before maintenance is needed. The zinc silicate/aluminium silicone treatment SE8 is to be preferred for the more severe conditions and in favourable circumstances may have long life to first maintenance.

For temperatures up to 900 °C aluminium (175 µm nominal thickness) applied by electric arc under controlled conditions may be considered for some uses; the current edition of BS 2569 : Part 2, gives some alternatives.

For components to be used at service temperatures up to 1000 °C the current edition of BS 2569 : Part 2, specifies a nickel-chromium alloy; with sulphurous gases present the nickel-chromium is followed by aluminium and in each case there is a subsequent heat treatment.

The life to first maintenance of coatings recommended for temperatures up to 550 °C, up to 900 °C, and up to 1000 °C will depend on the exact combination of conditions in service but will usually be less than 10 years, although the sprayed aluminium coating may last longer if maximum temperature and other conditions are not too severe.

Table 3. Part 12. Mines

Specialist advice should be sought because conditions differ considerably in different mines.

Advice should also be sought from H.M. Inspector of Mines and Quarries regarding the special restrictions which apply to materials taken down into mines (e.g. low-flash-point paints) and the processes which may be used in mines (e.g. blast-cleaning).

Zinc coatings (but not aluminium coatings or paint in coal mines) should be considered provided that the water has pH > 5. For sprayed zinc or aluminium a sealed coating is preferred. Data on the coatings and likely performance, given in parts 8, 9 and 10 of this table, can be used for guidance but the time spans to first maintenance may vary widely according to local conditions.

Table 3. Part 13. Soil

Many specialist coatings exist, e.g. wrapping tapes, bituminous coatings (BS 3416, BS 4147, BS 4164 as appropriate), powder coatings and polythene sleeves, often in conjunction with cathodic protection. The choice is greatly influenced by the nature of the structure, i.e. pipe, pile, or column.

Suitable coal tar epoxy systems are SK8 for 10 to 20 years, SK7 for 5 to 10 years and SK6 for 2 to 5 years.

The suitability of metallic coatings and other paint systems (which may be desired because they form the

preferred protective scheme of the part of the structure above ground) may vary according to the nature of the soil, and specialist advice is required. Clinker and ashes contain soluble sulphates and unburnt coke, which shorten coating life. In inorganic moderately reducing soils and highly reducing organic soils, zinc coatings usually have paint or plastic finishes, sprayed zinc is preferably sealed. Aluminium coatings are not recommended for direct contact with alkaline clays.

Table 3. Part 14. Encasement in concrete (see note (f))

Steel requires no protection when fully encased in alkaline (uncarbonated) concrete. Protection by sprayed zinc, by galvanizing, or by zinc-rich coatings to BS 4652, type 3, is beneficial in the zone which may become carbonated	(see 13.4 and A.3.5.3). Where the coated steel enters the concrete, a bituminous coating may subsequently be applied usefully at any interface where water may tend to remain (see figure 6).
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Table 3. Part 15. Refrigerated surfaces (down to -30 °C)

The low temperature reduces the corrosion rates but facilitates condensation conditions. Where water is present an effective barrier layer is required on the steel. Sealed or unsealed sprayed-metal coatings and bare galvanizing are generally suitable (e.g. SB1, SC1A, SC1Z, SC5A, SC5Z of table 4).	Typical coating systems include zinc silicate SE1 or two-pack zinc epoxy SD2 for 5 to 10 years; one-pack chemical-resistant paint systems SH4 for 5 to 10 years and SH3 for less than 5 years; and two-pack chemical-resistant systems SK2 for 5 to 10 years and SK1 for less than 5 years. For temperatures below -30 °C specialist advice should be sought.
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Table 3. Part 16. Chemicals

