SERIES NG 5000
MAINTENANCE PAINTING OF STEELWORK

Contents

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

Scotland

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MAINTENANCE PAINTING OF STEELWORK

NG 5001 Introduction

1 (11/03) The Series 5000 Clauses cater for surface preparation and protective coating requirements for maintenance painting of steelwork for protection against corrosion.

The Clauses are applicable to steel sections and fabricated steelwork in bridges, parapets, gantries and other highway structures, including bearings, CCTV masts, cantilever masts, steel lighting columns and bracket arms, (but excluding traffic sign posts), which are to be protected with the protective systems described in Clause 5007. Clause 5015 is concerned similarly with steel CCTV masts, cantilever masts, steel lighting columns, (but excluding traffic sign posts), and bracket arms.

2 The detailed requirements for surface preparation, the coatings and their application are specified by means of appropriate Series NG 5000 Appendices. The format is flexible and can cater for a single component contract, e.g. from a length of parapet, up to the involved requirements of a bridge strengthening and widening scheme.

3 (05/05) The information on environment, accessibility, type and condition of existing protective system and expected durability will give the Contractor guidance on the constraints and extent of the work to be carried out. The 'Required Durability' is a means of alerting the paint manufacturer as to the performance expected from the protective system offered.

Substitute and Additional Clauses

4 Clauses 5001 to 5015, should be scrutinised to ensure that all aspects of the Contract can be covered satisfactorily. When, exceptionally, Substitute or Additional Clauses are required, the alterations should be made after agreement with the Technical Approval Authority and, where appropriate, after consultation with the Overseeing Organisation.

Consultations on Health Hazards and Environmental Restrictions

5 (05/05) Health hazards associated with pollution of the atmospheric environment have to be taken into account during surface preparation and the application of protective coatings. Unless necessary precautions are taken and any limitations on the Contractor's method of working (Appendix 1/23) are observed, people may be adversely affected, also the site ground area and waterways may become contaminated to an unacceptable extent. The precautions to be taken during the application of protective coatings are usually stated by the suppliers, e.g. ventilation to remove strong solvent vapour. In the case of blast cleaning with non-metallic abrasives, particularly if large surface areas are involved, plans should be discussed with the Environmental Health Officer, the Health and Safety Executive, the Environment Agency and other interested parties and clearance obtained for the proposals. The debris produced by combined wet and dry blast cleaning (see sub-Clauses 5003.18 and 19) can usually be contained satisfactorily. However, in some cases it may be necessary to use dry blast cleaning only, e.g. to clean up a thermally sprayed metal coating based system. This method is usually acceptable for a structure in an unpopulated area, even over a road.

For a structure near or over a river, it may be necessary to prevent any debris from falling into the water or even on the ground nearby. In other areas, for example near a dust sensitive industrial process, the spreading of any dust in the atmosphere near the plant would be unacceptable.

Also, although operators can usually be protected from the effects of spray application, it may be necessary in some cases to protect the immediate environment from overspray (see Clause NG 124); it may even be expedient to specify brush application only.

If as a result of investigation it is clear that side sheeting or close boarded scaffolding is required to reduce or prevent dust and debris being released into the atmosphere or from falling into a river, say, this should be stated in Appendix 50/5.

The Contractor should ensure that all his operations fully comply with the Control of Lead at Work Regulations 2002, or Control of Lead at Work Regulations (Northern Ireland) 2002.

6 (05/05) Dry blast cleaning on its own breaks up an existing protective system into small particles and these, together with the spent abrasive, form a dense dust cloud which may also contain toxic material, e.g. debris from lead paints. Dust from dry abrading may sometimes be toxic e.g. dust from fungus spores inside box girders, but the volume of dust is much smaller. Operatives and supervisors who work in these

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conditions should be suitably protected. Although protection during wet abrasive blast cleaning is also necessary, the wetted particles are more easily contained in the Work area.

7 When the existing paint system on the structure is found to contain lead the use of closed circuit ultra high pressure water blasting (which combines water blasting, filtration and vacuum) should be considered.

8 (05/05) Highly volatile solvents can cause illness very quickly during paint application. Less volatile but strong smelling solvents may not be so injurious but can be temporarily almost as disabling. Some pigments and media are also toxic. Appropriate protection and control measures, in accordance with the paint manufacturer's health and safety data sheets, should therefore be taken by personnel likely to be affected by either handling or the close proximity of paints. Adequate ventilation is necessary particularly in enclosed spaces such as inside box girders.

9 Where the maintenance painting is to be undertaken over a road open to traffic, the need for traffic management and other measures to protect road users should be implemented.

NG 5002 Surface Preparation - General Requirements

1 In most cases the use of a cleaning agent followed by rinsing is considered to be more effective than the use of a solvent. If traces of oil or grease remain after the first attempt, further cleaning may be necessary. However, if wetting of the surface is not permissible, use of a solvent may be necessary.

2 (05/05) It should be ensured that, throughout the duration of the Work, clean water is used for wet cleaning and rinsing. Generally, potable water will be satisfactory, but there should be a check that the water (or the cleaning agent) does not leave harmful residues on the surface. Warm water may be used where appropriate.

3 There should also be a check that the cleaning agents offered do clean satisfactorily and do not themselves leave harmful residues on the surface after final rinsing. Abrasives should be checked for freedom from impurities, which could contaminate the surface to be cleaned.

4 It should be ensured that the necessary information and equipment for the optical and chemical checking of surfaces for freedom from corrosion products and contamination are available (see Clause NG 5004).

The appearance of surfaces prepared to clean steel or sound metal coating can be checked satisfactorily for residues of rust and other corrosion products or impacted dirt with a 10x illuminated magnifying glass. Although a magnifying glass can also be used on dry surfaces for an initial check for soluble salts, a final check has to be made using reagents, especially after wet blast cleaning or cleaning down.

In cases of heavy contamination, more intensive or repeated surface preparation may be necessary. The Contractor will be expected to have sufficient expertise to recognise such areas when the extent of the work is ascertained.

5 Dry methods or closed circuit wet methods of surface preparation should be specified for the inside of box girders otherwise excessive water will accumulate on the bottom surfaces especially between stiffeners. Appropriate ventilation should be provided as surfaces may remain wet for some time and delay painting. The internal surfaces of hollow sections which are to be coated should be free from dust and debris as far as practicable.

6 Although the initial surface preparation may have been satisfactory, and all dust and debris removed, further dust may well collect on the cleaned surface. In harsh environments further pollutants may also be deposited. It is essential, therefore, to check surfaces immediately before painting.

7 As part of good practice feathering of existing paint should take place, exposing weak edges.

8 Unless otherwise specified fasteners should be prepared and painted to the same standard as adjacent main surfaces, if special treatment of fasteners is required, this should be specified in Appendix 50/2.

9 One or two typical joints should be included in the procedure trials to verify the efficiency of techniques for freeing joints of water or for preventing its ingress. If a wet joint is suspected, dry compressed air should be used to free the joint of water, after the surface preparation at the joint has been completed. If painting is undertaken in winter months, then it may be necessary to apply heat to dry out joints. During dry warm weather, the problem will be less severe although it should be ensured that water penetrating the joint as a result of surface preparation, is removed.

The use of sealants which set hard should be avoided unless they are known to adhere well and not to shrink.

#NG 5003 Surface Preparation-Materials and Methods

Abrading

1 (05/05) Abrading and blast cleaning are the two basic methods for removal of unsound coatings. Scraping and wire brushing alone will not achieve an adequate standard of cleanliness and are therefore considered as no more than an aid in removing thick rust scale, encrusted dirt and paint from areas which should then be abraded. Other methods such as flame cleaning may be specified by the introduction of additional clauses. 'BS EN ISO 8504-3, BS 7079-D3' describes methods for hand-tool and power-tool cleaning of steel substrates before application of paints and related products. It applies both to new steelwork and to steel surfaces that have been coated previously and that show areas of breakdown requiring maintenance painting. It also describes the equipment to be used and the procedure to be followed.

2 Wet abrading by hand is often preferred for surface preparation of hot dip galvanized only or hot dip galvanized and painted parapets.

Wet abrading may also be used for cleaning down finishes over sound paint where any underlying thermal metal spray coating is protected by an adequate thickness of paint. However, if the coats are unsound, water should not be used.

3 Power wire brushing, whether or not preceded by chipping or scraping, is unlikely to achieve a satisfactory standard of cleanliness and is therefore considered as no more than an aid prior to abrading.

4 Abrading will be used mainly to repair mechanical damage and during restoration of local failure in the paint system. Water should not be allowed to come into contact with exposed thermally sprayed metal coatings which are porous, nor if possible with bright steel. However, wet abrading can be usefully employed where hot dip galvanizing is present.

5 Only power tools which rotate at the relatively high speeds necessary for abrading or power wire brushing should be used. The use of hard grinding wheels or discs is not permitted for abrading as their edges can easily cut into the surface.

6 Electric drill speeds are relatively slow, the use of hand-held drills as a power source for wire brushing often results in a polished appearance due to the formation of a patina of pollutants and corrosion products.

7 Sub-Clause 5003.5 caters for the protection of exposed areas of cleaned steel substrate or thermally sprayed metal coatings before they can be adversely affected by wetting or debris from adjacent surface preparation.

Dry or Wet Cleaning

8 It should be ensured that the selected cleaning agent is used at the recommended concentration.

9 Dry cleaning is usually satisfactory for internal surfaces as these are less likely to have become contaminated. Nevertheless these surfaces should be checked before painting and further cleaning carried out if necessary. If this is unsatisfactory, advice should be sought from the Overseeing Organisation.

10 Metallic grit particles embedded in the existing paint or steel surface should be dislodged during cleaning down, otherwise they should be dislodged by scraping as described in sub-Clause 5003.10.

