

**MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS
VOLUME 1 SPECIFICATION FOR HIGHWAY WORKS**

**SERIES 1900
PROTECTION OF STEELWORK
AGAINST CORROSION**

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**NATIONAL ALTERATIONS OF THE
OVERSEEING ORGANISATIONS OF
SCOTLAND, WALES AND NORTHERN
IRELAND**

Scotland

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denotes a Clause or Sample Appendix which has a substitute National Clause or Sample Appendix for one or more of the Overseeing Organisations of Scotland, Wales or Northern Ireland.

PROTECTION OF STEELWORK AGAINST CORROSION

1901 (05/01) Introduction

1 Surface preparation and protection against corrosion of steelwork shall be carried out in compliance with Clauses 1901 to 1921, using systems appropriate to the information given in Appendix 19/1, Form HA/P1 (New Works) Paint System Sheet (parts 3, 4 and 5) and Appendix 19/2 if applicable, as appropriate to the design and method of fabrication of the components.

2 (05/05) The Manual of Paints for Structural Steelwork, which is included in BD 35 (DMRB 2.4.1), provides data on paints and similar materials for use in the Overseeing Organisation's contracts. The Manual contains item numbers and a summary is also given in Table 19/1.

3 Subject and without prejudice to the Conditions of Contract, the Contractor shall comply with any measures to contain people, plant, materials, dust and debris described in Appendix 19/5.

4 Compliance with sub-Clause 3 of this Clause does not confer immunity from relevant legal requirements.

1902 Surface Preparation - General Requirements

(05/05) Workshop and Site Work

1 (05/05) Before blast cleaning or abrading steel surfaces or before overcoating painted or hot dip galvanized surfaces, contamination by oil or grease shall be removed by wet cleaning the affected areas as described in sub-Clause 1903.9. Unless otherwise described in Appendix 19/5, solvents shall not be used.

2 Clean water which does not leave harmful residues on the surface shall be used for cleaning and rinsing.

3 Only cleaning agents which do not leave harmful residues on the surface after final rinsing shall be used for cleaning.

4 (05/05) Surface preparation shall be continued until the required standard has been achieved. The surfaces are required to be free from condensation, oil, grease, dust residues and detrimental contamination such as chlorides and sulphides. These shall be tested using the procedures of DD ENV ISO 8502-1: 2001, BS EN ISO 8502-2, BS EN ISO 8502-3,

BS EN ISO 8502-4, BS EN ISO 8502-6 and 'BS EN ISO 8502-9, BS 7079-B9'.

5 (05/01) Weld spatter shall be removed from accessible areas which are to be hot dip galvanized or protected by thermally sprayed metal coating or paint. Firmly adhering weld spatter in the heat-affected zone shall be removed before blast cleaning.

6 After dry surface preparation of internal surfaces and before any wet cleaning, all dust and debris shall be removed from accessible areas by sweeping and vacuum cleaning.

7 (05/01) Immediately before application of each coat of paint, the Contractor shall ensure that the surfaces:

- (i) meet the required standard of preparation;
- (ii) are free from harmful residues, including mortar, concrete, dust, grit and paint degradation products;
- (iii) are free from detrimental contamination;
- (iv) are free from moisture detrimental to the coating to be applied.

8 (05/01) Joints, plies and fasteners shall be sealed in compliance with sub-Clauses 1906.27 and 28.

9 Coats of paint shall be free from embedded metallic or other foreign particles including metallic dust. Deposits of adherent matter on metallic coatings or painted surfaces shall be cleaned off immediately they occur. Coatings damaged in the process shall be restored.

10 (05/05) Unless otherwise described in Appendix 19/5, the final workshop coats on external surfaces shall be wet cleaned on site.

1903 Surface Preparation - Materials and Methods

(05/05) Dry Blast Cleaning in the Workshop

1 (05/05) Unless otherwise described in Appendix 19/5, chilled-iron grit complying with 'BS EN ISO 11124-2, BS 7079-E2', high carbon cast-steel or grit complying with 'BS EN ISO 11124-3, BS 7079-E3', with a hardness value greater than 650 HV, non-metallic abrasive such as fused aluminium oxide to 'BS EN ISO 11126-6, BS 7079-F7', almandite

garnet to 'BS 7079-F10, ISO 11126-10', copper slag to 'BS EN ISO 11126-3, BS 7079-F3' or recycled glass complying with BS EN ISO 11126-7 shall be used.

Grades for metallic abrasives shall comply with the following:

Profile (see sub-Clause 1904.1)	Grade
Fine	G050 or S060
Medium	G070 or S100
Coarse	G100 or S120

2 The particle size of metallic abrasive in plant or equipment shall not exceed the maximum for the relevant grade as specified above.

3 (05/01) Before the start of blast cleaning and during blast cleaning the Contractor shall ensure that the abrasive is free from matter which could leave detrimental contamination, as defined in sub-Clause 1904.7, on the surfaces to be coated.

(05/05) Abrading in the Workshop or on Site

4 Any encrusted foreign matter or paint which may be difficult to remove by abrading alone shall be dislodged by scraping, aided by hand or power wire-brushing. This work shall be completed before abrading the areas so affected.

5 (05/01) Abrading shall be carried out using abrasive paper or other material or a flexible abrasive disc mounted on a power driven flexible pad, or a power driven arbor or spindle-mounted flexible abrasive flap wheel. Abrading tools may be used to remove weld spatter. Wet abrading may be employed for the preparation of finishes over sound undercoats, over unsound systems over hot dip galvanizing, or hot dip galvanizing. Wet abrading shall not be allowed to come into contact with exposed thermally sprayed metal coatings.

6 (05/05) All equipment including tools, abrasive sheets, abrasive discs and abrasive wheels shall be of a type, capacity and in a condition appropriate for the work. The use of hard grinding wheels for abrading shall not be permitted.

7 (05/03) A polished appearance caused by polishing in of paint, rust or dirt shall not be acceptable.

8 (05/03) Areas of previously corroded steel or unsound metal coatings, except hot dip galvanizing, which have been prepared by abrading down to bright steel or bright metal coating, and blast cleaned where appropriate, shall be protected by the primer and next coat of paint before any cleaning down or preparation of adjacent surfaces.

(05/05) Wet Cleaning in the Workshop or on Site

9 (05/03) Wet cleaning shall be carried out by scrubbing with a stiff-bristled brush using water and a cleaning agent or a pressure washer. Immediately after cleaning, the surfaces shall be thoroughly rinsed.

(05/05) Dry Cleaning in the Workshop or on Site

10 Surfaces shall be cleaned by scrubbing with a dry stiff-bristled brush.

(05/03) Dry Blast Cleaning on Site Using Dry Air/ Abrasive System

11 (05/01) Metallic abrasives shall comply with sub-Clauses 1, 2 and 3 of this Clause. Metallic grit or aluminium oxide abrasive shall be used for dry blast cleaning of relatively small areas on site which are to be thermally sprayed metal coating, such as at site welds, at areas prepared to clean steel or areas where a thermally sprayed metal coating is to be restored, as indicated in sub-Clause 1905.3(i). The Contractor shall ensure that the grade and particle shape of non-metallic abrasives are adequate for the purpose intended. Excepting for aluminium oxide, non-metallic abrasives shall not be recycled.

(05/03) Wet Blast Cleaning Using Low Pressure Air/ Water/Abrasive System on Site

12 (05/05) Unless otherwise specified in Appendix 19/5 a low-pressure air/water/abrasive system shall be used. The air/water pressure at the nozzle shall not exceed 7.0 kgf/cm² and shall be fully adjustable below this level. The system shall incorporate a mechanical metering device remote controlled by the operator from the nozzle to enable him to regulate from zero to maximum the quantity of non-metallic abrasive being fed into the air/water mixture. During abrasive cleaning, the air, water and abrasive shall be thoroughly mixed and this mixture shall be projected on to the surface to be cleaned through a single bore nozzle or tube. The use of an inhibitor during wet blast cleaning or washing shall not be permitted.

(05/03) Wet Blast Cleaning using High Pressure Water/Abrasive System or Ultra High Pressure Water System on Site

13 (05/03) Unless otherwise specified in Appendix 19/5, the water pressure shall not exceed 562 kgf/cm² for high pressure or between 1750 and 2860 kgf/cm² for ultra high pressure. The system shall incorporate a mechanical metering device controlled by the operator at the nozzle, to regulate from zero to maximum the quantity of non-metallic abrasive being fed into the water.

14 (05/05) Within 60 minutes of wet blast cleaning, the whole of the cleaned surface shall be thoroughly washed using the blast cleaning equipment with air and water. Any further deposits of abrasive on already rinsed surfaces shall be removed in a similar manner also within 60 minutes of being deposited. All accumulated deposits of abrasive and debris on other parts of the structure shall be removed by the same method before the end of the working day. After washing, the surfaces shall be free from all contamination. Tests for freedom from detrimental contamination shall be made after the washing.

Combined Wet/Dry Blast Cleaning on Site

15 (05/05) Wet blast cleaning using the low pressure air/water/abrasive system (in compliance with sub-Clauses 12 and 14 of this Clause) shall be followed, after a minimal interval, by dry blast cleaning in compliance with sub-Clause 11 of this Clause, of all the previously wet blast cleaned areas.

16 (05/03) The specified standard of surface preparation shall have been achieved in full, initially by wet blast cleaning and washing, before any later dry blast cleaning of the same areas to remove flash rusting or to restore the required standard of surface preparation.

Other Requirements

17 (05/03) When surface preparation is to be carried out by dry blast cleaning and, on adjacent surfaces, by wet cleaning and or abrading, then unless otherwise necessary, the wet cleaning and any abrading shall be carried out first.

When combined wet/dry blast cleaning has been specified instead of dry blast cleaning only, the above sequence may be reversed. On completion of the wet blast cleaning part of the process, the areas to be abraded shall be cleaned in compliance with sub-Clause 9 of this Clause except that for rinsing, the wet blast cleaning equipment may be used. The dry blast cleaning part of the process, and dry abrading shall be carried out after any wet abrading required and final rinsing. Any prepared dry metal surface shall be protected from the effects of any further wet method of surface preparation by the application of a minimum 75 microns dry film thickness of paint.

(05/05) Grinding After Surface Preparation in the Workshop or on Site

18 (05/05) Grinding wheels and discs shall be of the size, shape and grade of coarseness appropriate to the particular operation. The speed of revolution shall be appropriate for the work.

19 (05/05) Grinding shall be carried out after surface preparation by other methods, including cleaning down, has been completed, except where it is necessary to achieve a blast profile and this would necessitate blast cleaning after grinding.