For storage or transport of chemicals specialist advice should be sought. The effect of the coating on the chemical should be considered as well as the protection of the steel. When subject to splashes of acid or alkaline chemicals, painting recommendations are similar to those given in part 7 of this table, except that oil-type paints (systems F and G) should not be used and zinc silicates are not recommended for acid conditions.	Metallic zinc is generally suitable for chemicals when the pH-value is in the range 5 to 12; metallic aluminium is generally suitable when the pH-value is in the range 4 to 9. Only specially formulated two-pack chemical-resistant paints and silicates are suitable for solvents and petroleum products. In splash conditions coal tar epoxy (SK7 for 10 to 20 years, SK6 for 5 to 10 years, SK5 for less than 5 years) or zinc silicate (SE2 for 10 to 20 years) may be suitable.
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Table 3. Part 17. Road (de-icing) salts

Highway authorities recognize that special protection is required for bridge steelwork such as parapets and railings exposed to de-icing salts. For example, galvanizing plus paint is advised in the Department of Transport's Notes for Guidance on the Specification for Road and Bridge Works, published by HMSO London, 1976 (see pages	79 to 88). On the other hand, no provision is made for the special protection of the undersides of bridges against road salts. When, occasionally, de-icing salt can attack such steelwork it is usually the result of accidental blockage of a drain or failure of a deck joint.
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Table 3. Part 18. Abrasion and impact

Galvanized steel is recommended for resistance to abrasion, rough handling, or impact. The thickness of coating should be determined by the surrounding environment and the degree of wear expected. Sprayed metal (sealed or unsealed) also has good resistance and the coating polishes by friction.	For the longest life of paints, an abrasive should be incorporated in the finish, e.g. in SK4 two-pack chemical-resistant. Zinc silicate systems, SE1 for less than 5 years or SE3 or SE4 for 5 to 10 years may also be recommended.
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Table 3. Part 19. Fungi and bacteria

As for the appropriate environment (see parts 1 to 10 of this table) with suitable fungicidal or bactericidal additives to the undercoat and finish of paint systems.

Table 3. Part 20. Notes to table 3.

(a) *Life of zinc coatings.* The life of metallic zinc coatings in typical atmospheres and sea water is shown in figure 1. Life in the atmosphere decreases with increase in sulphur dioxide pollution.

(b) *Thickness of galvanizing.* BS 729 specifies the standard galvanized coating at the equivalent of 85 µm minimum for steel 5 mm thick or more. Thinner steel, automatically galvanized tubes and centrifugal work (usually threaded work and fittings) have thinner coatings. Galvanized coatings thinner than 85 µm minimum are not included in table 3, but where it is desired to use such thinner coatings their lives can be ascertained by reference to figure 1. Thicker galvanized coatings (see 11.1.2) are not specified in BS 729 but the general provisions of that standard apply; the galvanizer should be consulted before specifying.

(c) *Build-up or repair of zinc coatings.* Inadequate thickness e.g. on small components, may be made-up by applying zinc-dust paint to give the total thickness of zinc for the life requirement. Discontinuities and damaged areas may be made good by zinc-spraying, special zinc-alloy solder-sticks or zinc-rich paint.

(d) *Maintenance intervals for metal coatings which are to be painted.* When bare galvanized surfaces or sealed sprayed-metal surfaces are maintained by the use of paint, the future maintenance intervals will be those of the metal-plus-paint system, which is often less than that for the bare metal coating but longer than for a similar paint system applied directly to steel. Unsealed sprayed-metal coatings are usually designed to protect the structure for its required life. Maintenance operations for such coatings are usually more elaborate than for sealed coatings. The systems recommended in table 3 in the 'very long' life category will in general meet the life requirements when maintenance is effected after 20 years. Where there is scope for maintenance of very-long-life coatings before the 20-year period has elapsed, it may be advantageous to undertake such maintenance, especially if the structure is required to last indefinitely. In the more unfavourable combinations of circumstances in one category it may be necessary to blast-clean and recoat the steel (see table 10).

(e) *Sealed and painted metal coatings.* The appearance and life of sprayed-metal coatings is improved by sealing (see 11.2.2). There is no requirement for a measurable overlay of sealer but sealers should be applied until absorption is complete. Sealing is particularly desirable when it is desired to retain the sprayed coating when the surface is eventually to be maintained, and such maintenance requires only the renewal of the sealer. Painting of sprayed-metal coatings is seldom the preferred treatment except when colour, an inert barrier or abrasion resistance is required.

