SERIES 1900
PROTECTION OF STEELWORK AGAINST CORROSION

Contents

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

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

PROTECTION OF STEELWORK AGAINST CORROSION

1901 (05/01) Introduction

1 (08/14) This Series is part of the Specification for Highway Works. Whilst this Series is particularly relevant to the subject matter in its title it must be read in conjunction with the general requirements in Series 000 and 100 and with all other Series relevant to the specification for the particular works to be undertaken.

2 (08/14) Surface preparation and protection against corrosion of steelwork shall be carried out in compliance with Clauses 1901 to 1921 and where applicable Series 1800, 1810, 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 execution of the components.

3 (08/14) 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.

4 (08/14) 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.

5 (08/14) Compliance with sub-Clause 4 of this Clause does not confer immunity from relevant legal requirements.

6 (08/14) Corrosion protection of steelwork shall be undertaken by a Contractor registered to National Highways Sector Scheme 19A 'For corrosion protection of ferrous metals by industrial coatings', as described in Appendix A.

7 (08/14) Numbered appendices (identified by digits, e.g. 19/5) contain contract specific information and requirements.

1902 Surface Preparation – General Requirements

(05/05) **Workshop and Site Work**

1 (08/14) Before blast cleaning or abrading steel surfaces or before overcoating painted or hot dip galvanized surfaces, any contamination including by oil or grease shall be removed. Unless otherwise described in Appendix 19/5, solvents shall not be used.

2 (08/14) Clean water which does not leave harmful residues on the surface shall be used for wet cleaning and rinsing.

3 (08/14) Cleaning agents which are not harmful to the surface being cleaned and which do not leave harmful residues on the surface after final rinsing may be used for cleaning.

4 (08/14) Surface preparation shall be continued until the required standard has been achieved.

5 (08/14) Weld spatter shall be removed, in accordance with Series 1800, 1807.5.17 if applicable.

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 (08/14) Immediately before application of each coat of paint, the Contractor shall ensure that the surfaces to be painted:

(i) meet the required standard of preparation;

(ii) are free from harmful residues and detrimental contamination, including water, moisture, condensation, oil, grease, mortar, concrete, dust, grit, paint degradation products, chlorides and sulphides. (See sub-clause 1904.7)

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 (08/14) Unless otherwise described in Appendix 19/5, metallic blast cleaning abrasives complying with BS EN ISO 11124 or non-metallic blast cleaning abrasives complying with BS EN ISO 11126 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.

(05/08) **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 (08/14) 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 aluminium 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 (08/14) 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 receive a thermally sprayed aluminium metal coating, such as at site welds, at areas prepared to clean steel or areas where a thermally sprayed aluminium 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. 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 (08/14) 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 detrimental 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 (08/14) 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'.

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 (08/14) '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 to a radius of not less than 2mm, in accordance with Series 1800, 1810.2 if applicable. If thermally sprayed aluminium 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) (08/14) Sa3 to 'BS EN ISO 8501-1'

(ii) (08/14) Sa2½ to 'BS EN ISO 8501-1'

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':

(08/14) Surfaces shall be deemed to be free from 'harmful residues' or 'detrimental contamination' after surface preparation when any such remaining matter will not be detrimental to the application, adhesion, curing or 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) (08/14) 'restored' coatings. Unless otherwise described in Appendix 19/5, when paint or similar coatings or thermally sprayed aluminium 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 aluminium metal coating shall be restored using dry blast cleaning. The thickness of any underlying thermally sprayed aluminium metal coating or paint coating which may have been reduced in thickness during surface preparation shall be brought up to specification;

(ii) (08/14) 'restored' surface preparation. Unless otherwise described in Appendix 19/5, the original standard shall be obtained. When further thermally sprayed aluminium metal coating is to be applied, the surface of the existing thermally sprayed aluminium 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.

(08/14) When clean steel is exposed through a metal coating during remedial surface preparation, remnants of sound thermally sprayed aluminium metal coating, which cannot be removed with a tungsten scraper 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 (08/14) 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 as described in Table 19/2B.

3 Metal coatings on surfaces of fasteners which are to be painted shall be:

(i) (05/08) free from all traces of oil or grease and then treated with an adhesion promoter where specified; 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.

(08/14) 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 adhesion promoter Item 155.

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

Joint Material and Parent Material in Joints

5 (08/14) The standard of blast cleaning of joint material and parent material in joints shall be at least equal to that for the parent material. The standard of preparation and treatment of the friction surfaces of joint material and parent material in slip resistant connections shall be as described in Series 1800, 1810.1(5). Before a slip resistant connection is made, friction surfaces shall meet the standard of preparation and treatment described in Series 1800, 1810.1(5).