20 (05/03) Surfaces prepared by grinding to bright steel shall be protected by the application of the primer and the next coat of paint, including any stripe coats, before cleaning down or other preparation of adjacent surfaces specified in Appendix 19/5 is undertaken.

1904 (05/01) Workmanship Standards for the Surface Preparation of Steel by Blast Cleaning, Abrading, Grinding and Cleaning

1 (05/05) The surface profile to be achieved by blast cleaning, either 'Fine' 'Medium' or 'Coarse' as appropriate, shall be within the limits set by the Surface Profile Comparator for the Assessment of Abrasive Blast Cleaned Surfaces, conforming to 'BS EN ISO 8503-1, BS 7079-C1'.

2 Blast cleaned surfaces shall be virtually free from sharp spikes of parent metal defined as 'rogue peaks' formed by the impact of abrasive particles and which project above the blast cleaning profile. Any 'rogue peaks' which would be detrimental to the protective system shall be removed.

3 (05/05) 'Hackles' and inclusions caused by the rolling process, visible after blast cleaning, which would be detrimental to the protective system, shall be removed. Affected surfaces shall be prepared by grinding or abrading to bright steel in compliance with sub-Clause 1907.1. Sharp edges shall be rounded. If thermally sprayed metal coating is to be applied the surfaces shall then be blast cleaned.

4 Steel surfaces to be prepared by any of the methods described in the Contract shall be such that after surface preparation the surfaces are free from detrimental contamination.

5 Surface preparation by blast cleaning shall be to one or more of the following standards of visual cleanliness:

- (i) (05/05) Sa3 to 'BS EN ISO 8501-1, BS 7079-A1'
- (ii) (05/05) Sa2½ to 'BS EN ISO 8501-1, BS 7079-A1'
- (iii) (05/05) Sa2 to 'BS EN ISO 8501-1, BS 7079-A1'

6 (05/05) Additionally, after surface preparation by blast cleaning to Sa3 or Sa2½ quality the surface profile shall be virtually free from embedded abrasive particles

when viewed through a 10X illuminated magnifying glass. Surfaces assessed as unsatisfactory in this respect shall be blast cleaned again with fresh abrasive. Another abrasive complying with the Specification may be used if necessary.

7 'Harmful residues' or 'detrimental contamination':
Surfaces shall be deemed to be free from 'harmful residues' or 'detrimental contamination' after surface preparation when any such remaining matter will not reduce the required durability of the specified protective system.

8 'Bright steel':
Surfaces free from defects or prepared to this standard by grinding or abrading shall have an overall bright appearance.

1905 (05/01) Workmanship Standards for the Surface Preparation of Coated Steelwork by Blast Cleaning, Abrading, Grinding and Cleaning

1 Before overcoating, surfaces shall be free from:

- (i) (05/05) any visible gloss;
- (ii) any unsound paint down to sound paint;
- (iii) any unsound paint down to Sa3 or Sa2½ quality steel;
- (iv) any unsound paint down to bright steel;
- (v) any unsound paint down to sound metal coating;
- (vi) any unsound paint down to bright metal coating;
- (vii) any unsound metal coating down to sound metal coating;
- (viii) any unsound metal coating down to bright metal coating;
- (ix) any unsound metal coating down to Sa3 or Sa2½ quality steel;
- (x) any unsound metal coating down to bright steel;
- (xi) detrimental contamination.

2 Definitions of terms used in describing the above standards of workmanship are as follows:

- (i) Sa3 or Sa2½ quality, as in sub-Clause 1904.5;
- (ii) 'bright steel', as in sub-Clause 1904.8;
- (iii) 'free from detrimental contamination', as in sub-Clause 1904.7;

(iv) 'bright metal coating' resulting from abrading, a metal coating whose surfaces are free from all corrosion products and of bright appearance overall;

(v) 'unsound metal coating', a metal coating showing signs of disruption, inadequate adhesion or penetration by rust or other corrosion products;

(vi) 'sound metal coating', a metal coating which complies with sub-Clause 1909.2 including such a metal coating which has been blast cleaned but which has a reduced thickness in accordance with sub-Clause 1908.1;

(vii) 'unsound paint', paint showing signs of disruption, rusting through, having inadequate adhesion or covering rust scale, loose rust, loose mill scale or other detrimental products;

(viii) 'sound paint', paint which is sound down to a metal substrate.

3 Definitions of terms used in Clauses 1906, 1907 and 1908 are as follows:

- (i) 'restored' coatings. Unless otherwise described in Appendix 19/5, when paint or similar coatings or thermally sprayed metal coatings are to be restored, the standard of surface preparation and coating material shall comply with the original standard. Damaged or failed paint systems over thermally sprayed metal coating shall be restored using dry blast cleaning. The thickness of any underlying thermally sprayed metal coating or paint coating which may have been reduced in thickness during surface preparation shall be brought up to specification;
- (ii) (05/05) 'restored' surface preparation. Unless otherwise described in Appendix 19/5, the original standard shall be obtained. When further thermally sprayed metal coating is to be applied, the surface of the existing thermally sprayed metal coating shall be restored by dry blast cleaning with metallic grit abrasive or aluminium oxide to metal coating;
- (iii) 'local failure'. An isolated breakdown of a protective coating or system due to extraneous causes excluding mechanical damage.

- 4 Permitted residual thermally sprayed aluminium.
When clean steel is exposed through a metal coating during remedial surface preparation, remnants of sound thermally sprayed aluminium metal coating, which cannot be picked away with a knife blade, may be retained within the blast clean profile.

1906 (05/01) Procedures for Treatment at Joints

(05/05) Fasteners, Joint Material and Parent Material in Joints, Before Assembly or Welding, in the Workshop or on Site

Fasteners, Including Bolts, Nuts and Washers

- 1 Surfaces of uncoated fasteners shall be free from all but traces of oil or grease before assembly.
- 2 Unless otherwise described in Appendix 19/5, threaded fasteners at joints in hot dip galvanized steelwork or in hot dip galvanized steelwork which is to be painted, shall be hot dip galvanized. Hot dip galvanized fasteners which are to be painted shall be treated with an adhesion promoter before assembly.
- 3 Metal coatings on surfaces of fasteners which are to be painted shall be:
 - (i) free from all traces of oil or grease and then treated with an adhesion promoter; or
 - (ii) treated at the same time as the parent material where fasteners are already assembled in compliance with sub-Clause 24 of this Clause.

Fasteners excluding those in (ii) above shall be pressure-rinsed with water and allowed to dry before assembly or packing for delivery at least one hour and not more than four hours after satisfactory application of an adhesion promoter.

- 4 Fasteners which have become difficult to tighten because of corrosion shall be replaced.

Joint Material and Parent Material in Joints

- 5 The standard of initial blast cleaning of joint material and parent material in joints shall be at least equal to that for the parent material. Before a joint is made on site, contact surfaces shall be restored to Sa2½ quality or to sound metal coating.

At Joints Made with High Strength Friction Grip and Tension Control Bolts

- 6 In steelwork painted only overall:
The blast primer applied to the parent material shall be taken 10 mm to 15 mm inside the perimeter of the joints. The outer surfaces and edges of site joint material may, at the option of the Contractor, also be given a coat of the blast primer.

- 7 (05/05) In steelwork with thermally sprayed metal coating at joints only, and painted overall:

Unless otherwise described in Appendix 19/5, the thermally sprayed metal coating shall be applied to the contact surfaces of the joints and to the outer surfaces and edges of joint material. The thermally sprayed metal coating on the contact surfaces of the parent material shall be taken 10 mm to 15 mm outside the perimeter of the joints. The blast primer applied to the parent material shall be taken 10 mm to 15 mm inside the perimeter of the joints. The thermally sprayed metal coating on the outer surfaces and edges of site joint material shall be given a coat of aluminium epoxy sealer (two-pack).

- 8 (05/05) In steelwork with thermally sprayed metal coating overall and sealed only or painted overall:

Unless otherwise described in Appendix 19/5, the thermally sprayed metal coating shall be applied to the contact surfaces of the joints and to the outer surfaces and edges of joint material. The sealer applied to the parent material shall be taken 10 mm to 15 mm inside the perimeter of the joints. The thermally sprayed metal coating on outer surfaces and edges of site joint material shall also be given a coat of aluminium epoxy (two-pack) sealer.

- 9 In steelwork hot dip galvanized only or hot dip galvanized and painted overall:

All material at joints shall be hot dip galvanized. When an adhesion promoter and a first undercoat are applied before a joint is made they shall be taken 10 mm to 15 mm inside the perimeter of the joint; these coats shall also be applied to edges and outer surfaces of the joint material.

- 10 The thickness of a protective paint coat applied to the outer surfaces of joint material prior to assembly of any high strength friction grip or tension control bolted joint shall not exceed 20 microns dry film thickness.

At Non Friction Bolted Joints

- 11 (05/05) At workshop joints in all steelwork other than in hot dip galvanized steelwork the blast primer alone or thermally sprayed metal coating plus sealer shall be applied initially to parent and joint material.

Immediately before assembly of a joint which is to be painted the first undercoat shall be applied to the contact surfaces and the joint made while the paint is wet.

12 (05/05) At site joints in all steelwork other than in hot dip galvanized steelwork unless otherwise described in Appendix 19/2, all surfaces except those of fasteners, shall receive in the workshop the workshop protective system which is applied to the parent material.

13 (05/05) At all joints in hot dip galvanized steelwork, an adhesion promoter and workshop coats may be applied to the joint material before or after workshop joints are made. When hot dip galvanized steelwork is painted on site an adhesion promoter and paint shall be applied to joint material after the joint has been made.

At Welded Joints

14 (05/05) At workshop and site joints in all steelwork, surfaces to be welded shall be restored to Sa2½ quality or to bright steel and shall be free of any protective or other coating immediately prior to welding.

(05/05) Parent Material, Workshop Treatment Adjacent to Joints Which Are to be Assembled or Welded Later on Site

At High Strength Friction Grip and Tension Control Bolted Joints

15 The paint coats, with the exception of the primer or first coat of paint, shall be stepped back at 30 mm intervals commencing 10 mm from the perimeter of the joints.

At Non Friction Bolted Joints

16 (05/05) Unless otherwise described in Appendix 19/5, workshop paint coats are not required to be stepped back.

At Welded Joints

17 Thermally sprayed metal coating shall be kept clear of the weld by a distance of at least 15 times the thickness of the steel in the area to be welded, with a maximum of 300 mm from the joint. The restricted area shall be masked during metal spraying. Hot dip galvanizing shall be removed a minimum of 5 mm back from the edges of weld areas. Paint coats shall be stepped back at 30 mm intervals commencing at least 100 mm from the joint, or from the edge of the thermally sprayed metal coating, starting with the 2nd coat of paint.