(f) *Contact of metal coatings with concrete.* The alkalinity of concrete makes it unsuitable for direct contact with aluminium and an inert barrier layer should be present. Such a layer is not needed with zinc coatings which react sufficiently with concrete to form only a useful mechanical bond. In the atmosphere an interface of either aluminium or zinc with concrete, soil, etc. benefits from application of an inert layer.

(g) *Sealed zinc-rich coatings.* The appearance of a zinc-rich coating is improved by the application of a suitable sealer coat. Guidance on type of top coat to be used should be obtained from the supplier of the zinc-rich coating.

(h) *Painted galvanized coatings.*

(1) For the less aggressive environments (or for shorter lives than indicated) a single coat of paint (30 µm or more), over pretreatment if specified, is sufficient.

(2) For more aggressive and wet environments two coats of paint (60 µm or more) are used to minimize through-pores.

(i) *Maintenance of painted metal coatings.* The 'life to first maintenance' given in the first column of the table is calculated to allow substantial retention of the metal coating and is suitable for maintenance work designed to retain a metal-plus-paint protective coating. The apparent anomaly in some parts of the table (that metal coatings are recommended 'for very long' life to first maintenance, whilst the same thickness of metal coating plus paint is recommended for 'long' life only) arises from the normal practice of maintaining metal-plus-paint coatings before significant degradation of paint or loss of metal has occurred. (It should be noted that an area of degraded paint can hasten the corrosion of metal by acting as a poultice, particularly on a surface not subjected to washing by rain.) Where it is desired to retain a reasonably intact layer of paint as the basis for maintenance after the recommended life to first maintenance, the initial paint coating should be thicker (typically more than 75 µm). The extra thickness should be in finishing paints rather than in primers or undercoats.

(j) *Painting of surfaces which have not been blast-cleaned.* It is recognized that blast-cleaning is not always possible, but schemes based on lower standards of preparation require maintenance more frequently than do comparable paint coatings over blast-cleaned surfaces.

(k) *Anti-fouling paints.* Special formulations of paints are available to prevent formation of marine deposits on structures. Most anti-fouling paints need to be re-applied every year or two. Zinc and aluminium should not normally be overcoated with copper or mercury compounds.

(l) *Sealers for metal coatings for potable water.* Vinyl or epoxy co-polymer sealers (see table 4C, part 2) are usually used.

(m) *Zinc and aluminium coatings in non-saline water.* The maintenance-free lives given for zinc are for cold scale-forming waters. The maintenance period in non-scale-forming waters will be one category less (Langelier's index is used to calculate whether the water is scale-forming). Choice of aluminium or zinc is often on the basis of pH-value, aluminium for pH < 5 or 6; zinc for pH > 5 or 6. Since the composition of these waters may vary greatly, previous experience or expert advice should be sought. For hot water, specialist advice should be sought.

(n) *Structures for potable water.*

(1) *General.* Coatings used for all structures, including pipes, fittings, tanks and tank covers in contact with potable water, must be non-toxic and must not impart any taste or odour, colour or turbidity to the water, and must not foster microbial growth. The National Water Council maintains a list of approved coatings.

(2) *Tanks.* Small tanks should be galvanized and, if further protection is necessary, high-build bitumen paint should be applied in sufficient coats to give a dry-film thickness of 500 µm.

Tanks too large for galvanizing may be protected as follows.

(i) Prepare the steel surface by blast-cleaning or manual cleaning and apply high-build bitumen paint to give 500 µm dry-film thickness. Alternatively, a hot-applied bitumen coating may be used, although some coatings of this type can support microbial growth.

(ii) Blast-clean and apply an approved high-build chlorinated rubber or cold-cured epoxy resin coating that complies with the potable water requirements above to give a dry-film thickness of 250 µm.

(3) *Tank covers.* The undersides of tank covers should also receive a protective coating.