(08/14) *At Preloaded Connections*

6 In steelwork painted only overall:

(08/14) Unless otherwise described in Appendix 19/5, 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 (08/14) In steelwork with thermally sprayed aluminium metal coating at joints only, and painted overall:

(08/14) Unless otherwise described in Appendix 19/5, the thermally sprayed aluminium 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 aluminium 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 aluminium metal coating on the outer surfaces and edges of site joint material shall be given a coat of aluminium epoxy sealer (Item 159).

8 (08/14) In steelwork with thermally sprayed aluminium metal coating overall and sealed only or painted overall:

(08/14) Unless otherwise described in Appendix 19/5, the thermally sprayed aluminium 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 aluminium metal coating on outer surfaces and edges of site joint material shall also be given a coat of aluminium epoxy sealer (Item 159).

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 (08/14) The thickness of a protective paint coat applied to the outer surfaces of joint material prior to assembly of any preloaded connection shall not exceed 50 microns dry film thickness.

(08/14) *At Non Preloaded Connections*

11 (08/14) At workshop joints in all steelwork other than in hot dip galvanized steelwork the blast primer alone or thermally sprayed aluminium 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**

(08/14) *At Preloaded Connections*

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.

(08/14) *At Non Preloaded Connections*

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

At Welded Joints

17 (08/14) Thermally sprayed aluminium 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 minimum of 150mm and 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 150 mm from the joint, or from the edge of the thermally sprayed aluminium 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 (08/14) In steelwork with thermally sprayed aluminium metal coating at joints only, and painted overall, primed or sealed thermally sprayed aluminium metal coatings shall be prepared by dry blast cleaning to restore the surfaces to the required standard.

21 (08/14) In steelwork with thermally sprayed aluminium metal coating overall, and sealed only or painted overall, thermally sprayed aluminium metal coatings shall be prepared as described in sub-Clause 20 of this Clause.

22 (08/14) In steelwork hot dip galvanized only or hot dip galvanized and painted overall the surfaces shall be free from detrimental contamination by wet cleaning.

At Welded Joints

23 (08/14) In all steelwork, welds shall be prepared by the methods and to the standards described in sub-Clause 1911.6 (ii), 1911.7, 1911.9 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 (08/14) Uncoated and temporarily coated fasteners shall be free from all traces of oil and grease and be blast cleaned to Sa2½ quality, medium profile, before painting.

25 (08/14) Fasteners, including those which have been treated with an adhesion promoter shall be dry cleaned after final surface preparation of the joint and then painted.

26 (08/14) Fasteners which are to receive thermally sprayed aluminium 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 (08/14) 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 aluminium 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 (08/14) 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 'ASTM D4541 (type III)', before overcoating with the next coat in the system. The first paint coat over abraded surfaces shall be an aluminium epoxy (two-pack) primer (Item 115).

4 (08/14) When an area of a thermally sprayed aluminium metal coating is to be restored after surface preparation by abrading or grinding, any affected thermally sprayed aluminium metal coating or exposed steel substrate shall be dry blast cleaned immediately before further application of thermally sprayed aluminium metal coating.

5 (08/14) In the workshop, a damaged thermally sprayed aluminium metal coating, together with any damaged sealer or paint coats, shall be restored.

6 (08/14) 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 aluminium metal coating, together with any damaged sealer or paint coats shall be restored but with a minimum thickness of 150 microns of thermally sprayed aluminium metal coating.

7 (08/14) On site, small areas of isolated damage in a thermally sprayed aluminium metal coating plus paint system, need not be restored; after surface preparation in compliance with sub-Clause 1 of this Clause, the thermally sprayed aluminium 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 (08/14) 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 overcoated with two coats of Zinc Rich Epoxy Blast Primer (Item 109), minimum dry film thickness of 50 microns each.

9 (08/14) 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 two coats of Zinc Rich Epoxy Blast Primer (Item 109), minimum dry film thickness of 50 microns each. Alternatively, the components shall be regalvanized.

10 In all cases where paint coats only are to be restored, or thermally sprayed aluminium 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 (08/14) 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 (08/14) In the workshop, failed paint coatings and failed thermally sprayed aluminium metal coating shall be restored. Abrading down to sound paint only is permissible. If a thermally sprayed aluminium metal coating is damaged or reduced to less than 80% of the specified minimum thickness during abrading, it shall be restored.

2 (08/14) On site, failed paint coatings and thermally sprayed aluminium 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 (08/14) Sub-Clauses 1907.3, 4, 10 and 11shall be complied with.

1909 (05/01) Metal Coatings

Hot Dip Galvanized Coatings

1 (08/14) 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 15ºC to 25ºC or inhibited sulphuric acid with a strength not exceeding 18% and within a temperature range of 60ºC to 80ºC 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 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, in accordance with Series 1800, 1810.5 if applicable.

(viii) The contractor shall take measures to minimise the potential for liquid metal assisted cracking occurring during the galvanizing process and to identify any cracks that may have occurred in galvanized steelwork.