At Completed Joints

18 Within 14 days of a joint being completed, exposed surfaces of parent and joint material shall be prepared in compliance with sub-Clauses 19 to 23 of this Clause and fasteners in compliance with sub-Clauses 24 to 26 of this Clause.

At Bolted Joints

19 (05/05) In steelwork painted only overall, blast cleaned only or primed surfaces shall be prepared by dry blast cleaning to restore or provide the required standard of surface preparation, for workshop or site work as appropriate.

20 In steelwork with thermally sprayed metal coating at joints only, and painted overall, primed or sealed thermally sprayed metal coatings shall be prepared by dry blast cleaning to restore the surfaces to the required standard.

21 In steelwork with thermally sprayed metal coating overall, and sealed only or painted overall, thermally sprayed metal coatings shall be prepared as described in sub-Clause 20 of this Clause.

22 In steelwork hot dip galvanized only or hot dip galvanized and painted overall the surfaces shall be free from contamination detrimental to paint coats by wet cleaning.

At Welded Joints

23 (05/05) In all steelwork, welds shall be prepared by the methods and to the standards described in sub-Clause 1911.6 or Appendix 19/2 for workshop or site work as appropriate. Surfaces of areas adjacent to the weld shall be similarly prepared. For site welds in hot dip galvanized steelwork, surfaces shall be treated in accordance with sub-Clause 1907.8.

Surfaces of Fasteners

24 Uncoated and temporarily coated fasteners shall be free from all but traces of oil and grease and blast cleaned to Sa2½ quality, medium profile, before painting.

25 Metal coated fasteners which have been treated with an adhesion promoter before assembly shall be dry cleaned after final surface preparation of the joint and then painted.

26 Fasteners which are to receive thermally sprayed metal coating after assembly shall be blast cleaned to Sa3 quality, medium profile, with chilled iron grit, cast steel grit or aluminium oxide.

Sealing at Joints or Plies

27 Bolted joints or built-up sections shall be free from any water which has penetrated the plies.

When drying out has been completed or when surfaces are dry after surface preparation, fine gaps around the perimeter of joints or along plies shall be sealed by successive application of undercoat paint. All wider gaps shall be sealed with a proprietary sealant compatible with the paint system.

Sealing of Gaps at Nibs of Load Indicating Fasteners or Washers

28 Gaps shall be sealed by brush application of primer and successive undercoats, of the types used on adjacent areas.

1907 (05/01) Procedures for Treatment at Areas of Mechanical Damage or Other Surface Defects

1 (05/05) Score marks, other surface defects and indentations in the surface of a steel substrate or of a metal coating shall be treated by abrading or grinding to bright steel or bright metal coating, to produce a surface without sharp edges or abrupt change in contour. Damage to unprepared surfaces shall be treated before blast cleaning. A blast cleaning profile shall be restored on areas to be thermally metal sprayed but not necessarily areas to be painted only. Other surface defects in the steel substrate, including fissures caused by the removal of 'hackles' or inclusions described in sub-Clause 1904.3, shall be similarly treated.

2 In the case of damage to paint coatings only, surface preparation shall be by blast cleaning or abrading. The paint coatings shall then be restored.

3 (05/05) When a two-pack Epoxy paint system is restored over a steel substrate prepared by abrading, the adhesion of the first paint coat to the substrate shall be checked in accordance with 'BS EN ISO 4624, BS 3900-E10' or BS EN 22063 Annex A method 1, before overcoating with the next coat in the system. The first coat over abraded surfaces shall be an aluminium epoxy (two-pack) primer.

4 When an area of a thermally sprayed metal coating is to be restored after surface preparation by abrading or grinding, any affected thermally sprayed metal coating or exposed steel substrate shall be dry blast cleaned immediately before further application of thermally sprayed metal coating.

5 (05/05) In the workshop, a damaged thermally sprayed metal coating, together with any damaged sealer or paint coats, shall be restored.

6 On site, with the exception of the small areas, relative to the size of the component, permitted under sub-Clause 7 of this Clause, a damaged thermally sprayed metal coating, together with any damaged sealer or paint coats shall be restored but with a minimum thickness of 150 microns of thermally sprayed metal coating.

7 On site, small areas of isolated damage in a thermally sprayed metal coating plus paint system, need not be restored; after surface preparation in compliance with sub-Clause 1 of this Clause, the thermally sprayed metal coating shall be replaced by 100 microns of the first undercoats, omitting the sealer. Adjacent paint coats, excluding the sealer shall then be restored over the repaired area.

8 (05/05) In the workshop, in the case of hot dip galvanizing only, small isolated areas of up to 40 mm², and not exceeding 0.5% of the total surface area of the component, whichever is the lesser, may after surface preparation, be repaired with low melting point zinc alloy, providing that the total area of any damage on a component does not exceed 0.5% of the total surface area of the component. Components with damaged areas greater than the above limits shall be regalvanized.

Isolated areas of damage larger than 40 mm² in hot dip galvanizing which is to be painted later or which has already been painted may be repaired with low melting point zinc alloy after surface preparation. Alternatively the whole of the affected area including exposed steel substrate shall, after surface preparation, be given a coat of an adhesion promoter, which, when wet cleaned in accordance with sub-Clause 1903.9 and finally dry, shall be overcoated with two coats of Zinc Phosphate High Build Quick Drying Epoxy (2-pack) blast primer or Extended Cure Epoxy (2-pack) primer, minimum dry film thickness of 70 or 75 microns each. An adhesion promoter shall not be applied over existing paints.

9 On site, surfaces of hot dip galvanized components found to have minor damage shall be prepared in accordance with sub-Clause 8 of this Clause and coated with zinc-rich primer of 75 microns minimum dry film thickness, complying with BS 4652. Alternatively, the components shall be regalvanized.

10 In all cases where paint coats only are to be restored, or thermally sprayed metal coatings replaced or restored, or hot dip galvanizing is to be replaced by paint, the edges of paint coatings or metal coating adjacent to the affected area shall be bevelled back into sound paint or metal coating. This work shall be carried out before any final blast cleaning described in sub-Clause 4 of this Clause.

11 An adhesion promoter applied outside the areas to be overcoated shall be removed immediately by wet cleaning.

12 (05/05) In the workshop exposure and overcoating times shall not exceed those specified in Clause 1914.

On site overcoating shall be started immediately after surface preparation of the affected area and before any deterioration in the standard of the prepared surface occurs, and continued as soon as each coat is dry enough for overcoating.

1908 (05/01) **Procedures for Treatment of Local Failure in Protective Coatings**

1 (05/05) In the workshop, failed paint coatings and failed thermally sprayed metal coating shall be restored. Abrading down to sound paint only is permissible. If a thermally sprayed metal coating is damaged or reduced to less than 80% of the specified minimum thickness during abrading, it shall be restored.

2 On site, failed paint coatings and thermally sprayed metal coatings shall be restored except that:

- (i) abrading down to sound paint or to bright steel; or
- (ii) blast cleaning to Sa2½ quality

are permissible methods of surface preparation when restoring paint systems over a steel substrate.

3 (05/05) In the workshop and on site, hot dip galvanized components showing signs of failure, eg blisters and rust, of the coating shall be regalvanized.

4 (05/05) In the workshop and on site, failed paint coatings over hot dip galvanizing shall be restored. Surface preparation of affected areas shall be by abrading. Areas of sound hot dip galvanizing exposed through a paint system shall be abraded only as necessary to ensure satisfactory application of an adhesion promoter and paint. If the hot dip galvanizing is damaged or reduced to less than 80% of the specified minimum thickness during abrading, the component shall be regalvanized.

5 Sub-Clauses 1907.3, 4, 10, 11 and 12 shall be complied with.

1909 (05/01) **Metal Coatings**

Hot Dip Galvanized Coatings

1 Hot dip galvanized coatings shall, unless otherwise described in Appendix 19/5, comply with BS EN ISO 1461 and with the following:

- (i) Inhibited hydrochloric acid with a strength not exceeding 18% and within a temperature range of 15°C to 25°C or inhibited sulphuric acid with a strength not exceeding 18% and within a temperature range of 60°C to 80°C shall be used for pickling.
- (ii) Components shall not be immersed in the pickling acid longer than is necessary for cleaning the surfaces prior to hot dip galvanizing. Components shall receive a fresh water rinse between pickling and the galvanising bath.
- (iii) The surfaces of components to be hot dip galvanized shall be dried before immersion in the molten zinc.
- (iv) When an aqueous flux is to be used, all traces of acid shall be washed off immediately after pickling.
- (v) Hot dip galvanized coatings shall be relatively smooth, continuous and free from flux staining.
- (vi) Detrimental surface contamination of hot dip galvanized coatings which are to be painted shall be removed by wet cleaning in compliance with sub-Clause 1903.9. Surfaces to be painted shall not receive chromate passivation treatment.
- (vii) Vent holes drilled in hollow sections prior to hot dip galvanizing shall be plugged after hot dip galvanizing and before any painting.

Thermally Sprayed Metal Coatings

2 Thermally sprayed metal coatings shall, unless otherwise described in Appendix 19/5, comply with BS EN 22063 and with the following:

- (i) (05/05) Aluminium coating shall be of a material with minimum quality in accordance with type A1 99.5 (1050A) of ISO 209-1. Zinc coating shall have a composition in accordance with type Zn 99.99 of ISO 752.
- (ii) The thickness of the coating shall be not less than 100 microns.
- (iii) The strength of adhesion of thermally sprayed metal coatings shall not be less than the following:

Aluminium	50 kgf/cm ²
Zinc	50 kgf/cm ²
- (iv) Thermally sprayed metal coatings shall be applied continuously over each 0.5 m² per

gun or the area of the component whichever is the lesser until the specified thickness has been achieved.

- (v) (05/05) The application of thermally sprayed metal in separate layers shall not be permitted.
- (vi) All surfaces to be thermally metal sprayed, including that of the reference panel having equivalent hardness to that of the parent material, shall be blast cleaned with chilled iron grit or high carbon cast-steel grit with a hardness value greater than 650 HV, or aluminium oxide with a hardness value greater than 9 Mohs, and the standard shall be Sa3 quality, medium profile.
- (vii) Thermally sprayed metal coatings shall be de-nibbed.

Sherardized Coatings

3 Sherardized coatings shall, unless otherwise described in Appendix 19/5, comply with Class 1, Table 1 of BS : 4921.

Electroplated Coatings

4 (05/05) Electroplated coatings shall, unless otherwise specified in Appendix 19/5, comply with BS 3382-1 and BS 3382-2. Additionally BS 3382-1 and BS 3382-2 shall be deemed to cover the electroplating of components up to and including 36 mm in diameter. Electroplated surfaces which are to be painted shall not receive chromate passivation treatment.