(o) *Table 3, Parts 7, 8, 9 and 10.* Electrochemical attack can occur in a wet environment if parts of a structure coated with zinc or aluminium are in contact with bare steel or more cathodic metals such as copper. In immersion conditions such as sea-water the anodic zinc or aluminium can be rapidly destroyed. This action can be avoided by electrically insulating the differing parts from each other.

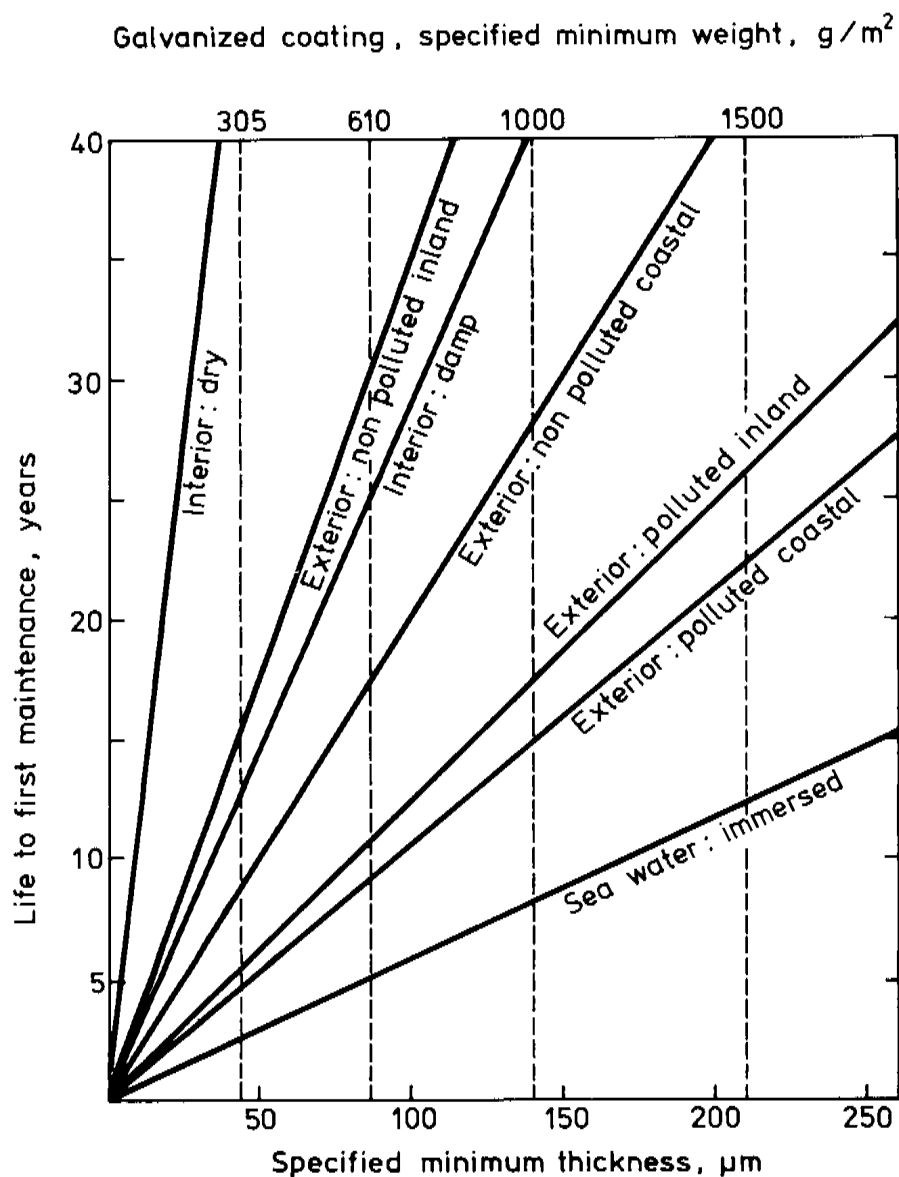


Figure 1. Typical lives of zinc coatings in selected environments

Table 4. Typical coating systems and their components* (see 12.1.4 regarding compatibility)

This table is presented in twelve principal sections, identified as tables 4A, 4B etc., to 4M according to the group key reference letters (see table 2). These main sections are, where applicable, further divided into sub-parts according to the following list.