(08/14) **Thermally Sprayed Aluminium Metal Coating**

2 (08/14) Thermally sprayed aluminium metal coatings shall, unless otherwise described in Appendix 19/5, comply with BS EN ISO 2063 and with the following:

(i) Aluminium coating material shall have a composition complying with BS EN ISO 14919 – 3.1.

(ii) The thickness of the coating shall be not less than 100 microns.

(iii) The strength of adhesion of thermally sprayed aluminium metal coatings shall not be less than the following:

Aluminium 50 kgf/cm²

(iv) Thermally sprayed aluminium 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) The application of thermally sprayed aluminium 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 aluminium metal coatings shall be de-nibbed.

Other Requirements

3 (08/14) When a metal coating is required on only part of a component it shall be applied before the rest of the component receives paint.

1910 (08/14) Testing of Thermally Sprayed Aluminium Metal Coatings

1 (08/14) 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 aluminium metal coating at site joints or areas restored on site), the Contractor shall demonstrate by means of a pull off adhesion test in accordance with 'ASTM D4541-Type III', 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 ISO 2063. Areas affected by the tests shall be restored in accordance with Clause 1907.

2 (08/14) 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 aluminium 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 (08/14) 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 aluminium metal coating shall be restored and the tests repeated.

5 (08/14) If more than two local areas of faulty adhesion occur on any one component, the whole of the thermally sprayed aluminium 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 (08/14) The term paint shall be deemed to refer to protective coatings in general.

2 (08/14) 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 appropriate to the use of the paint in the proposed paint system.

3 (08/14) All paints shall be supplied in sealed containers of a capacity suitable for the volume and method of application. For sitework, all paints shall be supplied in sealed containers of not more than 25 litre capacity. The capacity of the containers to be used shall be confirmed as being suitable as part of the Procedure Trials described in Clause 1915. All containers shall be used in order of date of manufacture and batch number, the oldest being used first. 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 may be supplied in sealed containers of 5 litre capacity for testing purposes in accordance with Clause 1912, for 'A' samples.

4 (08/14) 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 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 (08/14) Protective systems

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

(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 Tables 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: (08/14) 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
109	Zinc Rich Epoxy Blast Primer (two pack)	Blast Primer	LB or NB	B or AS (B to small areas only)
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) maintenance undercoat	Surface tolerant	HB	B or AS
121	Extended Cure Epoxy MIO (two-pack)	Primer, Undercoat and/or Finish for hot dipped galvanized steel	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)
155	'T' Wash	Adhesion promoter for hot dip galvanized steel	LB	B
157	Adhesion promoting (single-component)	To promote substrate adhesion properties of coating systems for hot dip galvanized 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 NB	B AS
167	Epoxy Acrylic Finish (two-pack)	Gloss or Semi-gloss Finish	NB	B (small areas by brush) AS

TABLE 19/1: (08/14) **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
168	Polyurethane (two-pack)	Gloss Finish	LB NB	B AS
169	Polyurethane (two-pack)	Semi-gloss Finish	NB HB	B (small areas by brush) AS
185	Organic Modified Polysiloxane (two-pack)	Gloss Finish for new works or maintenance	NB HB	B 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 (08/14) 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.

3 (08/14) All materials to be handled and applied in accordance with the manufacturers Product and Health & Safety Data Sheets.

TABLE 19/2A: (08/14) 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	Sa3, Medium profile	I for Inland Ready Access II for Inland Difficult Access, Marine Ready or Difficult Access
Area B Interior of box girder surfaces, except area C, but including shop welds	Blast clean	Sa2½, Medium profile	III
Area C Friction surfaces of parent material at slip resistant connections	As described in Series 1800, 1810.1(5)	As described in Series 1800, 1810.1(5)	As described in Series 1800, 1810.1(5)
Area D Friction and outer surfaces of joint material at slip resistant connections.	Friction surfaces: As described in Series 1800, 1810.1(5) Outer surfaces: Blast clean	Friction surfaces: As described in Series 1800, 1810.1(5) Outer surfaces: Sa3, Medium profile	Friction surfaces: As described in Series 1800, 1810.1(5) Outer surfaces: I for Inland Ready Access II for Inland Difficult Access, Marine Ready or 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 Inland Ready Access II for Inland Difficult Access, Marine Ready or Difficult Access
Area F Interior surfaces of site welds and weld affected areas	Remove slag, wire brush, wet clean and blast clean as Area B	Sa2½, Medium profile	III with additional coat of primer
(iii) Parapets.			
Area G All surfaces, subject to accessibility	Pickling for hot dip galvanizing	In accordance with Clause 1909	IV