Dry Blast Cleaning using Dry Air/Abrasive System

11 (05/05) The abrasive offered by the Contractor for blast cleaning should be checked for impurities as these may contaminate the surfaces to be cleaned (methods for checking for impurities are given in ISO 8502). If the type, grade and particle shape offered are appreciably different from those of the abrasive used during the procedure trials then the results that were achieved at that time are unlikely to be repeated during the Work.

12 If particles of abrasive are allowed to fall onto a freshly painted surface they are likely to become embedded in the wet paint. Embedded abrasive in fresh paint should be removed, and if necessary, the affected coat restored. If dried films only have been affected, wet cleaning may prove effective in removing such surface dust, however, careful checks should be made.

13 Copper slag can be used to blast clean steel surfaces, also to remove unsound paint; however, if surfaces have become heavily contaminated, dry blast cleaning may not be adequate and wet blast cleaning may be necessary. Modern and efficient blast cleaning equipment, which will recirculate metallic abrasive, is available. The requirements for fasteners are covered in sub-Clause 5002.9.

Under the Control of Substances Hazardous to Health Regulations 2002, sand (or other substance) containing free silica may not be used as an abrasive for blast cleaning.

Wet Blast Cleaning using Low Pressure Air/Water/ Abrasive System

14 The main advantages of wet blast cleaning are that it keeps dust down and that it is the best method of removing heavy contamination and soluble steel

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corrosion product. It should not be used to clean up thermally sprayed metal coatings because they are porous. Wet blast cleaning will not produce a profile on the surface and should not be used as the only method for surface preparation of steel. It should only be used on bolted connections if dry blast cleaning is impractical, otherwise water will penetrate into the joint. It is, however, satisfactory for welded joints which are to be painted, also for cleaning up or removing paint over a steel substrate.

15 Unless blast cleaned and adjacent surfaces are cleared of abrasive and debris within a short period, re-contamination is likely.

Wet Blast Cleaning using High Pressure Water/ Abrasive System or Ultra High Pressure Water System

16 The efficiency of the equipment selected by the Contractor should be checked during the procedure trials. Wet blast cleaning will not produce a surface profile and should not be used as the only method of surface preparation of steel.

17 No flash rusting should occur after ultra high pressure water system cleaning.

Combined Wet/Dry Blast Cleaning

18 When wet blast cleaning is used to prepare steel surfaces, flash rusting may occur if painting is delayed. The required standard of cleanliness should be restored by light dry blast cleaning and paint should be applied while the surfaces are still clean.

19 As already mentioned, one of the main advantages of wet blast cleaning is its effectiveness in removing contamination; however, if this is not achieved using wet blast cleaning any subsequent light dry blast cleaning, although it may restore a clean appearance, is unlikely to remove contamination remaining on the surface or in the blast cleaned profile. For very heavy contamination ultra high pressure water/abrasive system cleaning should be considered, as in this method heat is generated by the impact energy of the water on the steel, which will assist in contamination removal.

Other Requirements

20 (05/05) If water from cleaning down, and debris from abrading, spreads onto blast cleaned and freshly painted surfaces, the paint is likely to be damaged or contaminated. On the other hand, when dry blast cleaning is carried out last, the dry dust and debris can be removed without difficulty from the surfaces of cleaned down existing coatings. This also applies to wet blast cleaning debris which, in any case, has to be washed off within 1 hour. Areas of metal spray coating which have been prepared to bright metal should be protected before they become wetted for any reason, e.g. rain, condensation as well as by washing down water. This problem does not arise with hot dip galvanising which is not porous. Local areas of steel substrate or metal coatings which have been prepared and then painted to protect them from adjacent washing down, as required by sub-Clauses 5003.5 to 7, 5003.20 to 22 and 5003.25 should also be rinsed using clean water at the same time as the adjacent areas are finally rinsed down.

21 The removal of deposits from the workpiece and adjacent surfaces after wet blast cleaning is important otherwise serious recontamination of the surface may occur. A scatter of abrasive particles and minor spot or flash rusting can be removed by the subsequent dry blast cleaning.

22 Sub-Clauses 5003.20 to 22 are important sub-Clauses as they inform the Contractor of the sequence of operations necessary to keep contamination of adjacent surfaces to a minimum when different methods of surface preparation are used.

Grinding After Surface Preparation

23 Grinding has to be carried out carefully without damaging the surface and only skilled operators should be allowed to carry out this work. It should be ensured that checks for defects are undertaken as surface preparation proceeds and that these are remedied by the Contractor.

NG 5004 Surface Preparation - Workmanship Standards

1 The standards of surface preparation which can be achieved on site are covered by sub-Clause 5004.1. The appropriate description should be used in Appendix 50/1 for the particular Contract for cross reference by the Contractor, this will enable him to ascertain the degree of cleanliness required.

2 (05/05) Only the terms for the description of the standards of surface preparation listed in these clauses should be used in writing out Appendix 50/1 requirements. Failed paint and paint over rust scale and loose mill scale, also failed metal coatings of any type, are described as ‘unsound’ as they have to be removed (see sub-Clause 5004.2). The term ‘metal coating’ is used to describe zinc thermal metal spray, aluminium thermal metal spray and hot dipped galvanized coatings. It should be verified during the procedure trials that the Contractor is capable of detecting and removing unsound coatings and that the standard is maintained throughout the Work.

3 Prolonged surface preparation may be required to ensure that any remaining traces of contamination or corroded metal coating will not be detrimental to the existing or subsequent coatings.

4 Aluminium metal spray which has been properly applied in the first place is difficult to remove completely and therefore traces of firmly adhering aluminium may be allowed to remain in the profile. Fortunately aluminium is generally less affected by corrosion than zinc and the surface can usually be cleaned up satisfactorily. Complete removal, except for traces of clean aluminium, is only necessary when the coating has been badly applied, e.g. when there is evidence of dry spray or lack of adhesion, in which case the coating tends to disintegrate and can be blast cleaned off without difficulty. These faults should be looked for during the pre-specification survey and checked during the feasibility trials where these are carried out.

5 (05/05) The various terms used to describe coatings e.g. unsound paint, and the extent of surface preparation and cleanliness e.g. clean steel, are defined. For practical purposes it will be seen that there are basically two requirements for surface preparation, firstly the workmanship or physical requirements (see sub-Clauses 5004.2 (i) to (vi)) and the requirements for chemical cleanliness (see sub-Clause 5004.1 (i) to (vii)). Also refer to BS EN ISO 8504-1 to -3.

6 There are, broadly speaking, three types of surfaces to be checked for satisfactory surface preparation, viz. a steel substrate, a metallic coating and paint coating. Some of the contaminants and most corrosive agents will affect each type of surface differently; also any resulting corrosion products will be different. The method of surface preparation has a bearing both on the appearance and on chemical cleanliness. Wet blast cleaning and wet cleaning down will remove most contamination more effectively than dry blast cleaning or dry brushing down. The appearance of a rusted and pitted surface after dry blast cleaning may be satisfactory, but where steelwork has been exposed in a harsh environment, considerable quantities of harmful soluble salts such as sulphates and chlorides will remain in the surface profile and in any pits. It is also the case that it will be more difficult to free paint coats which have a rough surface, such as micaceous iron oxide, of contamination than it would be for a gloss finish. Pitted surfaces should be washed down and dried to remove contaminants.

7 Where feasibility trials have been undertaken, these will have enabled the surveyor's recommendations for specifying surface preparation to be verified; also by the time the trials have been completed, the methods of checking for cleanliness optically and chemically should have been established satisfactorily and thus be ready for use when the contract procedure trials take place. Unfortunately, at present there are no known published standards for tests or acknowledged safe limits for contamination, but refer to BS EN ISO 8502.

8 The most practical methods at the moment for detecting chemical contamination involve swabbing and noting the effect on indicator papers or liquid reagents. Some indicator papers are described as being 'semi-quantitative'; however, as commercial kits have not yet been designed specifically for the detection of contamination found on painted or steel surfaces of exposed structures such as bridges, final assessment is often done after analysing the swabbing water in a laboratory, when a judgement based on experience is made as to whether any remaining residues are likely to be detrimental. Even so, the amount of contamination removed by a given swabbing technique will vary considerably according to the roughness of the surfaces, particularly if pitted. The various liquid reagents which require safe handling conditions on site show the presence only of contamination in the swabbing water by changing colour and do not indicate the quantity of contamination. When effective surface preparation methods are used, residues can usually be shown to have been reduced to trace levels. The inspection firms should have the necessary equipment for checking for contamination at site and in the laboratory and could provide a demonstration from one of their surveyors or inspectors during the survey or feasibility trials, or during the procedure trials at the start of the Contract. Contractors are aware of the problems of contaminants and will usually accept reasonable requirements. The requirements for each Contract, however, have to be considered separately.

NG 5005 Metal Coatings

1 (05/05) Effective protection is unlikely in areas where the thickness of a thermally sprayed metal coating is less than 100 microns. Although zinc metal spray is referred to in sub-Clause 5005.2, the use of aluminium metal spray is preferred.

Zinc metal spray will, however, have an application for other components e.g. temporary structures in a mild environment.

It is known that many failures of thermally sprayed metal coatings have been due to unsatisfactory surface preparation leading to poor adhesion. Application in two layers and poor application technique have also caused problems. Particular close inspection at all stages is essential. The standard of blast cleaning should be clean steel, medium profile using chilled cast iron grit, steel or aluminium oxide grit.

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NG 5006 Testing of Metal Spray Coatings

1 (05/05) It is to be expected that Contractors undertaking thermally sprayed metal coating have the necessary expertise, particularly in respect to understanding the importance of a clean sharp blast cleaning profile and of being able to check adhesion with modern equipment. Nevertheless, it should be ensured that all the requirements are being met, otherwise experience has shown that early and very expensive failures can occur. Adhesion tests should be made in accordance with recommendations of the manufacturer of the testing equipment, for example the pull-off force should be normal to the surface. Usual reasons for lack of adhesion are bad application techniques or blast cleaned surfaces which have been exposed, even for a short time, in a damp environment and have lost their initial bright finish. When the overall adhesion is suspect, all the thermally sprayed metal coating should be blast cleaned off the area in question as obviously any residual thermally sprayed metal coating may also be defective. In the excepted areas, adhesion cannot be checked by the test panel method; the only practical method being the grid test described in BS EN 22063 Annex A, carried out as the Work proceeds.