Other Requirements

5 When a metal coating is required on only part of a component it shall be applied before the rest of the component receives paint.

6 Electroplated items under torque or tension conditions shall be stress relieved by heat treatment at appropriate temperature and time to prevent failure by hydrogen embrittlement.

1910 (05/01) Testing of Metal Spray Coatings

1 (05/03) At the start of the Works, and subsequently at intervals scheduled in Appendix 1/5 (with the exception of coatings on steel in bearings, curved surfaces, repairs to mechanical damage, local failure of thermally sprayed metal coating at site joints or areas restored on site), the Contractor shall demonstrate by means of a tensile test in accordance with BS EN 22063, that the minimum adhesion requirement is being attained as detailed in sub-Clause 1909.2 (iii).

In the excepted areas, the Contractor shall demonstrate that the adhesion is satisfactory by means of grid tests in accordance with BS EN 22063. Areas affected by the tests shall be restored in accordance with Clause 1907.

2 The tensile tests shall be carried out initially on flat panels 150 mm x 150 mm x 6 mm which are of the same grade of steel as the parent material and which before blast cleaning had the same surface condition. The panels shall be blast cleaned and thermally metal sprayed together with the parent material to the same standard and using the same technique.

3 The Contractor shall ensure that adhesion tests have been carried out satisfactorily before any further work continues.

4 If the adhesion requirement on any test panel is not met, the Contractor shall carry out a further test on the parent material adjacent to the panel position. In the case of adhesion failure on the steelwork itself by either method of test, unsound thermally sprayed metal coating shall be restored and the tests repeated.

5 If more than two local areas of faulty adhesion occur on any one component, the whole of the thermally sprayed metal coating on the component shall be considered as having failed, and it shall be restored. Sub-Clause 1905.4 is not applicable in the case of adhesion failure.

#1911 (05/01) Paint and Similar Protective Coatings

General

1 (05/05) The term paint shall be deemed to refer to protective coatings in general.

2 (05/05) The paints permitted for use by the Overseeing Organisation in the Works are listed in the Manual of Paints for Structural Steelwork which is included in BD 35 (DMRB 2.4.1) and which also contains details of the quality assurance scheme for paints and similar protective coatings. All paints shall have a current BBA HAPAS Roads and Bridges Certificate or equivalent.

3 (05/05) All paints shall be supplied in sealed containers of not more than 25 litre capacity and these shall be used in order of date of manufacture and batch number. Each container shall have a completely removable lid and be clearly marked on the side to show the name of the manufacturer, registered description of the material (including purpose, e.g. whether primer, undercoat or finish), colour, Item No, paint manufacturer's reference number, batch number and date of manufacture. Where date of manufacture is coded, the Contractor shall provide the code key. In

addition paints shall be supplied in sealed containers of no greater than 5 litre capacity for testing purposes in accordance with Clause 1912, for 'A' samples.

4 (05/05) The Contractor shall ensure that the properties of the paints he has selected are suitable for the atmospheric conditions in the workshops and on site, including temperature and humidity, and that he is able to apply the paints satisfactorily to all parts of the structure in these conditions.

5 (05/05) Unless otherwise described in Appendix 19/5, all paints forming any one protective system or overlapping systems shall be obtained from the same manufacturer, as named by the Contractor in Appendix 19/1 Form HA/P1 (New Works) Paint System Sheet.

(05/05) **Surface Preparation and Protective Systems for Steelwork Except Bearings, CCTV Masts, Cantilever Masts and Steel Lighting Columns and Bracket Arms**

6 (05/05) Protective systems

Note: mdft = minimum dry film thickness
 B = apply by brush
 AS = apply by airless spray
 HB = High Build (dft: above 75 µm)
 NB = Normal Build (dft: between 50
 and 75 µm)
 LB = Low Build (dft: below 50 µm)

- (i) (05/05) Item numbers in the Protective Systems are listed in the Manual of Paints for Structural Steelwork at Annex A of BD 35 (DMRB 2.4.1) and a summary is shown in Table 19/1.
- (ii) (05/05) Details of Surface Preparation and Protective Systems for Steelwork Except Bearings, CCTV Masts, Cantilever Masts and Steel Lighting Columns and Bracket Arms are given in Table 19/2A and 19/2B.

Surface Preparation and Protective Systems for Steel in Bridge Bearings (and Metal Coated Fasteners)

7 (05/05) Details of surface preparation are given in Table 19/3A and the protective system Type V is given in Table 19/3B.

TABLE 19/1: (05/05) BD 35 Quality Assurance Scheme for Paints and Similar Protective Coatings Annex A Manual of Paints for Structural Steelwork

Current Paint Item Numbers

Item	Description	Coat Type	Build	Applied by
14	Zinc Phosphate Epoxy Ester (single-component)	Primer/Undercoat	LB or NB	B or AS
32	MIO Modified Phenolic (single-component)	Undercoat	LB	B or AS
35	MIO Modified Phenolic (single-component)	Undercoat/Finish	LB	B or AS
47	MIO Phenolic (single-component)	Undercoat	LB	B or AS
50	MIO Phenolic (single-component)	Undercoat/Finish	LB	B or AS
70	Silicone Alkyd (single-component)	Finish	LB	B or AS
74	Silicone Alkyd (single-component)	Undercoat	LB	B
			NB	AS
110	Zinc Phosphate Epoxy (two-pack)	Blast Primer/Sealer	LB	B or AS (B to small areas only)
111	Zinc Phosphate High Build Quick Drying Epoxy (two-pack)	Blast Primer	HB	AS (B to small areas only)
112	MIO High Build Quick Drying Epoxy (two-pack)	Undercoat/Finish	HB	AS
113	Water based epoxy primer for blast cleaned internal surfaces (two-pack)	Primer	HB	B or AS
114	Water based epoxy undercoat/sheen finish for internal use (two-pack)	Undercoat/Sheen Finish	HB	B or AS
115	High Build Aluminium Epoxy (two-pack)	Surface tolerant maintenance (e.g. for abraded surfaces)	HB	B or AS
116	High Build Epoxy (2-pack)	Surface tolerant maintenance undercoat	HB	B or AS
121	Extended Cure Epoxy MIO (two-pack)	Primer, Undercoat and/or Finish	HB	AS (B to small areas only)
123	High Build Glass Flake Epoxy (two-pack)	Undercoat for blast cleaned steel new construction	HB	AS (stripe coats and small repairs only by brush)
124	High Build Glass Flake Polyester (two-pack)	Undercoat for blast cleaned steel new construction	HB	AS (stripe coats and small repairs only by brush)
132	Vinyl/Vinyl Copolymer MIO Zinc Phosphate (single-component)	Primer	NB or HB	B
133	Vinyl/Vinyl Copolymer Zinc Phosphate (single-component)	Primer	NB or HB	B
134	Vinyl/Vinyl Copolymer MIO Zinc Phosphate (single-component)	Primer/Undercoat/Finish	NB or HB	B
135	Vinyl/Vinyl Copolymer Sheen Finish (single-component)	Finish	NB or HB	B

(05/05) Notes:

- 1 Colour reference shall be as per the manufacturer's declared colour given with reference to BS 4800 and/or BS 381C where appropriate.
- 2 Dry Film Thickness (dft) range shall be as per the manufacturer's data sheet. The minimum dry film thickness of the paint coats and paint system shall be as per the protective systems detailed in Tables 19/2 to 19/4 where given.

TABLE 19/1: (05/05) BD 35 Quality Assurance Scheme for Paints and Similar Protective Coatings Annex A Manual of Paints for Structural Steelwork (continued)

Item	Description	Coat Type	Build	Applied by
141	Thixotropic Bitumen (single-component)	Primer/Finish	HB	B or AS
150	Pitch Epoxy (two-pack) Polyamide Cured	Undercoat/Finish	HB	B or AS
151	High Build Epoxy (two-pack) Hydrocarbon Resin Modified	Finish	HB	B or AS
155	'T' Wash	Adhesion promoter for hot dip galvanized steel	LB	B
156	Ultra low VOC adhesion primer (single-component)	To promote substrate adhesion properties of coating systems for hot dip galvanised steel, aluminium and stainless steel surfaces	LB	B or AS
157	Adhesion promoting (single-component)	To promote substrate adhesion properties of coating systems for hot dip galvanised steel, aluminium and stainless steel surfaces	LB	B or AS
159	Aluminium Epoxy (two-pack)	Sealer/Primer	LB	B or AS
160	Red Oxide Moisture Cured Polyurethane (single-component)	Primer/Blast Primer for maintenance or new works	LB	B or AS
162	MIO Moisture Cured Polyurethane	Undercoat/Finish	NB or HB	B or AS
164	Moisture Cured Polyurethane (single-component)	Semi-gloss Finish	LB	B
			NB	AS
168	Polyurethane (two-pack)	Gloss Finish	LB	B
			NB	AS
169	Polyurethane (two-pack)	Semi-gloss Finish	NB	B (small areas by brush)
			HB	AS
185	Organic Modified Polysiloxane (two-pack)	Gloss Finish for new works or maintenance	NB	B
			HB	AS
200	Grease Paint	Primer		B (AS for difficult access areas)
201	Grease Paint	Undercoat/Finish	HB	B or AS

(05/05) Notes:

- 1 Colour reference shall be as per the manufacturer's declared colour given with reference to BS 4800 and/or BS 381C where appropriate.
- 2 Dry Film Thickness (dft) range shall be as per the manufacturer's data sheet. The minimum dry film thickness of the paint coats and paint system shall be as per the protective systems detailed in Tables 19/2B, 19/3B and 19/4C where given.