TABLE 19/2B: (08/14) 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		109	112	167, 168, 169 or 185		275 (325 if Item 185 finish is specified)
	Min dry film thickness per coat(µm)		50	125	50 or 100*		
	Item No		111	112	167, 168, 169 or 185		300 (350 if Item 185 finish is specified)
	Min dry film thickness per coat(µm)		75	125	50 or 100*		
II	Item No		109	112	112	167, 168, 169 or 185	400 (450 if Item 185 finish is specified)
	Min dry film thickness per coat(µm)		50	125	125	50 or 100*	
	Item No		110	123	167, 168, 169 or 185		525 (575 if Item 185 finish is specified)
	Min dry film thickness per coat(µm)		25	400	50 or 100*		
	Item No		111	112	112	167, 168, 169 or 185	425 (475 if Item 185 finish is specified)
	Min dry film thickness per coat(µm)		75	125	125	50 or 100*	
III	Item No		109	112			200
	Min dry film thickness per coat(µm)		50	125			
	Item No		111	112			225
	Min dry film thickness per coat(µm)		75	125			
	Item No		113	114			225
	Min dry film thickness per coat(µm)		100	100			
IV	Item No	Hot dip galvanize	155 or sweep blast	110, 112 or 121	112 or 121	167, 168, 169 or 185	2nd Coat Item 110: 225 (275 if Item 185 finish is specified)
	Min dry film thickness per coat(µm)			25 (Item 110) or 125 (Items 112 or 121)	125	50 or 100*	2nd Coat Items 112 or 121: 350 (400 if Item 185 finish is specified)

TABLE 19/2B: (08/14) Requirements for Bridges, Parapets and Other Highway Structures Except Bearings, CCTV Masts, Cantilever Masts and Steel Lighting Columns and Bracket Arms Continued

(08/14) **Notes**

(08/14) **Finish Coats**

(i) *Items 167, 168 or 169 finish coats min. dft 50µm. Item 185 finish coat min. dft 100 µm.

(ii) 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 restored 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.

(08/14) **Area D, Type II**

(i) A Type II system incorporating a metal coating of thermally sprayed aluminium metal, 1st coat Item 159 (12-20 m^2/litre), 2nd coat Item 111 (mdft 75 µm), 3rd coat Item 112 (mdft 112 µm), 4th coat Item 167, 168, 169 (mdft 50 µm) or 185 (mdft 100 µm), with a total minimum dft of the paint system of 350 µm (Items 167, 168, or 169) or 400 µm (Item 185) may be used for Area D outer surfaces only, where aluminium metal spray is identified as the required treatment of Area D friction surfaces in Series 1800, 1810.1(5).

(08/14) **Parapets**

(i) Type IV: For parapets to be erected in a Marine environment, 1st, 2nd and 3rd coats shall be applied in the workshop; the 4th coat may be applied in the workshop or, if within the intermediate coat overcoating time, on site. For parapets in an Inland environment, all coats of paint may be applied in the workshop or on site.

(ii) Where sweep blast is the chosen method of adhesion promotion, it shall be undertaken in accordance with BS EN ISO 12944-4 to surface roughness 'fine' in accordance with BS EN ISO 8503-2.

(08/14) **Fasteners**

(i) Unless otherwise specified in Appendix 19/2, fasteners in steelwork shall be supplied with an anti-corrosive protective coating comprising hot dip galvanizing in accordance with BS EN ISO 10684, or a similar alternative surface protection treatment which has a current BBA HAPAS Roads and Bridges Certificate or equivalent, as an anti-corrosion protective coating for use on steel fixings intended for use on steel highway structures. For such similar alternative surface protection treatments, prior to commencement of the works, the Contractor shall provide to the Overseeing Organisation a copy of the BBA HAPAS Roads and Bridges Certificate or equivalent, and the fasteners shall be installed and prepared prior to application of paint in accordance with the requirements of the Certificate.

(ii) Hot dip galvanized fasteners in steelwork that is to be painted shall have surfaces that are to be painted treated with an adhesion promoter (Item 155) before installation, or alternatively after installation, shall be cleaned with a solvent wipe to remove all traces of oil and grease and be abraded with (coarse grade) abrasive paper to sufficiently roughen the exposed galvanized surface in order to provide a suitable 'adhesion key' and be painted with a coat of either Item 110, Item 157 or Item 160 as an adhesion promoter.

(iii) After the joints are made and fasteners have been treated with an adhesion promoter, fasteners shall be protected as specified for the joint material.