NG 5007 Paint and Similar Protective Coatings

1 Grease paints are protective coatings based on Calcium Soaps of Oxidized Petroleum Wax and are applied by brush or airless spray and are similar in appearance to ordinary paints but do not harden completely. When the solvent has evaporated grease paints are hard enough to walk on.

2 Appendix 50/1, Form HA/P1 (Maintenance) Paint System Sheet should be checked to ensure that the registered dates have been entered by the Contractor.

3 (05/05) Tins should show all the specified markings and the required standard should be insisted on at the outset. Omission of the Item Number for example, can lead to delay in checking the specific gravity on site and the despatch of 'A' and 'B' samples.

4 (05/05) In practice, a paint manufacturer issues Appendix 50/3, Form HA/P2 Paint Data Sheet, to the Contractor. The Data Sheets should be examined and any special stipulation as to application which may cause problems or delays during the Work should be noted and brought to the attention of the Contractor. If, for example, the weather is likely to be unfavourable the Contractor should be fully aware of any relevant restrictions on the application of the paints.

5 (05/05) A source of supply should only be rejected after consultation with the Overseeing Organisation.

Standard Terminology for the Description of Paint

6 (05/05) Standard Terminology enables paints to be described in generic terms and without specifying trade names. It is used for the Registered Description in Paint System Sheets, in Data Sheets and in the Specification and should convey the following information in the order given:

(i) (05/05) Name of Pigment: where a pigment provides inhibitive or structural properties it should be named, e.g. MIO, Zinc Phosphate. Where pigments provide colour, opacity or act as extenders etc. the pigments should not be named.

(ii) (05/05) Type of Medium: the type of medium should be stated, e.g., M/Phenolic, Phenolic (i.e. pure Phenolic), Silicone Alkyd, Polyurethane, Epoxy (two-pack). (See below for meaning of abbreviations.)

(iii) (05/05) Use: i.e. Blast Primer, Primer, Undercoat or Finish. If two-pack, add '(two-pack)'.

The first coat only of a new system is described as a Blast Primer or Primer, all subsequent intermediate coats are described as Undercoats, the last coat being the Finish. A Primer or Primer/Undercoat (i.e. a dual purpose paint) may be specified when it is desirable to obtain a relatively high film build in the first coat, usually for small areas on site.

(iv) (05/05) Colour: a descriptive colour should always be stated as part of the Registered Description in Appendix 50/1, Form HA/P1 (Maintenance) Paint System Sheet.

Convenient abbreviations have been introduced where these can be readily understood and used in Specifications, e.g.:

MIO	Micaceous Iron Oxide
M/Phenolic	Modified Phenolic
MC Polyurethane	Moisture cured Polyurethane
HB	High build
NB	Normal build
LB	Low build
QD	Quick drying

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Terminology Used in Painting Practice

7 For definitions of terms used in painting practice reference should be made to BS 2015 and BS EN 971-1. Specific meanings of the descriptions of workmanship standards for surface preparation of steel and coated steelwork are given in Clause 5004.

NG 5008 Surface Preparation and Protective Systems

Protective Systems

1 The types of protective systems for steelwork are outlined below:

The following systems are suitable for all environments and all access situations. All protective systems types, except for Type V (M) grease paints, should not require major maintenance up to 20 years.

TABLE NG 50/1 - (05/05) Summary of Protective Systems

Type	Description	Application on to:	Comment
I (M)	High Build Epoxy (two-pack)/Polyurethane (two-pack) finish systems	External steelwork where the existing protective system is removed by blast cleaning over the whole of the surface area down to clean steel or sound aluminium or zinc metal spray coating (small areas may be abraded).	Suitable for application when steel and ambient temperatures are at or expected to be above the minimum specified in sub-Clause 5012.6.i during the curing period
II (M)	Moisture cured Polyurethanes (two-pack) systems		Suitable for application at night-time when temperatures are low and when some surface moisture (but not running water) may be present on the steelwork surface due to the high relative humidity (RH) levels, however adequate levels of ventilation should be ensured.
III (M)	Epoxy/ Polyurethanes finish systems	Hot dip galvanizing treated with Item 155 or other adhesion promoter	MIO epoxy undercoat (Item 112) or slow curing single coat MIO epoxy (Item 121) which provides excellent adhesion properties for the treatment of galvanized surfaces which have been prepared using an adhesion promoter.
III (M) Alternative	Extended Cure Epoxy/ Polyurethanes finish systems	Hot dip galvanizing	Slow curing single coat MIO epoxy (Item 121) which provides very good adhesion properties for the treatment of galvanized surfaces.
IV (M)	MC/Epoxy/Polyurethane systems	External steelwork where the existing protective system is removed by blast cleaning over the whole of the surface area down to clean or Sa2 or St3 steel.	Not to be used when steel and/or ambient temperatures at the time of application or during the curing period are at or below 0°C.
V (M)	Grease paint systems	Where the remaining service life of the structure is less than 20 years or where the extent and intensity of surface preparation required to provide a surface suitable for applying a conventional paint system is technically unattainable or too costly to achieve.	Grease paints should not be used where there is pedestrian access, e.g. parapets on overbridges.

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2 (11/03) Using the information provided in parts 3 to 9 in Appendix 50/1, Form HA/P1 (Maintenance) Paint System Sheet, the protective systems in Table 50/2 should be detailed by the Contractor in the remainder of Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet for bridge steelwork and parapets, gantries and other structures, bearings, CCTV masts, cantilever masts, steel lighting columns and bracket arms.

3 An Appendix 50/2 may be incorporated for situations where special preparation and/or protective systems may be required, or for other works requiring protection.

4 General

(i) The protective systems for bridge and other highway structures include systems which are satisfactory for sign gantries, footbridges, parapets and also for structures such as towers and buildings. Systems for structures which have to withstand especially aggressive conditions, salt hoppers for example, are not listed. Systems for traffic sign posts and plastic coated items are covered in Series 1200 and in Series 2600.

(ii) Colours of finishing paints. Where the appearance of the structure is of particular importance, colours for gloss finishes and low sheen finishes should be selected as in (a) and (b) below:

(a) Gloss Finishes

From the following colours in BS 4800:

Light Grey	00 A 05
Medium Grey	18 B 21
Dark Grey	18 B 25
Green-yellow	12 B 21
White	00 E 55

(b) (05/05) Semi-gloss Finishes

High gloss is usually stated as 75 or more gloss units (gu), on a 60° geometry head in accordance with BS EN ISO 2813. Semi-gloss (or sheen) is usually stated as 45gu (±10) on a 60° geometry head. When a semi-gloss finish is acceptable, or is specifically required such as for sign gantry steelwork, Item 169, low sheen polyurethane, should be used.

When there is a need for other colours, for example in the case of a large bridge or one which is in an environmentally sensitive area and visually dominant, the matter should be referred to the Overseeing Organisation, describing the structure, its location and the proposed alternative BS 4800 colour and the reasons for selecting it. Advice on the choice and use of colour is available in the Highways Agency publication 'The Appearance of Bridges and other Highway Structures' Chapter 21.

Appendices 50/1 and 50/2

5 (05/05) The environment, accessibility, required durability of the systems, finish colour, the proposed sequence of operations and extent of surface preparation and painting required for the Works, should be written into Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet (parts 3 to 9): see Clauses 5013 and NG 5013. The factors to be taken into account in determining the descriptions are described below.

(i) **Environment**

Location of structures

Two locations are considered; 'Inland' and 'Marine'.

Structures out of reach of sea salt spray are considered as being 'Inland'. Structures which can be affected by sea salt spray are considered as being 'Marine'.

(ii) **Accessibility**

For maintenance painting purposes, structures are described as having either Ready Access or Difficult Access.

The description Ready Access would apply to structures where restrictions on working time due to road or rail traffic are likely to be minimal and where access on site is unlikely to be a problem.

The description Difficult Access would apply, for example, to a bridge or sign gantry over a motorway or to a bridge over a railway where painting is likely to be restricted to one section at a time or halted completely at certain periods when traffic is heavy.

It would also apply on two counts to a high bridge, say, without painting gantries and built over difficult terrain or a river where movement on the ground would be difficult and because extensive scaffolding would be required.

(iii) (11/03) **Required Durability**

For the protective systems (except for CCTV masts, cantilever masts, steel lighting columns and bracket arms), the periods 'No maintenance up to 15 years,' 'Minor maintenance from 15 years' and

'Major maintenance after 20 years' will be sufficiently accurate for both access situations and the environments described in this Clause. However when access is especially difficult, e.g. when dismantling of cover plates is necessary, a special system may be required. In such a case the usual periods for 'No maintenance' and 'Minor maintenance' would not be applicable (N/A); 'Major maintenance' being given as, say, 20 years, or even 25 years.

For the protective systems for CCTV masts, cantilever masts, steel lighting columns and bracket arms, the 'required durability' of the exterior coatings, which consist of aluminium metal spray plus sealer, hot dip galvanizing only or one of these metal coatings plus a paint system, is no maintenance up to 8 years, minor maintenance after 8 years and major maintenance after 15 years.

(iv) (05/05) **Description of Existing Protective System(s)**

The existing protective system(s) should be described briefly, the various coats, including metal coatings, being named as accurately as possible. On older bridges, where there may be as many as 20 coats, a group description should be given together with an estimate of the average total thickness. A description of coats of lead based paints and other materials which may become health hazards during surface preparation should be included.