Table 4A	Product section AP	Blast primers
Table 4B	Group B systems	Zinc coatings other than sprayed-metal
Table 4C Part 1	Group C systems	Sprayed-metal coatings
Part 2	Product section CP	Pretreatments and sealers for sprayed-metal coatings
Table 4D Part 1	Group D systems	Organic zinc-rich systems
Part 2	Product section DF	Organic zinc-rich paints
Table 4E Part 1	Group E systems	Inorganic zinc-rich paints
Part 2	Product section EF	Zinc silicate paints
Table 4F Part 1	Group F systems	Drying-oil-type paints
Part 2	Product section FP	Drying-oil-type primers
Part 3	Product section FU	Drying-oil-type undercoats
Part 4	Product section FF	Drying-oil-type finishes
Table 4G	Group G systems	Silicone alkyd paint over two-pack chemical-resistant primer and undercoat
Table 4H Part 1	Group H systems	One-pack chemical-resistant paints
Part 2	Product section HP	One-pack chemical-resistant primers
Part 3	Product section HU	One-pack chemical-resistant undercoats
Part 4	Product section HF	One-pack chemical-resistant finishes
Table 4J	Group J system	Drying-oil-type primer with one-pack chemical-resistant undercoat and finish
Table 4K Part 1	Group K systems	Two-pack chemical-resistant paints
Part 2	Product section KP	Two-pack chemical-resistant primers
Part 3	Product section KU	Two-pack chemical-resistant undercoats
Part 4	Product section KF	Two-pack chemical-resistant finishes
Table 4L	Group L systems	Two-pack primer and undercoat, overcoated with one-pack chemical-resistant finish
Table 4M	Product section MF	Bitumen and coal tar products

*Notes to table 4 are on a pull-out folder following table 4M. The folder should be extended whilst using any part of table 4 so that all notes are immediately visible when required.

Table 4A: Product section AP. Blast primers (note (c)*)

For airless spray, products AP2A to AP4A may have 2 % less (volume) solids

Reference	Binder	Main pigment	Volume solids (nominal %)	Main pigment in total pigment (weight % min.)	Dry-film thickness; (µm per coat) (advised)	Additional information (see note (c)*) for application method)
AP1A	Two-pack epoxy	Zinc phosphate	25	40	20	See BS 4652 Essential to avoid settlement of pigment
AP1B		Zinc dust	30	95	20	
AP2A	Two-pack polyvinyl butyral	Zinc tetroxychromate	10	85	15	Also has uses other than as a blast primer (see tables 4C and 4D)
AP3A	Two-pack polyvinyl butyral/phenolic	Zinc tetroxychromate	10	85	15	Suspect with cathodic protection if there is any discontinuity in covering system. See also AP2A
AP4A	One-pack polyvinyl butyral/phenolic	Zinc phosphate	22	40	20	Slightly inferior to AP3A
AP4B		Zinc chromate	22	20	20	Slightly inferior to AP3A

*Notes to this table are on a pull-out folder following table 4M. The folder should be extended whilst using any part of table 4 so that all notes are immediately visible when required.

Table 4B. Group B systems. Zinc coatings other than sprayed

For continuously galvanized sheet (BS 2989) or electroplated sheet (BS 3083) see DD 24.