TABLE 19/3A: (08/14) Requirements for Steel in Bridge Bearings (and Metal Coated Fasteners)

Surface Preparation

Area Description	Method:	Standard:
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	Blast clean	Sa3, Medium profile
Area B Central area of top bearing plates in contact with grout or mortar	Blast clean	Sa2½, Medium profile
Area C Areas of top bearing plates or base plates in contact with structural steel components	Blast clean	Sa3, Medium profile
Area D Exposed shop fasteners in components to be coated after assembly	Blast clean	Sa3, Medium profile
Area E Concealed shop fasteners	No requirement	No requirement
Area F Site fasteners for fixing bearings to piers or abutments and for fixing bridge components to bearings	Restore metal coating as necessary to specified standard of cleanliness	Restore metal coating as necessary to specified standard of cleanliness

TABLE 19/3B: (08/14) 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	167, 168, 169 or 185	275 (325 if Item 185 finish is specified)
	Min dry film thickness per coat (µm)	150	12-20 m^2/ litre	75	125	50 or 100*	
Area B	Item No		112				150
	Min dry film thickness per coat (µm)		150				
Area C	Item No	Aluminium metal spray	159				
	Min dry film thickness per coat (µm)	150	12-20 m^2/ litre				
Area F	Item No	Hot dip galvanize	Adhesion promoter (see Notes)	110	112 or 121	167, 168, 169 or 185	275 (325 if Item 185 finish is specified)
	Min dry film thickness per coat (µm)			25	125	50 or 100*	

(08/14) **Notes**

(08/14) **Finish Coats**

(i) *Items 167, 168 or 169 finish coats min. dft 50µm. Item 185 finish coat min. dft 100 µm

(08/14) **Area A and D**

(i) 4th coat for bearings for steel bridge beams, brush applied on site; colour to match finish on main steelwork.

(ii) Aluminium metal spray plus Items 110 or 159 are required on interfaces of machined surfaces of spreader plates and of bearing.

(08/14) **Areas A, B, C and D**

(i) Aluminium metal spray, Items 110 or 159, 111 and 112 shall be applied at the bearing manufacturer's works. Item 167, 168, 169 or 185 shall be applied on site.

(ii) Items 110 or 159 shall not be over-applied and shall not be included in the overall thickness of the protective paint system.

TABLE 19/3B: (08/14) Requirements for Steel in Bridge Bearings (and Metal Coated Fasteners) Continued

(08/14) **Area F**

(i) Adhesion promoter: 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. Alternatively after installation, surfaces to be painted shall be cleaned with a solvent wipe to remove all traces of oil and grease and be abraded with (coarse grade) abrasive paper to sufficiently roughen the exposed surface in order to provide a suitable 'adhesion key' and be painted with a coat of either Item 110, Item 157 or Item 160 as an adhesion promoter. The remaining site coats shall be applied to exposed surfaces after erection.

(08/14) **Stripe coats for bearings only**

(i) Area F: Stripe coats are not required for bearing site fasteners.

(ii) Area A and D: 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, eg medium grey, natural grey.

(08/14) **Site Coats**

(i) Site coats shall be applied by the Contractor.

(08/14) **Paint suppliers**

(i) The requirements of Clause 1920 shall be noted.

(08/14) **Appendix 19/1**

(i) 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 (08/14) **General**

(i) Details of protective systems A1, G1, A2a and G2a, A2b and G2b are given in Tables 19/4A, B & C.

(ii) In the case of protective systems A2a and G2a, A2b and G2b the Contractor may opt to apply the finishes in the workshop or, if within the intermediate coat overcoating time, at site, unless otherwise specified.

(iii) When a white or pale tint finish is specified, an additional finish coat may be required to ensure full opacity is achieved, completely obliterating 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.

(vi) Unless otherwise stated in Appendix 19/5 the nominal ground level adjacent to a mast or column shall be assumed to be at a distance of 600 mm below the door opening. The 'ground section' of planted masts and columns shall extend from the bottom of the mast or column to 250mm above the nominal ground level. The 'ground section' of flange mounted masts and columns applies where the flange is below ground level or is built over and shall extend from the bottom of the mast or column to 250mm above the nominal ground level. The 'upper section' of a mast or column with a ground section is the remainder of the mast or column above the ground section.

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	Difficult
	Marine	Ready or Difficult
G1	Inland	Ready
G2a and G2b	Inland	Difficult
	Marine	Ready or Difficult

TABLE 19/4B: (08/14) **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: Flange mounted and planted masts and columns, overall surface preparation.	Blast clean	Sa3, Medium profile
Internal surfaces: Flange mounted and planted masts and columns, surface preparation from the bottom to 300mm above the door opening.	Blast clean where access allows or Hand tool preparation	Sa2½, Medium profile or Bright steel
System G1, G2a and G2b		
External and internal surfaces: Flange mounted and planted masts and columns, overall surface preparation.	In accordance with sub-clause 1909·1	In accordance with sub-clause 1909·1

TABLE 19/4C: (08/14) 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 protection plus 2nd coat for ground section (See 1911.8 (vi)).	**Item No**	Thermally sprayed aluminium metal	159	112 *	125
		Application rate/Min dry film thickness per coat (µm)		12-20 m^2/litre	125	
	(ii) Internal surfaces					
	Flange mounted and planted masts and columns, protection applied from the bottom to 300mm above the door opening.	**Item No**		110	112 *	175
		Min dry film thickness per coat (µm)		25	125	
	(08/14) **Notes** (i) * Item 112 finish coat colour to be black (BS 4800 shade 00 E 53) (ii) Blast cleaning, thermally sprayed aluminium metal and all workshop paint coats on external surfaces shall be returned on to edges at ends, at door and other openings and under the base flange. (iii) All paint coats shall be applied in the workshop. (iv) Item 159 shall be overcoated within 96 hours.					