(v) (05/05) **Sequence of Operations**

In most cases it will be adequate for the sequence of operations to be as proposed by the Contractor. However, when the Work has to be carried out in a special sequence, detailed requirements should be given in Appendix 50/2.

(vi) (05/05) **Surface Preparation**

It is important that the principle of specifying 'Method' and 'Standard' using the appropriate references to Clause 5003 and 5004 should be followed carefully, also each part of the structure and the surfaces to be painted on each part should be described accurately.

If parapets are included in the maintenance painting contract for a bridge, and a different paint system is required, then the system for the parapets should be listed separately and a separate Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet provided. For parapets and similar items, where there may be many small areas requiring different methods of surface preparation and painting, the method of billing may be by length, all variations being allowed for in the price.

The various parts of the structure should be referred to as Area A, B, C etc, and a standard method of surface preparation and paint system should be specified and billed separately for each part, minor variations in the amount of work being ignored. However if there is a large area where different surface preparation and protective coatings, e.g. where different intensities of abrading are required the related cleaning down and painting therefore have to be specified and billed in detail, as is necessary.

In the case of work by Contract, the paint coat summary is intended to make clear to tenderers the system required for each of the prepared surfaces, and assists in the pricing of like for like.

(vii) (05/05) **Calculating Paint Quantities and Costs**

(a) The minimum dry film thickness (mdft) of a coat of paint is the specification requirement from which the amount of paint to be ordered and cost of paint are calculated.

(b) The quantity of paint required for painting a known area to a specific minimum dry film thickness is a function of a number of criteria:

- The volume solids of the paint.
- The degree of roughness for the surface to which the paint is to be applied. The roughness is mainly created by the blast cleaning process, and in particular by the particle size of the abrasive used in the operation. The coarser the abrasive, the greater the 'peak to valley' height produced, and the larger is the quantity of paint required to fill the profile before measurable dry film thicknesses over the peaks is achieved.
- The amount of over-application and uneven application of paint, overspray wastage, and wastage due to losses in containers, equipment, and spillage etc.
- The shape, configuration and complexity of the structure to be painted.

(c) The volume solids of a paint is the ratio of solid components remaining after evaporation of solvent, expressed as a percentage of the volume of the wet film.

Calculation of the theoretical quantity of paint required to cover a known area on a smooth plane surface is based upon the following relationship:

1 litre of paint at 100% volume solids will cover an area of 1 square metre to a thickness of lmm (1000 micronss).

The theoretical spreading rate for a particular product is calculated from the volume solids of that product using the following equation:

Theoretical spreading rate (metres^2/litre)

$$= \frac{\text{Volume solids x 10}}{\text{Required dft (microns)}}$$

The volume solids should be determined using 'BS 3900-A10, ISO 3233'.

Other methods of determining and expressing volume solids are sometimes quoted by paint suppliers. Some of these alternatives lead to a higher value of volume solids and hence a more optimistic theoretical spreading rate, which may not be achieved in practice.

(d) Factors indicated in (vii)(b)(2nd and 3rd bullets points above) affect the actual spreading rate, which is derived from the theoretical rate. Extra paint must be allowed for, to take these factors into account. The most significant of these factors is normally the peak to valley height of the blast profile (vii)(b)(2nd bullets point above). For a blast profile of 60 micronss it is necessary to apply an extra quantity of paint equivalent to a dft of approximately half the peak to valley height ie an extra 30 micronss of dft before measurable thickness occurs. In a specified 50 microns primer coat, this would result in an increase of 30/50 or 60% over the theoretical quantity required over a smooth surface. A blast profile with a peak to valley height of 100 micronss would result in 100% increase over the theoretical quantity for the same primer coat. The effect of blast profile on subsequent undercoats and final coats will be much less significant.

The skill of the applicator and the awareness of the Inspector checking the Work play an important part in determining the extent of losses from over-application. By exercising careful control of paint fluid pressure and by the constant use of wet film thickness gauges to monitor paint application, excessive wastage can be avoided.

The responsibilities of the Contractor with respect to the application of paint are clearly stated in sub-Clause 5012.8.

Estimated percentages of extra paint to allow for factors 2(iii) and 2(iv) will vary significantly. At best they can be as low as 20%, but can also be as high as 60%, for complex geometric structures such as lattice girders.

(e) Calculation of Paint Costs

Comparisons of price between different brands of paint, which may have different volume solids content should be based upon the following steps:

Step 1 Determine the theoretical spreading rate for the required dry film thickness, as follows:

Theoretical spreading rate (m^2/litre)

$$= \frac{\text{Volume solids x 10}}{\text{Required dft (microns)}}$$

Step 2 Divide the price per litre by the theoretical spreading rate to arrive at a cost/square metre

Cost per square metre

$$= \frac{\text{Price/litre}}{\text{Theoretical spreading rate}}$$

Step 3 Theoretical overall cost = (Cost per square metre) x (total area)

Step 4 Practical overall cost = (Theoretical overall cost) x (factors considered in paragraph (vii)(d) above)

(viii) (05/05) **Paint system(s) and application instructions**

Although the methods of surface preparation of the main steelwork are specified separately, each maintenance paint system should be specified as one continuous operation in the order in which the Contractor will be expected to carry out the Work. For example, the 1st coat to be applied may be a patch primer for application to local areas abraded to bright steel, the next coat, i.e. the 2nd coat, may be a blast primer to be applied over areas of clean

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steel, the 3rd coat may be an undercoat applied over the 1st and 2nd coat, the 4th coat may be an undercoat applied over the 2nd coat. Painting instructions on the amount of overlap and method of application should also be given as appropriate in Appendix 50/2 if different from standard.

Excepting for small areas of overlapping, e.g. inside corners and where application is particularly difficult, the local dry film thickness for any primer should not exceed the specified mdft by more than 30% and for other paints by more than 75%. This is particularly important if the specified mdft is on the upper limit of the range given in the Manual.

Experience has shown that any special instructions should be listed separately under 'Special application instructions' in Appendix 50/2.

The application of a coat should only be specified over areas which have a clear demarcation. For example, once an overall undercoat has been applied, it is not practical to specify that the next coat should only be applied over areas previously blast cleaned.

For specification purposes, a patch is an area in an existing system, which is abraded or blast cleaned down to sound paint (viz not to a steel substrate or metal coating) and which, prior to applying overall coats, is required to be patch painted in order to provide the extra dft necessary for protection. Areas prepared down to a steel surface or to a metal coating will require a full paint system and are not termed patches - even if the areas are small. Paint for patching is called off separately and not with the paints for the system, one or two of the undercoats being specified for this purpose. Generally patches will be less than, say, 0.5 m^2. Only very exceptionally will the finished appearance be of sufficient importance to warrant applying extra patch painting over and above the thickness necessary to provide protection, that is to match the thickness of the old surrounding paint in order to provide a virtually even surface. Where patch painting has been carried out, the total dft of the old coats plus patch coats and overall new coats should not be less than 250 microns and, with the exception of parapets having ready access, not less than 350 microns in harsh environments for steelwork not having a metal coating. The total dft of old coats plus patch coats and overall new coats on parapets not having a metal coating, but with ready access, should not be less than 250 microns.

(ix) (05/05) **Dry film thickness**

Paint coats which are applied at too great a thickness may have to be left to harden considerably longer than the recommended overcoating time otherwise solvent may be trapped causing blistering of the next coat(s). Also, overthick application may give rise to crazing or cracking or other surface defects, especially if exposed to heat before the coating has hardened.

(x) **Special application instructions**

If special methods are required for applying paint, say, at bearings or expansion joints, or due to environmental conditions, then these should be specified in Appendix 50/2.

(xi) (05/05) **Paint products**

Requirements for the quality assurance scheme and certification of paints are given in BD 35 'Quality Assurance Scheme for Paints and Similar Protective Coatings' (DMRB 2.4.1). All paints to be used in the Works should have a current BBA HAPAS Road and Bridges Certificate or equivalent.

Copies of BBA HAPAS Road and Bridges Certificates for those paint products that have gained approval can be downloaded from the BBA website: www.bbacerts.co.uk.

(xii) (05/05) **Colour**

When a BS colour is specified in Appendix 50/1, Form HA/P1 (Maintenance) Paint System Sheet, the BS 4800 reference should follow the descriptive colour, e.g. green-yellow 12 B 21.

Additionally any special finishes should be stated, e.g. low sheen.

6 The choice of system will depend finally on the type of structure, especially in the case of a bridge and the expected service life of structure based on its use.

#NG 5009 Testing of Paints

Provision of Samples

1 Quality assurance of paint as delivered, that is verification of the composition data and application characteristics given in paint manufacturers' registered formulations, can only be carried out on paint samples taken from previously unopened tins; these are known as 'A' samples.

Before the Contractor despatches the 'A' Samples to the address given in sub-Clause NG 5009.5 or 5009.6 for testing in accordance with Clause 5009, the checks referred to in sub-Clause NG 5009.3 below should be carried out but on paint taken from other tins of the same batch.

'B' samples on the other hand, should be taken from paint in use to ensure that it is as supplied. See sub- Clause 5009.9 and sub-Clause NG 5009.9.

'A' Samples

2 Although 'A' samples are not required in the case of certain bridge and other highway structures described in sub- Clause 5009.4, 'B' samples should still be taken as these make an effective contribution to quality control.

3 (05/05) Special deliveries of single tins of paint arranged by the Contractor, to the site or to the testing authority, are not acceptable as 'A' samples. Samples should be selected from fully representative batches. As a minimum, the condition of the paint in the tins should be examined and, after mixing, the specific gravity should be checked; matching of finish colours to BS 4800 should also be checked. Paint found to be faulty, especially in the case of appreciably incorrect specific gravity should be rejected on site. The Supervisor is required to check the specific gravity of paints before despatching 5 litre 'A' samples and 500 ml 'B' samples to the testing authority for testing. When the specific gravity of paint samples is appreciably incorrect, then the paints should be rejected in the Works or at site, testing of samples by the testing authority being unnecessary. Painting inspectors will, in most cases, have the experience to know when to reject a paint which has an appreciably high or low specific gravity. For example, the Inspector will know that a ± 3 % difference on the specific gravity of, say, an MIO phenolic paint is not as critical as a ± 3% difference on, say, a Silicone Alkyd Finish.