TABLE 19/2A: (05/05) Requirements For Bridges, Parapets and Other Highway Structures Except Bearings, CCTV Masts, Cantilever Masts and Steel Lighting Columns and Bracket Arms**Surface Preparation and Protective Systems**

Surface preparation			Protective systems (given in Table 19/2B)
(i) Bridge steelwork, fabrication stage			
Area Description	Method	Surface Standard	Type
Area A Exterior main surfaces, including shop welds	Blast clean with chilled iron grit or aluminium oxide grit	Sa3, Medium profile	I for Ready Access II for Difficult Access
Area B Interior of box girder surfaces, except area C, but including shop welds	Blast clean with metallic abrasive	Sa2½, Medium profile	III
Area C Contact surfaces of parent material at high strength friction grip and tension control bolted joints	Blast clean with chilled iron grit or aluminium oxide grit	Sa3, Medium profile	Thermally sprayed metal coating: Aluminium metal spray
Area D High strength friction grip and tension control bolted joints. Contact and outer surfaces of joint material	Blast clean with chilled iron grit or aluminium oxide grit	Sa3, Medium profile	Contact surfaces: Thermally sprayed metal coating: Aluminium metal spray Outer surfaces: I for Ready Access II for Difficult Access
(ii) Bridge steelwork, erection stage			
Area E Exterior surfaces of site welds and weld affected areas	Remove slag, wire brush, wet clean and blast clean as Area A	Sa3, Medium profile	I for Ready Access II for Difficult Access
Area F Interior surfaces of site welds and weld affected areas	Remove slag, wire brush and wet clean	Sa2	1st Coat: Zinc or ferrous based phosphate solution followed by Type III (as 2nd and 3rd Coats)
(iii) Parapets.			
Area G All surfaces, subject to accessibility	Pickling for hot dip galvanizing	In accordance with Clause 1909	IV

TABLE 19/2B: (05/05) Requirements for Bridges, Parapets and Other Highway Structures Except Bearings, CCTV Masts, Cantilever Masts and Steel Lighting Columns and Bracket Arms**Protective Systems**

Type		Metal Coating	1st Coat	2nd Coat	3rd Coat	4th Coat	Minimum total dry film thickness of the paint system (microns)
I	Item No		111	112	168 or 164		300
	Min dry film thickness (µm)				50 or 40		
II	Item No	Aluminium metal spray	159	111	112	168 or 164	300
	Min dry film thickness (µm)		12-20 m ² /litre			50 or 40	
	Item No		110	123	168 or 164		475
	Min dry film thickness (µm)				50 or 40		
III	Item No		111	112			200
	Min dry film thickness (µm)			100			
IV	Item No	Hot dip galvanize	155	110 or 121	112 or 121	168 or 169	175
	Min dry film thickness (µm)					50	

Application instructions

(a) (05/05) Parapets.

Type IV: For parapets to be erected in a Marine environment, Item 155, the 2nd and 3rd coats shall be applied in the workshop; the 4th coat may be applied in the workshop or on site. For parapets in an Inland environment, Item 155 and coats of paint may be applied in the workshop or on site.

(b) (05/05) Areas A, D and E.

Item 159 shall not be over-applied and shall not be included in the overall thickness of the protective paint system.

Fasteners

Unless otherwise specified on the Drawings, bolts nuts and washers in bridge steelwork shall be supplied zinc electroplated or hot dip galvanized. After the joints are made, they shall be prepared and protected as for the joint material.

Paint suppliers

Paints for any one system shall be obtained from the same manufacturer.

Notes:

- (05/05) The finish coats in Type I and II protective systems above are either gloss coats (Item 168) or semi-gloss coats (Item 164). When a low sheen finish is required, e.g. fascia of a sign gantry, the semi-gloss or gloss finish shall be replaced by Item 169.
- (05/05) Type II incorporating Item 123. The completed system shall be tested for pinholes using a spark test over the whole of the coating area. The test current selected shall be in accordance with the coatings dielectric strength and/or the coating thickness in accordance with ASTM G 62-87.
- (05/05) Type I, Type II and Type IV: A finish coat may need to be applied in the workshop to comply with the maximum overcoating times for the preceding epoxy MIO undercoat (Item 112 or Item 121). In such circumstances an additional finish coat shall be applied on site to meet the requirements of sub-Clause 1914.9. Prior to applying the additional finish coat on site any damage to the paint system shall be treated in accordance with the requirements of Clause 1907 and the surface of the workshop applied finish coat shall be prepared by light abrading and wet cleaning.

**TABLE 19/3A: (05/05) Requirements for Steel in Bridge Bearings (and Metal Coated Fasteners)
Surface Preparation**

Area Description	Method:	Surface Standard:
<p>Area A Exterior surfaces, excepting wearing surfaces but including a 25mm minimum return on areas of top bearing plates or base plates in contact with grout or mortar</p>	Blast clean with chilled iron grit	Sa3, Medium profile
<p>Area B Central area of top bearing plates in contact with grout or mortar</p>	Blast clean with metallic abrasive	Sa2½, Medium profile
<p>Area C Areas of top bearing plates or base plates in contact with structural steel components</p>	Blast clean with chilled iron grit	Sa3, Medium profile
<p>Area D Exposed workshop fasteners in components to be coated after assembly</p>	Blast clean with chilled iron grit	Sa3, Medium profile
<p>Area E Concealed workshop fasteners</p>	No requirement	No requirement
<p>Area F Site fasteners for fixing bearings to piers or abutments and for fixing bridge components to bearings</p>	Restore metal coating as necessary to specified standard of cleanliness	Restore metal coating as necessary to specified standard of cleanliness

**TABLE 19/3B: (05/03) Requirements for Steel in Bridge Bearings (and Metal Coated Fasteners)
Protective System Type V**

Applied over		Metal Coating	1st Coat	2nd Coat	3rd Coat	4th Coat	Minimum total dry film thickness of the paint system (microns)
Area A and D	Item No	Aluminium metal spray	110 or 159	111	112	164 or 168	250
	Min dry film thickness (µm)	150	12-20 m ² /litre		100	40 or 50	
Area B	Item No		112				100
	Min dry film thickness (µm)		100				
Area C	Item No	Aluminium metal spray	159				
	Min dry film thickness (µm)	150	12-20 m ² /litre				
Area E							
Area F	Item No	Zinc electroplating or hot dip galvanising	155	110	121	164 or 168	250
	Min dry film thickness (µm)				100	40 or 50	
<p>Application instructions</p> <p>(a) Area A and D 4th coat for bearings for steel bridge beams, brush applied on site; colour to match finish on main steelwork Aluminium metal spray plus Items 110 or 159 are required on interfaces of machined surfaces of spreader plates and of bearing</p> <p>(b) (05/03) Areas A, B, C and D. Aluminium metal spray, Items 110 or 159, 111 and 112 shall be applied at the bearing manufacturer's works. Item 164 or 168 shall be applied on site. Items 110 or 159 shall not be over-applied and shall not be included in the overall thickness of the protective paint system.</p> <p>(c) Area F Item 155 shall be applied on site, either before or after erection, to surfaces to be painted. Item 155 coming into contact with adjacent paint coats shall be removed immediately. The remaining site coats shall be applied to exposed surfaces after erection.</p> <p>(d) Stripe coats for bearings only: (stripe coats are not required for bearing site fasteners). A single stripe coat in Item 112 paint shall be applied over Item 111 at the bearing manufacturer's works. A second stripe coat in Item 112 shall be applied on site. Item 112 coats shall be in contrasting shades, e.g., medium grey, natural grey.</p> <p>(e) Site coats shall be applied by the Contractor.</p> <p>Paint suppliers (05/03) The requirements of Clause 1920 shall be noted.</p>							

Note: (05/03) When completing Appendix 19/1, the appropriate finish paints shall be selected from the protective system. The letter references, A, B, C etc shall be varied as appropriate, and the application instructions arranged to suit.

(05/05) Surface Preparation and Protective Systems for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms

8 (05/05) General

- (i) Details of protective systems A1, G1, A2a and G2a, A2b and G2b are given in Tables 19/4A, B & C.
- (ii) (05/05) In the case of protective systems A2a and G2a, A2b and G2b the Contractor may opt to apply the finishes in the workshop or at site, unless otherwise specified.
- (iii) When a white or pale tint finish is specified, an additional coat of Item 164, 168 or 169 may be required to ensure complete obliteration of the Item 112 Undercoat.
- (iv) Type A1, A2a and A2b protective systems are based on aluminium metal spray.
- (v) Type G1, G2a and G2b protective systems are based on hot dip galvanizing.

Note: In these protective systems the protection for the ends of flange mounted masts and columns which are built over or protected by a plinth is assumed to be the same as for the ground section of planted masts and columns.

- (vi) (05/05) Unless otherwise stated in Appendix 19/5 the nominal 'ground' or 'plinth level' shall be assumed to be at a distance of 600 mm below the door opening.

9 (05/05) Protective system

TABLE 19/4A: (11/03) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Systems

System	Environment	Access
A1	Inland	Ready
A2a and A2b	Inland Marine	Difficult Ready or Difficult
G1	Inland	Ready
G2a and G2b	Inland Marine	Difficult Ready or Difficult

TABLE 19/4B: (05/05) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Surface Preparation

System A1, A2a and A2b		
Location	Method	Surface Standard
External surface:	Aluminium Metal Spray	Sa3, Medium profile
Flange mounted and planted masts and columns, overall treatment.	Blast clean with chilled iron grit or aluminium oxide grit.	
Internal surfaces:	Hot dip galvanize	
Flange mounted masts and columns, flange to door area. Planted masts and columns, ground section to door area		
System G1, G2a and G2b		
Location	Method	Surface Standard
External and internal surfaces:	Hot dip galvanize	
Flange mounted and planted masts and columns, overall treatment		

TABLE 19/4C: (11/03) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Protective Systems

Type			Metal Coating	1st Coat	2nd Coat	Minimum total dry film thickness of the paint system (microns)	
A1	(i) External surfaces						
	Flange mounted and planted masts and columns, overall treatment	Item No	Aluminium metal spray	159			
		Application rate		12-20 m ² /litre			
	Ground section, additional coat	Item No			150 or 151		120/180
		Min dry film thickness (µm)					
	(ii) Internal surfaces						
	Flange mounted masts and columns, flange to door area. Planted masts and columns, ground section to door area	Item No		110	150 or 151		175/200
		Min dry film thickness (µm)			125		
	(iii) Application Instructions		<p>(05/05) Blast cleaning, aluminium metal spray and all workshop paint coats on external surfaces shall be returned on to edges at ends, at door and other openings and 25mm under base flange.</p> <p>(05/05) All paint coats shall be applied in the workshop.</p> <p>Item 159 shall be overcoated within 96 hours.</p> <p>On external surfaces Item 150 or 151 shall be applied from the bottom to 250mm above ground level.</p> <p>On internal surfaces Items 110 and 150 or 151 shall be applied from the bottom to 300mm above the door opening.</p>				

TABLE 19/4C: (11/03) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Protective Systems (continued)