TABLE 19/4C: (08/14) 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 and upper section (See 1911.8 (vi)) of masts and columns, overall protection.	**Item No**	Thermally sprayed aluminium metal	110 or 159	112	167, 168, 169 or 185	200 (250 if Item 185 finish is specified)
		Application rate/Min dry film thickness per coat(µm)		12-20 m^2/ litre	125	50 or 100*	
	Overall protection for ground section (See 1911.8 (vi)).	**Item No**	Thermally sprayed aluminium metal	110 or 159	112	112**	275
		Application rate/Min dry film thickness per coat(µm)		12-20 m^2/litre	125	125	
	(ii) Internal surfaces						
	Flange mounted and planted masts and columns, protection applied from the bottom to 300mm above the door opening.	**Item No**		110	112**		175
		Min dry film thickness per coat(µm)		25	125		

(08/14) **Notes**

(i) * Items 167, 168 or 169 finish coats min. dft 50µm. Item 185 finish coat min. dft 100 µm

(ii) ** Item 112 finish coat colour to be black (BS 4800 shade 00 E 53)

(iii) Blast cleaning, thermally sprayed aluminium metal 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 under the base flange.

(iv) All paint coats except finish coats shall be applied in the workshop. Finish coats may be applied in the workshop or, if within the intermediate coat overcoating time, on site.

(v) Item 110 or 159 applied over thermally sprayed aluminium metal shall be overcoated within 96 hours.

(vi) For external surfaces, the upper section finish coat shall overlap the ground section finish coat by 25mm.

TABLE 19/4C: (08/14) 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 and planted masts and columns, overall protection.	**Item No**	Thermally sprayed aluminium metal	110 or 159	111	112	225
		Application rate/Min dry film thickness per coat(μm)		12-20	75	125	
	(ii) Internal surfaces						
	Flange mounted and planted masts and columns, protection applied from the bottom to 300mm above the door opening.	**Item No**		111	112		225
		Min dry film thickness per coat(μm)		75	125		

(08/14) **Notes**

(i) Blast cleaning, thermally sprayed aluminium metal, 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 under the base flange.

(ii) Item 110 or 159 shall be overcoated within 96 hours.

(iii) The ground section (See 1911.8 (vi)) of masts and columns shall have an additional sacrificial steel section thickness of a minimum 1.0mm, above that needed in the design. The additional thickness shall be recorded in which ever is appropriate of the following: Part A of Appendix 13/2 – Typical Lighting Column and Bracket Data Sheet; Part A of Appendix 13/5 – Typical CCTV Mast Data Sheet; Part A of Appendix 13/8 – Typical Cantilever Mast Data Sheet.

TABLE 19/4C: (08/14) 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 protection plus adhesion promotion and 2nd and 3rd coats for ground section (See 1911.8 (vi)).	**Item No**	Hot dip galvanize	155, or sweep blast	112 or 121	112 or 121**	275 (at ground section)
		Min dry film thickness per coat(µm)			125	125	
	(ii) Internal surfaces						
	Flange mounted and planted masts and columns, overall protection	**Item No**	Hot dip galvanize				
		Min dry film thickness per coat(µm)					
	(08/14) **Notes** (i) ** Items 112 or 121 finish coat colour to be black (BS 4800 shade 00 E 53) (ii) The requirements of sub-Clause 1914.21 relating to the application of the first coat of paint 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. (iii) All workshop paint coats on external surfaces shall be returned on to edges and 25mm inside at ends, at door and other openings and under the base flange. (iv) All paint coats shall be applied in the workshop. (v) Where sweep blast is the chosen method of adhesion promotion, it shall be undertaken in accordance with BS EN ISO 12944-4 to surface roughness 'fine' in accordance with BS EN ISO 8503-2.						