The following specific gravity tolerances are a useful guide for the Supervisor in deciding whether or not samples should be despatched to the testing authority for testing:

Paints with a specific gravity up to 1.4: + or - 3%

Paints with a specific gravity greater than 1.4: + or - 4%

The method of test to be used for determination of specific gravity is in accordance with 'BS EN ISO 2811-1, BS 3900-A19'. It should be ensured that the cause of any unsatisfactory application during the procedure trial is remedied before the start of the main painting.

4 (05/05) After submission of the first 'A' samples of each type of paint, further 'A' samples should be submitted for testing as painting proceeds depending on the quantity of paint to be used in the Contract.

The Contractor may deliver paints to the site in containers up to 25 litres providing that the tops are of the completely removable clip-on type and that the contents are thoroughly stirred using a mechanical mixer when taking samples and prior to use. 'A' samples should be correctly labelled before despatching for testing.

5 (05/05) For contracts in England and Wales, details of each set of samples despatched should be listed in Appendix 50/4, Form HA/P3 Paint Sample Despatch List.

For contracts in England and Wales, a copy of each form should be forwarded immediately to Scientifics Ltd, 500 London Road, Derby, DE24 8BQ.

For contracts in England, a further copy of each form should be sent to the Highways Agency, Paint Specialist, Safety Standards and Research (SSR), City Tower, Piccadilly Plaza, Manchester, M1 4BE.

For contracts in Wales, a further copy of each form should be sent to the Welsh Assembly Government, Transport Directorate, NM5, Cathays Park, Cardiff CF10 3NQ.

Single copies of completed Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet should be sent to the addresses as above, at the same time that Appendix 50/4 Form HA/P3 Paint Sample Despatch List is forwarded for the first 'A' samples or first 'B' samples (if 'A' samples are not required).

Results of tests will be notified by the Overseeing Organisation. The Overseeing Organisation will report all results of the testing to the Supervising Firm, as stated on Appendix 50/4 Form HA/P3, who will then notify the Contractor of the results.

Non-receipt of paint samples for testing, for which an Appendix 50/4 Form HA/P3 has been received, will be notified by the Overseeing Organisation.

6 (11/03) For contracts in Scotland, details of each set of samples despatched should be listed in Appendix 50/4SE, Form SEDD/P3 Paint Sample Despatch List. A copy of each form should be forwarded immediately to Scientifics Ltd, 500 London Road, Derby, DE24 8BQ or an approved local testing authority. A further copy of each form should be sent to The Director, Road Network Management and Maintenance Division, Scottish Executive, Victoria Quay, Edinburgh EH6 6QQ.

Single copies of completed Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet should be sent to the Scottish Executive, at the same time that Appendix 50/4SE Form SEDD/P3 Paint Sample Despatch List is forwarded for the first 'A' samples or first 'B' samples (if 'A' samples are not required).

Results of tests will be notified by the Overseeing Organisation. The Overseeing Organisation will report

all results of the testing to the Supervising Firm, as stated on Appendix 50/4SE Form SEDD/P3, who will then notify the Contractor of the results.

Non-receipt of paint samples for testing, for which an Appendix 50/4SE Form SEDD/P3 has been received, will be notified by the Overseeing Organisation.

7 (05/05) Separate arrangements exist for contracts in Northern Ireland, see Clause NG 5009 NI.

8 (05/05) It should be noted that at the height of the painting season, testing and assessment of the first 'A' samples may take 2 to 3 weeks. Unless special arrangements can be made with the Overseeing Organisation for priority testing of samples, the Contractor cannot be expected to start painting under 3 weeks from the time of awarding the Contract.

Once the Contract has been awarded, the Contractor should order paint early enough to enable the first 'A' samples to arrive at the testing authority at least 3 weeks before painting is due to start, or sooner if possible, so that the results of the analysis can be assessed in time. Also, throughout the Work, the remaining paint should be ordered sufficiently in advance to allow time for testing subsequent 'A' samples.

About 2 weeks are required for testing 'B' samples.

9 (05/05) Painting may be permitted to be started before the results of testing 'A' samples have been received only if postponing the painting would mean an unacceptable delay in the Work; however, such permission should not relieve the Contractor of his obligations under the Contract. When a first 'A' sample is rejected, an 'A' sample of the replacement batch of paint should be submitted for testing as soon as possible. If painting is allowed to proceed with a replacement batch or a subsequent batch still under test, such permission should not relieve the Contractor of his obligations under the Contract.

'B' Samples

10 (05/05) Control or 'B' samples for single component paints are to be taken from the painter's kettle or from the airless spray gun nozzle, in order to ensure that paint actually being applied will be tested. Samples should be taken as spot checks, with a minimum of, say, one batch in three being sampled. 'B' samples of mixed two-pack materials can only be tested on site and before any reaction has taken place. In addition, for two-pack material, separate samples are to be taken of the components and dispatched to laboratory for analysis.

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

11 (05/05) It should be ensured that there are an adequate number of tins, lids and lid clips at the start of the Work to enable samples to be taken.

12 Unless tin lids are clipped down securely, and the tins properly packed, the contents may be spilled. Even if only one tin leaks, the spilled contents may obliterate markings on other tins, thus delaying testing until new samples are checked and delivered.

13 The selected 'A' or 'B' samples should be labelled correctly as described in Appendix 50/4 and despatched promptly throughout the Contract. Not only should the Contractor despatch samples promptly, but his transport arrangements should be such that the samples reach the testing laboratory without delay, particularly in the case of the first 'A' or 'B' samples.

NG 5010 Storage Requirements and Keeping Periods for Paints

1 (05/05) The Contractor should ensure that suitable storage has been provided and that paint is unloaded directly into it. The store temperature should be controlled within the limits specified. Extremes of temperature, freezing conditions in particular, can affect the properties of the paint. The paint store should be as near as practicable to the painting areas. If the paint store is at a considerable distance from the Work area, paint is unlikely to be returned to the store at the end of the working day, or several tins may well be kept out on site to be ready for use and thus may be damaged by extremes of temperature; also if the inspector has to waste time in journeying to and from the paint store to check deliveries and select samples, his supervision of the Work will be less effective.

2 (05/05) The date of manufacture in particular should be marked on the tins (see sub-Clause 5007.3). If the date of manufacture is not indicated, the paint should always be rejected.

3 The requirement that paint in use should be returned to store and keep in sealed containers should be enforced for both brushing and airless spray grades. Paint with fast evaporating solvents will be adversely affected if the containers are left open in hot weather.

4 Only the types of paint referred to in sub-Clause 5010.4 should be considered for extended keeping times. The performance of other paints can be permanently affected if their keeping times are exceeded. The paint manufacturer's checks will include the following:

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Property	Likely fault
Condition in tin	Settlement, skinning, separation
Viscosity	Tendency to body
Drying time	Absorption of dryers
Fineness of grind	Pigment agglomeration, resin 'seeding'
Colour	Flocculation, agglomeration of colour pigments

Lastly, the paint manufacturer will verify that the specific gravity of the paint about to be returned to site after any necessary reconstitution is correct.

5 (05/05) Paints which have exceeded the keeping period before delivery, or during storage before or after testing under Clause 5009, should not be used. These paints should not be tested or re-tested until the requirements of sub-Clauses 5010.4 and 5 have been complied with. Remains of moisture cured type coatings in opened tins, should be discarded at the end of the Work shift.

NG 5011 Procedure Trials

1 (05/05) Procedure trials are to ensure that the Contractor has the necessary knowledge and expertise and that, with the supervision, labour and equipment he proposes to use, the Contractor is capable of carrying out the Work in accordance with the Specification.

2 The Overseeing Organisations attach considerable importance to procedure trials and permission to omit them should only be given in exceptional circumstances or in the case of very minor works.

3 (05/05) If changes in any paint formulation appear to be necessary, the Contractor should arrange for the paint manufacturer to make the necessary adjustments and forward the revised formulation to Highways Agency, Paint Specialist, Safety Standards and Research (SSR), City Tower, Piccadilly Plaza, Manchester, M1 4BE and verify that the revised formulation is acceptable before agreeing to its application.

4 The requirement for further trials may be relaxed providing the Contractor can furnish evidence to demonstrate that replacement labour has the necessary skill and experience and that new equipment is suitable.

NG 5012 Application of Paint

1 (05/05) The level of supervision of the application of paint will depend on the type and importance of the project, the degree of difficulty of the Work and local conditions, and on the type of coating and its intended service life. Supervision should be undertaken by suitably qualified and experienced people. The Contractor should be responsible for carrying out this supervision, but additional supervision by the Overseeing Organisation is advisable, even for corrosion protection work in the workshop. Guidance on the selection of Painting Inspection firms and their duties is given in BD 87 'Maintenance Painting of Steelwork' (DMRB 3.2.2).

2 In exceptional circumstances additional solvent may be required when painting is carried out at extremes of temperature or to correct a minor deviation from the normal viscosity.

3 It should not only be checked that surface preparation has been carried out in accordance with the Specification but also that the standard has been maintained up to the time of application.

4 (05/05) Paints and other protective coatings in the Manual of Paints for Structural Steelwork (BD 35 Annex A, DMRB 2.4.1) are generally applied either by brush or airless spray or by both. However, for paints with low viscosities e.g. aluminium epoxy sealer, good use can be made of air assisted spray equipment to avoid over application, flooding and overspray of paint.

The use of rollers has been found to be unsatisfactory and should not be permitted.

5 (05/05) Work should not proceed outside the limits specified in Clause 5012. Records should be kept, as these will be required should any premature failure occur.