Type		Metal Coating	1st Coat	2nd Coat	3rd Coat	Minimum total dry film thickness of the paint system (microns)	
A2a	(i) External surfaces						
	Flange mounted masts and columns, overall treatment	Item No	Aluminium metal spray	110 or 159	112	164 or 168	200
		Min dry film thickness (µm)		25		40 or 50	
	Planted masts and columns, for upper section only	Item No	Aluminium metal spray	110 or 159	112	164 or 168	200
		Min dry film thickness (µm)		25		40 or 50	
	Planted masts and columns, for ground section	Item No	Aluminium metal spray	110 or 159	112	150	260
		Min dry film thickness (µm)		25	125		
	(ii) Internal surfaces						
	Flange mounted masts and columns, flange to door area. Planted masts and columns, ground section to door area	Item No		110 or 159	150 or 151		175
		Min dry film thickness (µm)	Hot dipped galvanised	25	150		
(iii) Application Instructions		<p>(05/05) Blast cleaning, aluminium metal spray and all workshop paint coats on external surfaces and site paint coats where access permits shall be returned on to edges at ends, at door and other openings and 25mm under base flange.</p> <p>(05/05) All paint coats except Items 164 and 168 shall be applied in the workshop. Items 164 and 168 may be applied in the workshop or on site.</p> <p>Item 110 or 159 shall be overcoated within 96 hours.</p> <p>On internal surfaces Items 110 or 159 and 150 or 151 shall be applied from the bottom to 300mm above the door opening.</p> <p>For planted masts and columns:</p> <p>On external surfaces Item 150 shall be applied from the bottom to 250mm above ground level.</p> <p>Item 164 or 168 shall be applied down to 225mm above ground level, overlapping Item 150 by 25mm.</p>					

TABLE 19/4C: (11/03) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Protective Systems (continued)

Type			Metal Coating	1st Coat	2nd Coat	3rd Coat	Minimum total dry film thickness of the paint system (microns)	
A2b	(i) External surfaces							
	Flange mounted masts and columns, overall treatment	Item No	Aluminium metal spray	110 or 159	111	112	200	
		Min dry film thickness (µm)		12-20 m ² /litre	75	100		
	Planted masts and columns, for upper section only	Item No	Aluminium metal spray	110 or 159	111	112	200	
		Min dry film thickness (µm)		12-20 m ² /litre	75	100		
	Planted masts and columns, for ground section only	Item No	Aluminium metal spray	110 or 159	150 or 151		125	
		Min dry film thickness (µm)		12-20 m ² /litre				
	(ii) Internal surfaces							
	Flange mounted masts and columns, flange to door area. Planted masts and columns, ground section to door area	Item No			110	150 or 151		175
		Min dry film thickness (µm)			25	150		
(iii) Application Instructions		<p>(05/05) Blast cleaning, aluminium metal spray and all workshop paint coats on external surfaces, and site paint coats where access permits, shall be returned on to edges and 25mm inside at ends, at door and other openings and 25mm under base flange.</p> <p>On internal surfaces, Items 110 and 150 or 151 shall be applied from the bottom to 300mm above the door opening. If the internal surface is hot dip galvanised apply Item 155 plus 110 over the ground section.</p> <p>Item 110 or 159 shall be overcoated within 96 hours.</p> <p>For planted masts and columns:</p> <p>On external surfaces, Items 150 or 151 shall be applied over Item 159 or 110 from the bottom to 250mm above ground level.</p> <p>(05/05) On external upper section, Items 111 and 112 shall be applied down to 225mm above ground level, overlapping Item 150 or 151 by 25mm. Item 112 may be applied in the workshop or on site, to overlap Item 150 or 151 by 25mm.</p>						

TABLE 19/4C: (11/03) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Protective Systems (continued)

Type			Metal Coating	1st Coat	2nd Coat	3rd Coat	Minimum total dry film thickness of the paint system (microns)
G1	(i) External surfaces						
	Flange mounted and planted masts and columns, overall treatment of hot dip galvanizing plus additional coats for ground section	Item No	Hot dip galvanize	155	111 or 121	150 or 151	100/200 (at ground section)
		Min dry film thickness (µm)			75	100	
	(ii) Internal surfaces						
	Flange mounted and planted masts and columns, overall treatment of hot dip galvanizing plus additional coats for ground section	Item No	Hot dip galvanize				
		Min dry film thickness (µm)					
	(iii) Application Instructions		<p>(05/05) The requirements of sub-Clause 1914.21 need not apply for CCTV masts, cantilever masts and steel lighting columns and bracket arms which remain in a workshop environment after hot dip galvanizing.</p> <p>(05/05) All paint coats shall be applied in the workshop.</p> <p>Items 155, 111 or 121 and 150 or 151 shall be applied from the bottom to 250mm above ground level.</p>				

TABLE 19/4C: (11/03) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Protective Systems (continued)

Type			Metal Coating	1st Coat	2nd Coat	3rd Coat	4th Coat	Minimum total dry film thickness of the paint system (microns)	
G2a	(i) External surfaces								
	Flange mounted masts and columns, overall treatment	Item No	Hot dip galvanize	155	121	121	164 & 168	250	
		Min dry film thickness (µm)			100	100	40 or 50		
	Planted masts and columns, overall treatment plus additional coats for upper section only.	Item No	Hot dip galvanize	155	111 or 121	121	164 or 168	250	
		Min dry film thickness (µm)			100	100	40 or 50		
	Planted masts and columns, overall treatment plus additional coats for ground section only	Item No	Hot dip galvanize	155	121	121	150	225/325 (at ground section)	
		Min dry film thickness (µm)			100	100	100		
	(ii) Internal surfaces								
	Overall treatment	Item No	Hot dip galvanize						
		Min dry film thickness (µm)							
	(iii) Application Instructions	<p>(05/05) The requirement of sub-Clause 1914.21 need not apply for CCTV masts, cantilever masts and steel lighting columns and bracket arms which remain in a workshop environment after hot dip galvanizing.</p> <p>(05/05) Item 155, all workshop paint coats on external surfaces and site paint coats where access permits shall be returned on to edges and 25mm inside at ends, at door and other openings and under base flange.</p> <p>(05/05) All paint coats except Items 164 and 168 shall be applied in the workshop. Items 164 and 168 may be applied in the workshop or on site.</p> <p>Item 111 shall be overcoated within 96 hours.</p> <p>For planted masts and columns:</p> <p>Item 150 shall be applied over Item 121 from the bottom to 250mm above ground level.</p> <p>Item 164 or 168 shall be applied down to 225mm above ground level, overlapping Item 150 by 25mm.</p>							

TABLE 19/4C: (11/03) Requirements for CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms Protective Systems (continued)

Type			Metal Coating	1st Coat	2nd Coat	3rd Coat	4th Coat	Minimum total dry film thickness of the paint system (microns)
G2b	(i) External surfaces							
	Flange mounted masts and columns, overall treatment	Item No	Hot dip galvanize	155	110	112	168 or 169	225
		Min dry film thickness (µm)			30	100	50	
	Planted masts and columns, overall treatment plus additional coats for upper section only	Item No	Hot dip galvanize	155	110	112	168 or 169	250
		Min dry film thickness (µm)			30	100	50	
	Planted masts and columns, overall treatment plus additional coats for ground section only	Item No	Hot dip galvanize	155	112 or 121	150		150/250 (at ground section)
		Min dry film thickness (µm)			125	100		
	(ii) Internal surfaces							
	Overall treatment	Item No	Hot dip galvanize					
		Min dry film thickness (µm)						
	(iii) Application Instructions		<p>(05/05) The requirements of sub-Clause 1914.21 need not apply for CCTV masts, cantilever masts and steel lighting columns and bracket arms which remain in a workshop environment after hot dip galvanizing.</p> <p>(05/05) Item 155, all workshop paint coats on external surfaces and site paint coats where access permits shall be returned on to edges and 25mm inside at ends, at door and other openings and under base flange.</p> <p>Items 112 or 121 and 150 shall be applied from the bottom to 250mm above ground level.</p> <p>Items 110 and 112 shall be applied down to 225mm above ground level, overlapping Item 150 by 25mm.</p> <p>(05/05) Item 168 or 169 may be applied in the workshop or on site.</p>					
	Type G2b	(11/03) Planted masts and columns shall have an additional sacrificial steel section thickness of a minimum 1.0mm, above that needed in the design, from the bottom of the column to at least 250mm above ground level; additional thickness to be recorded in Part A of Appendix 13/2 - Column and Bracket Data Sheet, Part A of Appendix 13/5 - Typical CCTV Mast Bracket Data Sheet and Part A of Appendix 13/8 - Typical Cantilever Mast Bracket Data Sheet.						

#1912 (05/01) Testing of Paints

Provision of Samples

1 (05/05) Unless otherwise described in Appendix 19/5, the Contractor shall provide unopened 5 litre samples, known as 'A' samples, for quality assurance purposes, for each type of paint to be used for the Works in accordance with this Clause. In addition the Contractor shall supply at least 500 ml samples, known as 'B' samples, for application control purposes.

2 (05/05) 'A' and 'B' samples are tested for paint composition and/or properties against the original formulation issued by the paint manufacturer to the certifying body.

'A' Samples

3 (05/05) 'A' samples are required in all cases where more than 1000 litres of any one coat of paint is to be applied to road-bridge and gantry steelwork. 'A' samples are not required for footbridge steelwork or steel lighting columns and masts. For two-pack systems separate samples of the base and activator shall be despatched by the Contractor to the testing authority.

4 (05/05) The first 'A' samples shall be taken from the first representative batch of each type of paint delivered to the fabricator's workshop or to site.

5 (05/05) Additional 'A' samples of the paints subject to testing under sub-Clause 3 of this Clause shall be provided by the Contractor depending on the weight of structural steelwork in the Works in accordance with the following:

- (i) 500 tonnes to 1000 tonnes: one set of samples;
- (ii) over 1000 tonnes: a further set of samples for each part of or whole 1000 tonnes.

The Contractor shall also provide an 'A' sample:

- (iii) of any replacement batch of paint subject to testing under sub-Clause 3 of this Clause;
- (iv) returned paint described in sub-Clause 1913.4;
- (v) when the paint is showing unsatisfactory application characteristics under Clause 1914.

6 (05/05) If paint is to be supplied in tins of greater than 5 litre capacity then, for 'A' sampling, a minimum of four 5 litre tins of paint taken from each batch to be sampled shall be provided by the paint manufacturer. The 'A' samples shall be selected from these 5 litre tins.

7 (05/05) Immediately after selection, the 'A' samples shall be despatched by the Contractor to the testing authority, together with Appendix 19/4 Form HA/P3.

8 (05/05) Paint shall be supplied in sufficient time to allow for sampling and testing before the start of application.

9 (05/05) Except for procedure trials, paint shall not be applied until the 'A' sample from the paint to be applied has been tested and confirmed as being satisfactory for use.