TABLE 19/4C: (08/14) 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 and upper section (See 1911.8 (vi)) of masts and columns, overall protection.	**Item No**	Hot dip galvanize	155 or sweep blast	112 or 121	112 or 121	167, 168, 169 or 185	275 (325 if Item 185 finish is specified)
		Min dry film thickness per coat(µm)			100	100	50 or 100*	
	Overall protection for ground section (See 1911.8 (vi)).	**Item No**	Hot dip galvanize	155 or sweep blast	112 or 121	112 or 121	112 or 121**	350
		Min dry film thickness per coat(µm)			100	100	100	
	(ii) Internal surfaces							
	Overall protection.	**Item No**	Hot dip galvanize					
		Min dry film thickness per coat(µm)						

(08/14) **Notes**

(i) *Items 167, 168 or 169 finish coats min. dft 50µm. Item 185 finish coat min. dft 100 µm

(ii) ** Items 112 or 121 finish coat colour to be black (BS 4800 shade 00 E 53)

(iii) The requirement of sub-Clause 1914.21 relating to the application of the first coat of paint 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.

(iv) 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 the base flange.

(v) All paint coats except finish coats shall be applied in the workshop. Finish coats may be applied in the workshop or, if within the intermediate coat overcoating time, on site.

(vi) Where sweep blast is the chosen method of adhesion promotion, it shall be undertaken in accordance with BS EN ISO 12944-4 to surface roughness 'fine' in accordance with BS EN ISO 8503-2.

(vii) For external surfaces, the upper section finish coat shall overlap the ground section finish coat by 25mm.

TABLE 19/4C: (08/14) 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 and upper section (See 1911.8 (vi)) of masts and columns, overall protection.	**Item No**	Hot dip galvanize	155 or sweep blast	110	112 or 121	167, 168, 169 or 185	200 (250 if Item 185 finish is specified)
		Min dry film thickness per coat(μm)			25	100	50 or 100*	
	Overall protection for ground section (See 1911.8 (vi)).	**Item No**	Hot dip galvanize	155 or sweep blast	110	112 or 121	112 or 121**	250
		Min dry film thickness per coat(μm)			25	100	100	
	(ii) Internal surfaces							
	Overall protection.	**Item No**	Hot dip galvanize					
		Min dry film thickness per coat(μm)						

(08/14) **Notes**

(i) *Items 167, 168 or 169 finish coats min. dft 50 μm. Item 185 finish coat min. dft 100 μm

(ii) ** Items 112 or 121 finish coat colour to be black (BS 4800 shade 00 E 53)

(iii) The requirements of sub-Clause 1914.21 relating to the application of the first coat of paint 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.

(iv) 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 the base flange.

(v) Where sweep blast is the chosen method of adhesion promotion, it shall be undertaken in accordance with BS EN ISO 12944-4 to surface roughness 'fine' in accordance with BS EN ISO 8503-2.

(vi) For external surfaces, the upper section finish coat shall overlap the ground section finish coat by 25mm.

(vii) The ground section (See 1911.8 (vi)) of 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. The additional thickness shall be recorded in which ever is appropriate of the following: Part A of Appendix 13/2 – Typical Lighting Column and Bracket Data Sheet; Part A of Appendix 13/5 – Typical CCTV Mast Data Sheet; Part A of Appendix 13/8 – Typical Cantilever Mast Data Sheet.

#1912 (05/01) Testing of Paints

Provision of Samples

1 (08/14) Unless otherwise described in Appendix 19/5, the Contractor shall provide unopened 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 (08/14) 'A' and 'B' samples are tested for paint composition and/or properties against the values obtained during the approval testing of the original formulation and issued by the paint manufacturer to the certifying body.

'A' Samples

3 (08/14) 'A' samples are required in all cases where more than 500 litres of any one type of paint is to be used in the works. 'A' samples are not required for paints to be applied to bearings, CCTV masts, cantilever masts, steel lighting columns and bracket arms. 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 (08/14) Additional 'A' samples of the paints subject to testing under sub-Clause 3 of this Clause shall be provided by the Contractor at a rate of one set of samples for each 500 litres (or part there of) of each type of paint used in the works.

The Contractor shall also provide an 'A' sample:

(i) of any replacement batch of paint subject to testing under sub-Clause 3 of this Clause;

(ii) returned paint described in sub-Clause 1913.4;

(iii) when the paint is showing unsatisfactory application characteristics under Clause 1914.

6 (08/14) The 'A' samples shall be selected at random to be fully representative of each 500 litres (or part thereof) of paint to be used in the Works.

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 (08/14) 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 (08/14) 'B' samples are required in all cases including for paints to be applied to bearings, CCTV masts, cantilever masts, steel lighting columns and bracket arms. 'B' samples shall be taken as spot checks, with a minimum of every batch of paint being sampled. The Contractor shall take 'B' samples for two-pack materials as separate unmixed samples of the base and activator (cure) components. The 'B' samples shall be taken following homogenization 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 and clearly labelled 500ml tins which shall be filled and immediately sealed prior to despatch to the testing authority.

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 (08/14) Overseeing Organisation shall report back to the 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 (08/14) On delivery to the workshop or site, paint shall be unloaded directly into one or more secure paint stores which shall be located 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 10ºC and 27ºC.

(08/14) If at any time or place paint in tins, painters' kettles or airless spray containers is allowed to reach temperatures outside the 10ºC and 27ºC 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.