Difficulties may arise on site in deciding when a surface is dry enough to paint. Most types of paints, besides MC systems, are intolerant of moisture at the time of application and during the curing period. Generally, the rule should be, if moisture is present or may be expected to be present at the time of application or during the curing period, then painting should not go ahead. 'BS 7079-B4, BS EN ISO 8502-4' provides guidance on the estimation of the probability of condensation prior to paint application and 'BS 7079-B8, ISO 8502-8' describes the field method for the refractometric determination of moisture on a steel surface.

6 (05/05) A check on the amount of paint used after allowing for waste is a useful verification of film thickness.

7 (05/05) A record of wet film thickness checks should be kept. Non-destructive checks of total mdft are unlikely to be conclusive although they are useful as a guide. If there is any doubt about the mdft of the complete system, it is possible to cut out 10mm x 10mm samples and have these checked. The usual practice however is to make an angle cut using cutting tool edge

angle as BS EN ISO 2808 into the system and to check the thickness of each coat with a small viewing microscope fitted with a graticule. A proprietary instrument of this type is available. Equipment necessary to carry out these checks should be kept on site. Destructive tests on paint coats should be kept to a minimum and only used to confirm dry film thicknesses in cases of dispute.

8 (05/05) Defects are, as often as not, due to inadequate surface preparation rather than application of faulty paints. Compliance with the Specification, especially the requirement for satisfactory adhesion, should be checked from the time work starts and not left until the Contractor has dismantled his scaffolding and is about to leave the site. Remedying faults in a difficult access situation, such as over a motorway, is usually time consuming and expensive.

Stripe Coats

9 (11/03) During film formation or drying paint has a tendency to pull away from corners, and even if the specified minimum total dft can be attained by careful application it is unlikely to be maintained and stripe coating is always necessary. Stripe coat(s) should be specified in all areas taken down to a steel or metal coated surface and in all areas taken down to sound paint. It should be ensured that the first stripe coat on fasteners treated with Item 155 is brush applied carefully, any final traces of grease should be removed beforehand using a solvent, and not by wet cleaning. On small square bars a single extra undercoat replaces the stripe coat(s). For stripe coat details for CCTV masts, cantilever masts, steel lighting columns and bracket arms see sub-Clause 5015.1.

Except for the above, application of stripe coats by airless spray is acceptable, and in most cases gives better and more uniform results. However, in areas where space is restricted or when the system itself is brush applied, the Contractor will usually opt for brush application of stripe coats. 'Brushing out' of stripe coats should be avoided otherwise little paint will remain on the corners.

Exposure Times for Prepared Steel Surfaces and for Metal Coatings

Exposure Times and Treatment of Item 155 and Overcoating Times for Paints

10 (05/05) The times quotes in sub-Clauses 5012.23 to 30 are basic requirements when painting is carried out in average conditions. However, longer or shorter exposure times may be permissible depending on conditions. For example, in an environment where the relative humidity is low, clean steel which has been dry blast cleaned, can be left for longer than 4 hours provided that there will be no adverse effect. Exposure times for sealed thermally sprayed metal coatings may also be extended in good conditions.

#NG 5013 Form HA/P1 (Maintenance) Paint System Sheet (Appendix 50/1) Form HA/P2 Paint Data Sheet (Appendix 50/3)

1 (11/03) Normally, a copy or copies of Appendix 50/1, Form HA/P1 (Maintenance) Paint System Sheet, will be provided in the tender documentation, of which parts 1 to 9 will have been completed. It should be ensured that in part 1 of Appendix 50/1 the National Grid reference required for the Overseeing Organisation's records has been included.

Grid references are not required for parapets only, or for CCTV masts, cantilever masts, steel lighting columns and bracket arms (other than high masts).

2 As soon as the Contract has been awarded, the Contractor is required to prepare a copy or copies of Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet of which he will have completed parts 10 to 14 for each of the required systems. At the same time, the Contractor is required to provide relevant copies of Appendix 50/3, Form HA/P2 Paint Data Sheet, containing data which is required for checking paints before and after application. Full application instructions are also to be provided. The information provided in Appendix 50/3 is the responsibility of the Contractor.

Approved copies of Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet should be forwarded to the Overseeing Organisation, prior to any paint sampling.

Approved copies of Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet should be forwarded to the testing laboratory, together with the first Appendix 50/4, Form HA/P3 Paint Sample Despatch List. See Clause NG 5009 for details of checks on samples and despatch requirements, also the instructions to the inspector in Appendix 50/4.

NG 5014 Access, Containment and Lighting

1 For surface preparation and coating application to be carried out satisfactorily, it is important that the working area and access should permit, wherever possible, unrestricted access to the workface by the operators. For example, if the blast cleaning nozzle or the airless spray gun cannot be at the correct angle or be moved freely, then good uniform work will be difficult

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to attain. Care should be taken to provide access to ensure optimum distance of the spray gun, as well as adequate ventilation. It is equally important that the supervisory staff and inspectors should feel secure when carrying out checks.

2 If lighting is inadequate, workmanship will also be adversely affected and thorough inspection difficult; the Contractor should therefore ensure that the natural lighting is supplemented by temporary lighting as necessary to maintain an intensity of illumination at the workface of at least the specified 500 lux during working and inspection. Spot lighting of small areas is not acceptable and hence the requirement that the lighting should cover at least 1.0 m^2

NG 5015 (11/03) Additional Requirements for the Protection of CCTV Masts, Cantilever Masts, Steel Lighting Columns and Bracket Arms

Applicable Clauses

1 (05/05) The testing of 'A' samples is not required for CCTV masts, cantilever masts, steel lighting columns and bracket arms but 'B' samples should be taken and checked immediately for compliance. Also, as the procedure trials are unlikely to be necessary, it should be checked that the correct abrasive is being used and that the standard of blast cleaning complies with the Specification. A separate Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet should be provided for each different system on each area of the masts and columns in accordance with Clause 5013.

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APPENDIX 50/1 (SPECIFICATION FOR HIGHWAY WORKS) FORM HA/P1 (MAINTENANCE) PAINT SYSTEM SHEET

Sheet No…A.

1. CONTRACT TITLE:
STRUCTURE NO.:
GRID REF.:

2. DATE OF ISSUE OF DOCUMENTS TO TENDERERS:

3. ENVIRONMENT AND ACCESSIBILITY:

4. EXISTING PROTECTIVE SYSTEM(S):
Metal coatings:

Paint coatings:

Average total thickness (microns):

5. REQUIRED DURABILITY OF SYSTEM:
NO MAINTENANCE: …. YEARS
MINOR MAINTENANCE: …. YEARS
MAJOR MAINTENANCE: …. YEARS

6. COLOUR OF FINISH:

7. BILLED AREA

REF:	AREA DESCRIPTION:	SURFACE PREPARATION METHOD

8. PROTECTIVE SYSTEM TYPE: (i.e. I (M), II (M), III (M), etc):

.....

9. PAINT COAT SUMMARY

COAT & ITEM NO.	CONDITION OF SURFACES OF EXISTING SYSTEM AFTER SURFACE PREPARATION							
	Condition: Area Ref.		Condition: Area Ref.		Condition: Area Ref.		Condition: Area Ref.	
	mdft	B or AS	mdft	B or AS	mdft	B or AS	mdft	B or AS
1st Coat: Item ….								
2nd Coat: Item ….								
3rd Coat: Item ….								
4th Coat: Item ….								
MIN TOTAL DFT TO BE OBTAINED:								

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APPENDIX 50/1 (SPECIFICATION FOR HIGHWAY WORKS) FORM HA/P1 (MAINTENANCE) PAINT SYSTEM SHEET (CONT)

Sheet No…B

10. DETAILS				
	1st Coat	2nd Coat	3rd Coat	4th Coat
Registered Description				
Item No. and Colour				
BBA HAPAS Roads and Bridges Certificate Reference (05/05)				
Brand Name and Manufacturer's Ref. No.				
Manufacturer's Data Sheet No.				
Min dry film thickness (mdft) (µm)				
Max local dft (See sub-Clause 5012.6) (µm)				
Estimated total volume of paint likely to be used (litres)				
'A' type testing required ? (YES/NO) (See sub-Clause 5009.3)				
'B' type testing required? (YES/NO) (See sub-Clause 5009.11) (05/05)				
11. STRIPE COAT(S) DESCRIPTION (Including Item No. and colour)				
12. PATCH COAT(S) DESCRIPTION (Including Item No. and colour)				
13. ADDITIONAL INFORMATION (By Paint Manufacturer)				
14. PAINT MANUFACTURER'S OFFICIAL STAMP:				
15. Mdft (µm) NOTE. The minimum total dry film thickness (mdft) of the paint system, neglecting primers and sealers under 30 microns, shall be 15% greater (to the nearest 25 microns) than the sum of the mdfts of the individual paint coats.			16. APPROVED BY: DATE	

[Notes to compiler:

(i) (11/03) *Separate forms should be provided for each structure, including CCTV masts, cantilever masts, steel lighting columns and bracket arms if appropriate, with parts 1 to 9 completed. Sheets should be numbered for easy identification.*

(ii) (05/05) *A description of coats of lead based paints and other materials which may become health hazards during surface preparation should be included in the description of Existing Protective System(s).*

(iii) *If more than four types of surface condition are specified, a continuation Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet should be provided in the tender document.]*

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NG SAMPLE APPENDIX 50/2: REQUIREMENTS FOR OTHER WORK

[Notes to compiler:

1 An Appendix 50/2 may be incorporated for situations where special preparation and/or protective systems may be required, or for other works requiring protection. Appendix 50/1 Form HA/P1 (Maintenance) Paint System Sheet should be provided with parts 1 to 9 completed for structures described in this Appendix. The Contractor will then complete the Form using information provided in this Appendix.