'B' Samples

10 (05/05) The Contractor shall take 'B' samples of single component paints from painters' kettles or from nozzles of airless spray guns directly into clean, new 500 ml tins which shall be filled and then sealed prior to despatch to the testing authority. The Contractor shall take 'B' samples for two-pack systems as separate unmixed samples of the base and activator (cure) components. The 'B' samples shall be taken following the stirring of the individual components and immediately prior to mixing the two components for use in the Works. The samples shall be decanted directly into clean, new 500ml tins which shall be filled and immediately sealed prior to despatch to the testing authority. 'B' samples shall be taken as spot checks, with a minimum of, say, one batch in three being sampled. Also for each set of A samples taken, a further B set of samples is required to be submitted for testing. 'B' samples are required for footbridge steelwork and CCTV masts, cantilever masts, steel lighting columns and bracket arms even though 'A' samples are not required.

11 (05/05) Immediately after selection, the 'B' samples shall be despatched by the Contractor to the testing authority, together with Appendix 19/4 Form HA/P3.

Provision of 500 ml Tins, Packing and Transport of 'A' and 'B' Samples

12 (05/05) The Contractor shall provide 500 ml tins with lids and lid clips, for 'B' samples at the start of painting or before any procedure trials required by Clause 1915. The quantity supplied shall be sufficient to avoid any delay in taking 'B' samples throughout the work.

13 (05/05) The Contractor shall ensure that the lids of all tins of sample paint are securely clipped down when they are despatched for testing.

14 (05/05) The Contractor shall be responsible for handling, packing as necessary, prompt despatch and transit of 'A' and 'B' samples, including collection of samples from the testing authority for use or disposal as appropriate, following satisfactory testing and reporting.

15 (05/05) Overseeing Organisation shall report back to Supervising Firm, as stated on Appendix 19/4 Form HA/P3, all results of the testing, who shall then notify the Contractor of the results.

1913 Storage Requirements and Keeping Periods for Paints

1 (05/05) On delivery to the workshop or site, paint shall be unloaded directly into one or more secure paint stores which shall be located approximately within 100 metres of the painting area. Insulation and means of heating and ventilating shall be provided as necessary to maintain the temperature of paint stores between 5°C and 27°C.

If at any time or place paint in tins, painters' kettles or airless spray containers is allowed to reach temperatures outside the 5°C and 27°C limits or the paint manufacturer's recommended storage temperature, the paint shall be discarded and not used in the Works. Two pack products which produce an exothermic reaction when mixed, may be allowed to exceed the specified higher temperature limit. The Contractor shall also implement any additional storage restrictions recommended by the paint manufacturer.

2 (05/05) Unless excepted in accordance with sub-Clause 4 of this Clause, paint which has not been used within the shelf life recommended by the manufacturer or within 18 months of the date of manufacture, whichever is the lesser, shall be discarded or returned to the manufacturer and not used in the Works.

3 Chemically or moisture cured paints shall not be used after the expiry of the pot life stipulated by the paint manufacturer. They shall be discarded on expiry of the pot life or at the end of each working day/night whichever is the less. All other paints in opened tins or open containers including painters' kettles shall be returned to store and kept in sealed containers with not more than 10% ullage.

4 (05/05) Exceptionally, components of two-pack epoxy paints may have their keeping period extended to 24 months provided that the Contractor returns the paints to the paint manufacturer and ascertains that the manufacturer examines the contents of each tin and reconstitutes the paints as necessary so that such paints are equal in all respects to the paints described in the Contract. The Contractor shall provide a Certificate of Conformity confirming that such paints have been inspected and where necessary reconstituted and conform in all respects to the Contract.

5 (05/05) Each tin of reconstituted paint returned to the workshop or site by the manufacturer shall have an additional label affixed stating 'Extended Shelf Life to

(date)'. The previous date marking shall remain and not be obscured. Testing in compliance with Clause #1912 shall apply to reconstituted paints.

1914 Application of Paint

1 (05/03) Paint shall be supplied from the Contractor's paint store to the painters ready for application, the only adjustment of formulation permitted being as described in sub-Clause 1915.4. In exceptional circumstances any addition of solvent necessary to improve application shall be advised and if possible carried out by the paint manufacturer, preferably in the paint process plant with adequate equipment and controlled measurements.

2 Paint shall be applied only to surfaces that have been prepared and cleaned as described in this Series.

3 (05/01) Unless otherwise described in Appendix 19/2 a coat of paint in a system shall be applied by one of the following methods:

- (i) brush (B);
- (ii) airless spray (AS);
- (iii) (05/05) air assisted spray.

4 Paint shall not be applied under the following conditions:

- (i) (05/05) when the Dew Point is reached and/or when the ambient temperature falls below 5°C or the relative humidity rises above 80% in an enclosed workshop or 90% on site; or, for types of paints in sub-Clause 1914.12, outside the temperatures and humidities recommended by the paint manufacturer;
- (ii) during rain, snow, fog, mist or in a dust laden atmosphere;
- (iii) when the amount of moisture likely to be deposited on the surface by condensation or rain before or after painting, may have a harmful effect on the paint;
- (iv) when wind-borne dust may have a harmful effect on the paint.

5 (05/05) All workshop painting of steelwork shall be carried out in a fully enclosed workshop.

6 Before starting the procedure trials described in Clause 1915, the Contractor shall make available details of the overall wet film thickness for each coat he proposes to apply. He shall also make available information as to the total amount of paint that he expects to use for each coat of each system for which procedure trials are required. The calculation of the amount of paint to be used shall be based on the volume solids plus an allowance for waste.

7 (05/01) The following requirements on paint film thicknesses shall apply:

- (i) Wet film thickness gauges shall be used where practicable to check that the wet film thickness is not less than:

$$\frac{\text{minimum dry film thickness (mdft)} \times 100}{\text{volume solids \%}}$$

- (ii) (05/05) During the application of a paint system the Contractor shall ensure that the progressive total thickness of the applied coats shall allow the specified minimum total dft of the system to be attained without exceeding, overall, the proposed wet film thicknesses referred to in sub-Clause 6 of this Clause by more than 20%.
- (iii) (05/05) In no case shall the total dry film thickness of a paint system or the mdft of the last undercoat and finish be less than that specified in Appendix 19/1 Form HA/P1 (New Works) Paint System Sheet.
- (iv) The local dry film thickness for any primer shall not exceed the specified mdft by more than 30% and for other paints by more than 75%.

8 Each coat of paint of a specified system shall have satisfactory adhesion.

9 (05/05) Each applied specified paint coat shall be free from defects, including cratering, pin-holing, blistering, rivelling, sagging, bittiness, dry spray and cissing etc. The presence of these defects shall be determined by unaided visual assessment. The presence of pin holing or porosity shall be determined by low or high-voltage detectors (at corners, bolted joints and welds pin-holing shall be exempted). The finished system shall have an even and uniform appearance with no defects and the finishing paint in visually sensitive areas shall be from the same batch.

10 (05/05) The gloss level of the finishing coat shall be established before the procedure trials. A painted tin plate reference panel, 150 mm x 100 mm, shall be provided by the Contractor for this purpose.

11 (05/05) All successive coats in a system including the stripe coats shall be contrasting colours to aid identification. Before starting the procedure trials described in Clause 1915, the Contractor shall provide a reference panel, coated with the stepped-back paint system to indicate the contrast between each coat of paint.

12 (05/05) Two-pack chemically cured paints shall not be applied when the steel temperature falls below 3°C above dew point and/or 0°C or when the steel or ambient temperatures are below those advised by the

paint manufacturer, nor shall such paints be applied when the temperature is likely to fall below the advised temperatures during the curing period.

Stripe Coats

13 (05/05) Stripe coats shall be applied to all welds and all fasteners including washers and to all external corners except those of RHS. The first stripe coat, using second undercoat paint, shall be applied over the primer, sealer or Item 155. When a second stripe coat is specified, it shall be separated from the first stripe coat by an undercoat. The first stripe coat on fasteners treated with Item 155 shall be applied by brush; other stripe coats may be applied by brush or airless spray as appropriate.

A solvent shall be used to remove final traces of grease from fasteners before treatment with Item 155.

The Contractor shall enter the details of the stripe coats he has selected in Appendix 19/1 Form HA/P1 (New Works) Paint System Sheet giving the Item No., colour and method of application.

14 Square solid infill bars shall, after the second undercoat has been applied, be given an extra coat of first undercoat in lieu of stripe coats.

Exposure Times for Prepared Steel Surfaces and for Metal Coatings.

(05/01) Exposure Times and Treatment of Item 155 and Overcoating Times for Paints

15 Clean steel prepared by dry blast cleaning or bright steel prepared by abrading or by grinding shall be primed within 4 hours.

16 Clean steel prepared by wet blast cleaning only, shall be primed within 4 hours of being dry enough for painting.

17 Clean steel prepared by combined wet/dry blast cleaning shall be primed within 4 hours of dry blast cleaning.

18 (05/05) Steel or steelwork blast primed at the mills or in the workshop shall be overcoated within 8 weeks. The primed surfaces shall only be exposed outside for a maximum of 2 weeks of the 8 week period. Prepared surfaces affected by detrimental contamination or corrosion shall be restored before overcoating.

19 (05/05) Workshop steelwork which has been thermally metal sprayed shall be primed and sealed within 4 hours. The next coat shall be applied within 72 hours.

20 (05/05) Workshop prepared steel surfaces, unsealed thermally sprayed metal coating and undercoats, except final workshop undercoat, shall not be exposed outside.

21 (05/01) All surfaces treated with Item 155, except those of fasteners which have been treated in compliance with sub-Clause 1906.3, shall, after initial drying, be wet cleaned in compliance with sub-Clause 1903.9, taking care not to remove adhering Item 155, and allowed to dry before overcoating. The first coat of paint shall be applied within 48 hours of the surfaces treated with Item 155 being first dry enough for painting over.

22 (05/01) When hot dip galvanized steel is to be protected by a paint system, Item 155 shall be applied not later than 14 days after delivery to site.

23 (05/05) When hot dip galvanized steelwork is to be erected in a Marine environment and is to be protected by a paint system, Item 155 and the workshop coats shall be applied within 7 days after hot dip galvanizing.

24 (05/05) A first workshop undercoat shall be overcoated within 72 hours. Further shop coats shall be applied within 72 hour intervals per coat.

25 (05/01) The application of sealant in gaps, in compliance with sub-Clause 1906.27, may be carried out either before or after application, as appropriate, of the first coat of paint to be applied to the completed joints or assembled plies.

26 (05/01) Prepared steel surfaces and thermally sprayed metal coatings which have been restored, also paint coats and hot dip galvanizing which have been prepared after surface damage or deterioration shall be overcoated with the sealer primer or first undercoat as appropriate before the surfaces have been affected by moisture and in any case within 4 hours.