Reference number	Surface preparation	Coating				Remarks
		Zinc coating coating	Number of coats		Nominal system thickness, (µm)	
			Pre-treatment	Paint		
SB1	See BS 729	Galvanize	—	—	85 min.	Factory-applied after fabrication or semi-fabrication. This thickness is applicable to steel 5 mm (or more) thick (see 11.1.2)
SB2	Grit-blast and/or pickle	Galvanize	—	—	140	See 11.1.2. Consult galvanizer before specifying
SB3	Pickle	Galvanize (silicon in steel)	—	—	210	See 11.1.2. Consult galvanizer before specifying
SB4	See BS 729	Galvanize and centrifuge	—	—	43	Centrifuged after galvanizing. Mainly small parts, particularly threaded work. Consult galvanizer if greater thickness desired
SB5	See BS 4921	Sherardize	—	—	15	Factory-applied. Mainly small parts, particularly threaded work. SB5 is BS 4921 class 2 and SB6 is BS 4921 class 1
SB6	See BS 4921	Sherardize	—	—	30	
SB7	See BS 1706 or BS 3382	Zinc plate ZN10	—	—	25	BS 1706 class ZN10. Factory-applied. Small parts. Threaded parts plated to BS 3382 : Part 2 have 4 µm to 9 µm; are not recommended for general use: they would be satisfactory only in dry interiors
SB8	See BS 729	Galvanize (85 µm min.)	(1)	1	85 min. + 30 min.	See note (e) and 11.3 for advice on painting zinc coatings. Pretreatment not necessary for some paints
SB9	See BS 729	Galvanize (85 µm min.)	(1)	2	85 min. + 60 min.	See note (e) and 11.3 for advice on painting zinc coatings. Pretreatment not necessary for some paints

Note 1. SB1, SB4, SB5, SB6 and SB7 usually have average thickness up to 50 % higher than the minimum.

Note 2. *Paint systems for galvanized steel.* Galvanized steel should be degreased prior to applying paints. When galvanizing or zinc plating is supplemented by painting with some specially selected primers, in particular products FP1D, FP1E, FP2C, KP1C, KP1D, no pretreatment other than degreasing is necessary. Before applying most other paints it is necessary to degrease and apply one of the pretreatments listed in the table 4C, part 2. Finishes for use over these pretreatments include those listed in table 4K, part 4 and table 4H, part 4 or (for immersed conditions only) table 4M. Most drying-oil-type paints other than the primers listed above are unsuitable for use over zinc coatings because of possible development of adhesion failure (see 11.3).

Table 4C. Part 1. Group C systems. Sprayed-metal coatings
Applied to components in factory or to complete structures on site

Reference number	Surface preparation	Coating					Remarks
		Metal type	Number of coats			Nominal system thickness* μm	
			Pre-treatment	Sealer (see note (d))	Paint		
SC1A SC1Z SC2A	See BS 2569	Aluminium	—	—	—	100	See note (a)†. Also for use up to 550 °C (see note (b)) See note (a) See note (b) See note (a) See note (a)
		Zinc	—	—	—	100	
		Aluminium	—	—	—	150	
SC2Z		Zinc	—	—	—	150	
SC3A		Aluminium	—	—	—	250	
SC3Z		Zinc	—	—	—	250	
SC4Z		Zinc	—	—	—	350	
SC5A SC5Z SC6A SC6Z SC7A SC7Z SC8Z	See BS 2569	Aluminium	(1)	1	—	100	Pretreatment optional Choice of sealed versus unsealed: see 11.2.2. Choice of sealer: see table 4, part 2. Seal until absorption complete. Note: polyurethane sealer should be compatible with metallic zinc.
		Zinc	(1)	1	—	100	
		Aluminium	(1)	1	—	150	
		Zinc	(1)	1	—	150	
		Aluminium	(1)	1	—	250	
		Zinc	(1)	1	—	250	
		Zinc	(1)	1	—	400	
SC6AH	See BS 2569	Aluminium	—	1	—	175	For use up to 550 °C.
SC9A SC9Z SC10A SC10Z	See BS 2569 See BS 2569 See BS 2569 See BS 2569	Aluminium Zinc Aluminium Zinc	1 1 2 2	— — — —	See 11.3.1 See 11.3.1 See 11.3.1 See 11.3.1	100 + (30 to 100) 100 + (30 to 100) 100 + (60 to 100) 100 + (60 to 100)	See note (b). Inert paint coatings preferred: dry film thickness < 100 μm (see 11.3)

*Nominal thickness for metals given as in BS 2569. Minimum local thicknesses are also given in BS 2569. Zinc coatings thinner than 100 μm and sealed or painted may be specified for short and medium lives in some environments but are not incorporated in table 3.

†Notes to this table are on a pull-out folder following table 4M. The folder should be extended whilst using any part of table 4 so that all notes are immediately visible when required.