2. (05/05) *When a white or pale tint Moisture Cured Polyurethane Finish or Polyurethane Finish (two-pack) is to be specified, an additional coat of item 164 or 168 may be required to ensure complete obliteration of the MIO Epoxy Undercoat. Additional coats should be specified in this Appendix.]*

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APPENDIX 50/3

(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P2 PAINT DATA SHEET

(05/05) BBA HAPAS Road and Bridges Certificate Reference and Date:

Manufacturer :

Item No. :

Registered Description :

Brand Name and Reference No. :

Consistency and Method of Application :

Weight per 5 Litres (kg) :

Specific gravity: Colour:

For two-pack paints: (05/05)

Base: Activator: Mixed components:

Volume Solids % :

For two-pack paints volume solids % for mixed paint: (05/05)

VOC content g/l (mixed): :

Manufacturer's Minimum Dry Film Thickness Range

Recommended lower mdft :

Recommended upper mdft :

Full Application Instructions :

Mix ratio :

Flash Point :

Temperature		5°C	10°C	20°C	30°C
Drying Times (hours)	Surface Dry				
	Hard Dry				
Overcoating Times (hours)	Minimum				
	Maximum				
Pot Life (hours)					

Cleaning Solvent/thinner :

State effects on Drying Times of Temperatures below 20°C :

Manufacturer's Application Restrictions, e.g. for Temperatures or Humidity :

Manufacturer's General Recommendations :

#APPENDIX 50/4

(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 1

Contract Title……

Structure Name. ……Structure No. ……

Client Name ……(Highways Agency or other company)

Supervising Firm……

Supervising Firm's Representative Name: ……. Tel No. ……

Address: ……

Painting Inspection Firm:……

Samples Dispatched From: ……. (Note 1) Date Dispatched ……

Inspector's Name: ……. Tel No……

Inspector's Signature ……

SAMPLES: (Numbered A1, A2 etc. or B1, B2 etc.) (Note 2)					
Sample No.	**Item No.**	**Manufacturer's Reference No.**	**Batch No.**	**Colour BS 4800 reference (Note 3)**	**Sp.G. (Notes 4 & 5)**

Paint Manufacturer:……

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#APPENDIX 50/4

(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 2

INSPECTOR to complete Form HA/P3 and to forward single copies to each of the following within 24 hours of despatch of samples by the Contractor to Scientifics Ltd:

i. Scientifics Ltd
500 London Road
Derby DE24 8BQ.

ii. (05/05) Highways Agency
Paint Specialist
Safety Standards and Research (SSR)
City Tower
Piccadilly Plaza
Manchester M1 4BE

INSPECTOR to forward Form(s) HA/P1 Paint System Sheet(s) with the first Form HA/P3 to both addresses.
INSPECTOR to select 'A' samples and to ensure that manufacturer's labels on tins comply with the Specification.

INSPECTOR to take and mark each 'B' sample tin with Item No., manufacturer's name and brand reference No., batch No. sample No. and colour (Note 2).

CONTRACTOR to CLIP DOWN LIDS of all tins and to pack, address and despatch samples. In addition to address, CONTRACTOR to label each case (or tin sent loose): 'HA (State structure name) and DATE (date of dispatch as noted above)'.

Note

1 (05/05) State whether from workshop or site (give name and address).

2 Batch samples comprising unopened tins to be marked A1, A2, etc. Control samples in 0.5 litre tins to be marked B1, B2, etc. Samples No. to run consecutively, i.e. A1 and B1 onwards.

3 Colour reference to BS 4800 to be given, as stated on Form HA/P1 (Maintenance) Paint System Sheet, e.g. 18 B 25.

4 For 'A' samples specific gravity (Sp.G.) to be measured by Inspector from separate tins of the same batch. For 'B' samples Sp.G. to be measured by Inspector when taking samples. Samples will be rejected unless Sp.G. is filled in above by Inspector.

5 If Sp.G. differs appreciably from data sheet do not dispatch 'A' or 'B' samples.

6 Do not use this form and send samples if the client is not the Highways Agency, e.g. for a local authority contract.

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NG SAMPLE APPENDIX 50/5: GENERAL REQUIREMENTS

[Note to compiler: This should include:

1 Measures to contain, people, plant, materials, dust and debris *[5001.3].*

[Cross-reference should be made in Appendix 1/23].

2 Whether solvents may be used to remove oil or grease *[5002.2].*

3 (05/05) Whether fasteners should be prepared and painted to the same standard as adjacent main surfaces *[5002.9].*

4 (05/05) Requirements for

(i) abrasive if different from the requirements of sub-Clause 5003.11;

(ii) wet blast cleaning and water pressure value if different from the requirements of sub-Clauses 5003.15 and 16.

5 (05/05) Requirements for:

(i) requirements for hot dip galvanized coatings if different from the requirements of sub-Clause 5005.1;

(ii) thermally sprayed metal coating if different from the requirements of sub-Clause 5005.2;

6 (05/05) Requirements for procurement of paints if different from the requirements of sub-Clauses 5007.5 or 5007.7SE.

7 (05/05) Requirements for provision of samples if different from the requirements of sub-Clause 5009.1.

8 (05/05) Requirements for procedure trials if different from the requirements of sub-Clause 5011.1.

9 (05/05) Requirements for stripe coats if different from the requirements of sub-Clause 5012.15.

10 (05/05) Whether overcoating times are different from sub-Clause 5012.32.

11 (05/05) Requirements for the protection of CCTV masts, cantilever masts, steel lighting columns and bracket arms if different from the requirements of Clause 5015.*]*

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APPENDIX 50/4SE

(SPECIFICATION FOR HIGHWAY WORKS)
FORM SEDD/P3 PAINT SAMPLE DESPATCH LIST: SHEET 1

Contract Title……

Structure Name. ……Structure No. ……

Client Name ……(Highways Agency or other company)

Supervising Firm……

Supervising Firm's Representative Name: ……. Tel No. ……

Address: ……

Painting Inspection Firm:……

Samples Dispatched From: ……. (Note 1) Date Dispatched ……

Inspector's Name: ……. Tel No……

Inspector's Signature ……

SAMPLES: (Numbered A1, A2 etc. or B1, B2 etc.) (Note 2)					
Sample No.	**Item No.**	**Manufacturer's Reference No.**	**Batch No.**	**Colour BS 4800 reference (Note 3)**	**Sp.G. (Notes 4 & 5)**

Paint Manufacturer:……

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(11/03) APPENDIX 50/4SE

(SPECIFICATION FOR HIGHWAY WORKS)
FORM SEDD/P3 PAINT SAMPLE DESPATCH LIST: SHEET 2

PROCEDURES

To be followed closely before dispatch of paints to Scientifics Ltd or an approved local paint testing firm

1 Check the specific gravity of each batch of paint;

2 Check the matching of finish colours to BS 4800;

3 Select the required sample, i.e.

(i) 'A' sample - unopened tin

(ii) (05/05) 'B' sample - 500 ml sample from painter's kettle or from nozzle of airless spray gun in the case of single-pack coatings or if the check is to be done in situ otherwise for two-pack coatings separate samples of the base and the activator should be dispatched to the testing laboratory;

4 List Contract details and details of each set of samples, including the specific gravity of each sample in Sheet 1 SEDD/P3;

5 (11/03) Send Form HA/P1 Paint System Sheet with Form SEDD/P3 to the following addresses:-

i. Scientifics Ltd
500 London Road
Derby DE24 8BQ.

ii. OR an approved local paint testing firm.

iii. The Director
Road Network Management and Maintenance Division
Scottish Executive
Victoria Quay
Edinburgh EH6 6QQ

6 Contractor to dispatch samples to address (i) or (ii) above. It should be ensured that the Contractor labels samples correctly, clips lids of tins down securely and sends the samples promptly. Samples should be labelled with the Contract title, structure name, sample number, and additionally in the case of 'B' samples, item number, manufacturer's reference number, batch number and colour. Results will be notified by the Scottish Executive Road Network Management and Maintenance Division, as soon as they become available.

Note

1 (05/05) State whether from workshop or site (give name and address).

2 Batch samples comprising unopened tins to be marked A1, A2, etc. Control samples in 0.5 litre tins to be marked B1, B2, etc. Samples No. to run consecutively, i.e. A1 and B1 onwards.

3 Colour reference to BS 4800 to be given, as stated on Form HA/P1 (Maintenance) Paint System Sheet, e.g. 18 B 25.

4 For 'A' samples specific gravity (Sp.G.) to be measured by Inspector from separate tins of the same batch. For 'B' samples Sp.G. to be measured by Inspector when taking samples. Samples will be rejected unless Sp.G. is filled in above by Inspector.

5 If Sp.G. differs appreciably from data sheet do not dispatch 'A' or 'B' samples.

6 (11/03) Do not use this form and send samples if the client is not the Scottish Executive, e.g. for a local authority contract.

NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATION OF NORTHERN IRELAND

NG 5003NI Surface Preparation - Materials and Methods

Abrading

1 (05/05) Abrading and blast cleaning are the two basic methods for removal of unsound coatings. Scraping and wire brushing alone will not achieve an adequate standard of cleanliness and are therefore considered as no more than an aid in removing thick rust scale, encrusted dirt and paint from areas which should then be abraded. Other methods such as flame cleaning may be specified by the introduction of additional clauses. 'BS EN ISO 8504-3, BS 7079-D3' describes methods for hand-tool and power-tool cleaning of steel substrates before application of paints and related products. It applies both to new steelwork and to steel surfaces that have been coated previously and that show areas of breakdown requiring maintenance painting. It also describes the equipment to be used and the procedure to be followed.

2 Wet abrading by hand is often preferred for surface preparation of hot dip galvanized only or hot dip galvanized and painted parapets.

Wet abrading may also be used for cleaning down finishes over sound paint where any underlying thermal metal spray coating is protected by an adequate thickness of paint. However, if the coats are unsound, water should not be used.