27 (05/01) On site, steel surfaces and thermally sprayed metal coating shall be primed or sealed within 4 hours and shall have the following coat applied within 72 hours. The next coat shall be applied within a further 72 hours.

1915 Procedure Trials

1 (05/05) Unless otherwise described in Appendix 19/5, the Contractor shall carry out workshop and site procedure trials of the protective system when more than 50 litres of any coat of paint are to be applied to 'Difficult Access' road-bridge and gantry steelwork.

Procedure trials are not required for footbridges.

Procedure trials are not required for systems applied to joints or for hot dip galvanizing only. The procedure trials shall be completed at least ten days before the start of application of the systems on the main steelwork. The trials shall be carried out with the labour and equipment to be used for the work.

2 (05/05) The Contractor shall provide for the workshop trials, samples of steel from 2 m² to 10 m² representing the main steelwork, hot dip galvanized when necessary. The Contractor shall demonstrate his ability to carry out surface preparation by blast cleaning and by using power assisted tools, to apply thermally sprayed metal coating and the paints he has selected. He shall provide sufficient paint for the trials.

3 (05/05) Thermally sprayed metal coating application and painting of the main steelwork shall not be started in the workshop or on site until procedure trials have been completed satisfactorily.

4 Any adjustment to the registered paint formulations shown to be required by the trials, other than an adjustment to the solvent shall be agreed with the Overseeing Organisation and made at the paint manufacturer's works.

5 The Contractor shall carry out further procedure trials whenever he employs replacement skilled labour or proposes to use equipment of a different type.

1916 Storage and Transport of Steel and Fabricated Steelwork

1 (05/05) Steel awaiting fabrication for the Works and uncoated steelwork shall be adequately protected from contaminants liable to cause heavy rusting and possibly pitting of the surfaces.

2 Steelwork shall not be loaded for transport until the paint system is sufficiently hard for handling.

3 During storage, steelwork shall be kept clear of the ground and shall be laid out or stacked so as to prevent water or dirt accumulating on or against any of the surfaces. Suitable packings shall be placed between layers of stacked steelwork. When cover is provided it shall be ventilated sufficiently to keep condensation to a minimum.

4 Components weighing less than one tonne shall be kept in a storage area away from their erection point in order to minimise damage to protective coatings.

5 (11/03) Lengths of parapet and individual steel lighting columns and masts shall be supported on timber, and precautions taken to prevent damage to their protective coatings and ingress of water. They shall only be positioned adjacent to their erection point immediately before erection. If the planned erection time is delayed by more than 72 hours the components shall be returned to the storage area.

6 (05/05) Hot dip galvanized components shall be transported and stored under dry and well ventilated conditions, to avoid wet storage staining. If stored outdoors, close contact of surfaces of components shall

be avoided, and suitable packing shall be placed between components, and to keep the components clear of the ground. Components shall be stored wherever possible at a slight angle to allow water run off. When cover is provided it shall be ventilated sufficiently to keep condensation to a minimum.

7 If damage to coatings is excessive, or may be difficult to deal with satisfactorily after erection, the Contractor shall restore the coatings before erection.

1917 (05/01) Surfaces in Contact with Concrete

1 (05/05) Unless otherwise described in Appendix 19/5, thermally sprayed metal coating and all workshop paint coats shall be returned 25 mm into the concrete/steelwork contact area.

2 Where aluminium metal spray, which has been sealed only, is returned into the contact area, it shall be given a coat of Item 110 of 30 microns mdf, not later than 48 hours before concreting. Application of the paint outside the contact area shall be prevented, by masking if necessary.

3 Hot dip galvanized coatings shall be applied overall. Unless otherwise described in Appendix 19/5, concrete may come into direct contact with the hot dip galvanized surfaces.

1918 (05/01) Form HA/P1 (New Works) Paint System Sheet (Appendix 19/1) Form HA/P2 Paint Data Sheet (Appendix 19/3)

1 (05/05) As soon as the Contract has been awarded the Contractor shall prepare and make available a copy of Form HA/P1 (New Works) Paint System Sheet (Appendix 19/1), of which he shall have completed Parts 6 to 10 together with relevant copies of Form HA/P2 Paint Data Sheet (Appendix 19/3).

2 (05/05) Following any relevant approvals in accordance with the Contract, Forms HA/P1 (New Works) Paint System Sheet (Appendix 19/1) shall be adopted for the Works.

1919 Access and Lighting

1 Without prejudice to the Conditions of Contract, access for inspection shall be provided and erected by the Contractor. The access shall be adequate in all respects for inspection purposes.

2 Manual surface preparation and coating application work shall not be carried out when light intensity at the workface is less than 500 lux. When the natural light

intensity falls below this level the Contractor shall install and maintain temporary lighting which shall provide a minimum light intensity of 500 lux over at least 1.0 m² at the workface during the work and also for inspection when required.

#1920 (05/01) Additional Requirements for the Protection of Steel in Bridge Bearings

Applicable Clauses

1 Unless otherwise described in Appendix 19/5, the work described in this Clause shall be carried out in compliance with Appendix 19/1 and with Clauses 1901 to 1919, excepting sub-Clauses 1912.1 to 1912.8, and the following:

Supply of Coatings

2 (05/05) Information, including the name of the paint manufacturer, required for completing Form HA/P1 (New Works) Paint System Sheet (Appendix 19/1), for the bearings, shall be obtained by the Contractor from the bearing manufacturer.

3 (05/05) Item 155 and MIO Epoxy paints when required for application on site shall be obtained from the manufacturer of the workshop applied coats. Paint applied to the bearings on site to match the bridge steelwork paint system shall be obtained from the manufacturer of that system.

1921 (11/03) Additional Requirements for the Protection of CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms

Applicable Clauses

1 Unless otherwise described in Appendix 19/5, the work described in this Clause shall be carried out in compliance with Appendix 19/1 and with Clauses 1901 to 1919 and the following:

Surface Preparation

2 (05/05) In the workshop, any CCTV mast, steel lighting column or component material, the surfaces of which show rust pitting when viewed by normal vision after surface preparation, shall be discarded and not used for the Works.

3 (11/03) On site, any CCTV mast, cantilever masts, steel lighting column and bracket arms or component material, the internal surfaces of which show rust pitting when viewed by normal vision after surface preparation, shall be discarded and not used for the Works.

Stripe Coats

4 (05/05) For CCTV Masts, cantilever masts and steel lighting columns and bracket arms, only one stripe coat in undercoat paint is required. For protective system Types A2 and G2, the stripe coat shall be applied before the last undercoat of the total protective system, in the workshop or on site as appropriate.

Adhesion Strength of Aluminium Metal Spray

5 (11/03) For aluminium metal sprayed CCTV masts, cantilever masts and steel lighting columns and bracket arms, the strength of adhesion of thermally sprayed metal coating to the steel shall not be less than 35 kgf/cm² when tested by means of a tensile test in accordance with BS EN 22063.

NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATION OF SCOTLAND

1911SE (05/01) Paint and Similar Protective Coatings

1 The term paint shall be deemed to refer also to similar protective coatings including specialist coatings such as grease paints.

2 (05/05) The paints permitted for use by the Overseeing Organisation in the Works are listed in the Manual of Paints for Structural Steelwork, which is included in BD 35 (DMRB 2.4.1) and which also contains details of the quality assurance scheme for paints and similar protective coatings. All paints shall have a current BBA HAPAS Roads and Bridges Certificate or equivalent.

3 All paints shall be supplied in sealed containers of not more than 5 litre capacity and these shall be used in order of delivery. Each container shall be of the completely removable lid type and be clearly marked on the side to show the name of the manufacturer, registered description of the material (including purpose, eg whether primer, undercoat or finish), colour, Item No, paint manufacturer's reference number, batch number and date of manufacture. Where date of manufacture is coded, the Contractor shall provide the code key.

4 (05/05) The Contractor shall ensure that the properties of the paints he has selected are suitable for the conditions in the workshop and on site, including temperature and humidity, and that he is able to apply the paints satisfactorily to all parts of the structure in these conditions.

5 (05/05) Unless otherwise described in Appendix 19/5, all paints forming any one protective system, or overlapping systems, shall be obtained from the same manufacturer, as named by the Contractor in Form HA/P1 (New Works) Paint System Sheet (Appendix 19/1).

6 (05/05) The requirements of sub-Clauses #1911.5, 6 and 7 and their respective Tables shall apply in Scotland.

1912SE (05/01) Testing of Paints

1 (05/05) Unless otherwise described in the Contract, the Contractor shall provide unopened 5 litre samples, known as 'A' samples, of each type of paint to be used in the Works for testing for quality assurance purposes. 'A' samples shall be taken from the first batch of each type of paint delivered to the fabricator's workshop or site. In addition, during the painting work, the Contractor shall supply 500ml samples, known as 'B' samples taken from painters' kettles or from nozzles of airless spray guns directly into clean new tins. For two-pack systems separate unmixed samples of the base and activator shall be dispatched by the Contractor to the testing authority, approved by the Overseeing Organisation.

2 Depending upon the importance of the proposed painting application, the Overseeing Organisation may elect to have 'A' samples sent for limited testing by a local paint testing firm or other agency approved by the Overseeing Organisation. Appropriate forms for use in connection with limited testing shall be derived from the standard paint forms and shall be agreed with the Overseeing Organisation.

3 (05/05) The Contractor shall supply paint in sufficient time to allow for sampling and testing of 'A' samples at least 3 weeks prior to the start of application. The Contractor shall be responsible for handling, provision of clean tins for samples, packing as necessary, and prompt despatch and transit of all samples for testing.

4 (05/05) 'A' and 'B' samples are tested for paint composition and/or properties against the original formulation issued by the paint manufacturer to the certifying body.

5 (05/05) The requirements of sub-Clauses #1912.11, 12 and 13 shall apply in Scotland.

6 Except for procedure trials painting shall not start until the first of the 'A' samples are confirmed as satisfactory.

1920SE (05/01) Additional Requirements for the Protection of Steel in Bridge Bearings

Applicable Clauses

1 Unless otherwise described in the Contract, the work described in this Clause shall be carried out in compliance with Appendix 19/1 and with Clauses 1901 to 1919 inclusive.

Supply of Coatings

2 (05/05) Information, including the name of the paint manufacturer, required for completing Form HA/P1 (New Works) Paint System Sheet (Appendix 19/1), for the bearings, shall be obtained by the Contractor from the bearing manufacturer.

3 (05/05) Item 155 and MIO Epoxy paints when required for application on site shall be obtained from the manufacturer of the workshop applied coats. Paint applied to the bearings on site to match the bridge steelwork paint system shall be obtained from the manufacturer of that system.