(08/14) The Contractor shall also implement any additional storage requirements 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 (08/14) Exceptionally, components of two-pack epoxy paints may have their shelf life 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 (08/14) 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. A set of 'A' samples shall be taken and be submitted for testing in accordance with Clause #1912 from all batches of paint that have their shelf life extended.

1914 Application of Paint

1 (08/14) 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 in accordance with the paint manufacturers instructions and be carried out by the paint manufacturer, preferably in the paint process plant with adequate equipment and controlled measurements.

2 (08/14) Paint shall be applied only to surfaces that have been prepared and cleaned to the specified standard as described in this Series.

3 (08/14) 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) air assisted spray.

Application of paint by roller is not permitted.

4 (08/14) Paint shall not be applied when the following conditions will apply during paint application and/or curing:

(i) when the temperature of the surfaces to be coated is less than 3ºC above the Dew Point, and/or when the ambient air temperature is at or below 5ºC or the relative humidity is above 75% in an enclosed workshop or 80% on site; or, outside the temperatures and humidities recommended in the paint manufacturer's data sheet;

(ii) during rain, snow, fog, mist or in a dust laden atmosphere;

(iii) when moisture is likely to be deposited on the surface by condensation or rain;

(iv) when wind-borne dust may adhere to and contaminate the paint.

5 (08/14) All workshop painting of steelwork shall be carried out in a fully enclosed weatherproof 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 (08/14) Each coat of paint of a specified system shall have satisfactory adhesion which shall be determined by testing to ASTM D4541 – Type III. A minimum value of 52 kgf/cm^2 (750psi) shall be achieved before any paint film detachment occurs. The satisfactory adhesion of the coating system shall be confirmed by representative testing. Damage resulting from the adhesion testing shall be restored in accordance with Clause 1907.

9 (08/14) Each applied specified paint coat shall be free from defects, including bloom, cratering, pin-holing, blistering, rivelling, sagging, bittiness, dry spray and cissing etc. The presence of these defects shall be determined by unaided visual assessment supplemented by other appropriate test methods. The presence of pin-holing or porosity in the completed paint system, except at corners, bolted joints or welds, shall be determined by using low or high-voltage detectors in accordance with ASTM G62-07. 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 (08/14) All successive coats in a system including the stripe coats shall be contrasting colours to aid identification.

12 (08/14) 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.

Stripe Coats

13 (08/14) 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 adhesion promoter. When a second stripe coat is specified in Appendix 19/5, it shall be separated from the first stripe coat by an undercoat. All stripe coats shall be applied by brush.

A solvent shall be used to remove all traces of oil and grease from fasteners before treatment with an adhesion promoter.

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 (08/14) Steel or steelwork blast cleaned and 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 (08/14) Workshop prepared steel surfaces, unsealed thermally sprayed aluminium 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 (08/14) When hot dip galvanized steel is to be protected by a paint system, the adhesion promoter shall be applied not later than 14 days after delivery to site.

23 (08/14) When hot dip galvanized steelwork is to be erected in a Marine environment and is to be protected by a paint system, the adhesion promoter 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 (08/14) Prepared steel surfaces and thermally sprayed aluminium 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 (08/14) On site, steel surfaces and thermally sprayed aluminium 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. Finish coats shall be applied within 7 days of application of the preceding undercoat.

1915 Procedure Trials

1 (08/14) 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, footbridge and gantry steelwork.

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, methods and equipment to be used for the work.

2 (08/14) 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 aluminium metal coating where specified, and the paints he has selected. The Contractor shall provide sufficient paint for the trials in containers of the size to be used for the works.

3 (08/14) Thermally sprayed aluminium 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 (08/14) Unless otherwise described in Appendix 19/5 or in Series 1800,1810.7 if applicable, thermally sprayed aluminium metal coating and all workshop paint coats shall be returned 50 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 mdft, not later than 48 hours before concreting. Application of the paint outside the contact area shall be prevented, by masking if necessary.

3 (08/14) Hot dip galvanized coatings shall be applied overall. Unless otherwise described in Appendix 19/5 or in Series 1800,1810.7 if applicable, 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 (08/14) Following any relevant approvals in accordance with the Contract and recorded in Part 11 of Form HA/P1 (New Works) Paint System Sheet (Appendix 19/1), 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 (08/14) 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:

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 (08/14) Item 155 and Epoxy MIO 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 (08/14) 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. All stripe coats shall be applied by brush.

Adhesion Strength of Aluminium Metal Spray

5 (08/14) For aluminium metal sprayed CCTV masts, cantilever masts and steel lighting columns and bracket arms, the strength of adhesion of thermally sprayed aluminium 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 ISO 2063.

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 (08/14) The requirements of sub-Clauses #1912.12, 13 and 14 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.