3 Power wire brushing, whether or not preceded by chipping or scraping, is unlikely to achieve a satisfactory standard of cleanliness and is therefore considered as no more than an aid prior to abrading.

4 Abrading will be used mainly to repair mechanical damage and during restoration of local failure in the paint system. Water should not be allowed to come into contact with exposed thermally sprayed metal coatings which are porous, nor if possible with bright steel. However, wet abrading can be usefully employed where hot dip galvanizing is present.

5 Only power tools which rotate at the relatively fast speeds necessary for power wire brushing or abrading should be used. Deposits of concrete are difficult to remove if allowed to harden, hence it is important that appropriate chipping and scraping tools are used otherwise the paint system is likely to be damaged. The use of hard grinding wheels is not permitted for abrading as their edges can easily cut into the surface.

6 Electric drill speeds are relatively slow, the use of hand-held drills as a power source for wire brushing often results in a polished appearance due to the formation of a patina of pollutants and corrosion products.

7 Sub-Clause 5003.5 caters for the protection of exposed areas of cleaned steel substrate or thermally sprayed metal coating before they can be adversely affected by wetting or debris from adjacent surface preparation.

Dry or Wet Cleaning

8 Coats which may have been exposed on site for a considerable time, particularly in a marine environment, should be thoroughly cleaned. Scrubbing of flat surfaces is usually satisfactory, however, light wet blast cleaning may be necessary to remove harmful contamination from areas difficult to clean. The selected cleaning agent should be used as recommended.

9 Dry cleaning is usually satisfactory for internal surfaces as these are less likely to have become contaminated. Nevertheless these surfaces should be checked before painting and further cleaning carried out if necessary. If this is unsatisfactory, advice should be sought from the Overseeing Organisation.

10 Metallic grit particles embedded in the existing paint or steel surface should be dislodged during cleaning down, otherwise they should be dislodged by scraping as described in sub-Clause 5003.10.

Dry blast Cleaning Using Dry Air/abrasive System

11 (05/05) The abrasive offered by the Contractor for blast cleaning should be checked for impurities as these may contaminate the surfaces to be cleaned (methods for checking for impurities are given in BS EN ISO 8502). If the type, grade and particle shape offered are appreciably different from those of the abrasive used during the procedure trials then the results that were achieved at that time are unlikely to be repeated during the Work.

12 If particles of abrasive are allowed to fall onto a freshly painted surface they are likely to become embedded in the wet paint. Embedded abrasive in fresh paint should be removed, and if necessary, the affected coat restored. If dried films only have been affected,

wet cleaning may prove effective in removing such surface dust, however, careful checks should be made.

13 Copper slag can be used to blast clean steel surfaces which are to be painted only, also to remove unsound paint; however, if surfaces have become heavily contaminated, dry blast cleaning may not be adequate and wet blast cleaning may be necessary. Modern and efficient blast cleaning equipment which will recirculate metallic abrasive is available. The requirements for fasteners are covered in sub-Clause 5002.9.

It should be noted that, under the Control of Substances Hazardous to Health Regulations (Northern Ireland) 1999, sand (or other substance) containing free silica may not be used as an abrasive for blast cleaning.

Wet Blast Cleaning Using Low Pressure Air/water/ Abrasive System

14 The main advantages of wet blast cleaning are that it keeps dust down and that it is the best method of removing heavy contamination. It should not be used to clean up thermally sprayed metal coatings because they are porous. Wet blast cleaning will not produce a profile on the surface and should not be used as the only method for surface preparation of steel. It should only be used on bolted connections if dry blast cleaning is impractical, otherwise water will penetrate into the joint. It is, however, satisfactory for welded joints which are to be painted, also for cleaning up or removing paint over a steel substrate.

15 Unless blast cleaned and adjacent surfaces are cleared of abrasive and debris within a short period, re-contamination is likely. Wet blast cleaning will not produce a surface profile and should not be used as the only method of surface preparation of steel.

Wet Blast Cleaning Using High Pressure Water/ Abrasive System or Ultra High Pressure Water/ Abrasive System

16 The efficiency of the equipment selected by the Contractor should be checked during the procedure trials. Wet blast cleaning will not produce a surface profile and should not be used as the only method of surface preparation of steel.

17 No flash rusting should occur after ultra high pressure water/abrasive system cleaning.

Combined Wet/Dry Blast Cleaning on Site

18 When wet blast cleaning is used to prepare steel surfaces, flash rusting may occur if painting is delayed. The required standard of cleanliness should be restored by light dry blast cleaning and paint should be applied while the surfaces are still clean.

19 As already mentioned, one of the main advantages of wet blast cleaning is its effectiveness in removing contamination; however, if this is not achieved using wet blast cleaning any subsequent light dry blast cleaning, although it may restore a clean appearance, is unlikely to remove contamination remaining on the surface or in the blast cleaned profile. For very heavy contamination ultra high pressure water/abrasive system cleaning should be considered, as in this method heat is generated by the impact energy of the water on the steel, which will assist in contamination removal.

Other Requirements

20 (05/05) If water from cleaning down, and debris from abrading, spreads onto blast cleaned and freshly painted surfaces, the paint is likely to be damaged or contaminated. On the other hand, when dry blast cleaning is carried out last, the dry dust and debris can be removed without difficulty from the surfaces of cleaned down existing coatings. This also applies to wet blast cleaning debris which, in any case, has to be washed off within 1 hour. Areas of metal spray coating which have been prepared to bright metal should be protected before they become wetted for any reason, e.g. rain, condensation as well as by washing down water. This problem does not arise with hot dip galvanising which is not porous. Local areas of steel substrate or metal coatings which have been prepared and then painted to protect them from adjacent washing down, as required by sub-Clauses 5003.5 to 7, 5003.20 to 22 and sub-Clause 5003.25 should also be rinsed using clean water at the same time as the adjacent areas are finally rinsed down.

21 The removal of deposits from the workpiece and adjacent surfaces after wet blast cleaning is important otherwise serious recontamination of the surface may occur. A scatter of abrasive particles and minor spot or flash rusting can be removed by the subsequent dry blast cleaning.

22 Sub-Clauses 5003.20 to 22 are important sub-Clauses as they inform the Contractor of the sequence of operations necessary to keep contamination of adjacent surfaces to a minimum when different methods of surface preparation are used.

Grinding After Surface Preparation

23 Grinding has to be carried out carefully without damaging the surface and only skilled operators should be allowed to carry out this work. The extent of surface defects cannot be ascertained beforehand, and therefore this work is covered by a provisional sum. It should be ensured that checks for defects are undertaken as surface preparation proceeds and that these are remedied by the Contractor.

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NG 5009NI Testing of Paints

Provision of Samples

1 Quality assurance of paint as delivered, that is verification of the composition data and application characteristics given in paint manufacturers' registered formulations can only be carried out on paint samples taken from previously unopened tins; these are known as 'A' Samples.

Before the Contractor dispatches the 'A' Samples to the address given in Appendix 50/4NI for testing in accordance with Clause 5009, the checks referred to in sub-Clause NG 5009.5NI below should be carried out but on paint taken from other tins of the same batch.

'B' samples on the other hand, should be taken from paint in use to ensure that it is as supplied. See sub-Clause 5009.9 and sub-Clause NG 5009.9NI.

'A' Samples

2 Although 'A' samples are not required in the case of certain bridge and other highway structures described in sub-Clause 5009.4, 'B' samples should still be taken as these make an effective contribution to quality control.

3 (05/05) Special deliveries of single tins of paint arranged by the Contractor, to the site or to the testing authority, are not acceptable as 'A' samples. Samples should be selected from fully representative batches. As a minimum, the condition of the paint in the tins should be examined and, after mixing, the specific gravity should be checked; matching of finish colours to BS 4800 should also be checked. Paint found to be faulty, especially in the case of appreciably incorrect specific gravity should be rejected on site. The Supervisor is required to check the specific gravity of paints before despatching 5 litre 'A' samples and 500 ml 'B' samples to the testing authority for testing. When the specific gravity of paint samples is appreciably incorrect, then the paints should be rejected in the Works or at site, testing of samples by the testing authority being unnecessary. Painting inspectors will, in most cases, have the experience to know when to reject a paint which has an appreciably high or low specific gravity. For example, the Inspector will know that a ± 3 % difference on the specific gravity of, say, an MIO phenolic paint is not as critical as a ± 3% difference on, say, a Silicone Alkyd Finish.

The following specific gravity tolerances are a useful guide for the Supervisor in deciding whether or not samples should be despatched to the testing authority for testing:

Paints with a specific gravity up to 1.4: + or - 3%

Paints with a specific gravity greater than 1.4: + or - 4%

The method of test to be used for determination of specific gravity is in accordance with 'BS EN ISO 2811-1, BS 3900-A19'. It should be ensured that the cause of any unsatisfactory application during the procedure trial is remedied before the start of the main painting.

4 (05/05) After submission of the first 'A' samples of each type of paint, further 'A' samples should be submitted for testing as painting proceeds depending on the quantity of paint to be used in the Works.

The Contractor may deliver paint to the site in containers up to 25 litres providing that the tops are of the completely removable clip-on type and that the contents are thoroughly stirred using a mechanical mixer when taking samples and prior to use. 'A' samples should be correctly labelled before dispatching for testing.

5 Details of each set of samples should be listed in Appendix 50/4, Form HA/P3 Paint Sample Dispatch List. A copy of each form should be forwarded immediately to the appropriate addresses given in Appendix 50/4NI.

Single copies of completed Appendix 50/1, Form HA/P1 (Maintenance) Paint System Sheet should be sent to DETI IRTU and to DRD (Northern Ireland) Roads Service addresses as given in Appendix 50/4NI, at the same time that Appendix 50/4NI is forwarded for the first 'A' samples or first 'B' samples (if 'A' samples are not required).

DRD (Northern Ireland) Roads Service will notify the results of tests.

6 (05/05) It should be noted that at the height of the painting season, testing and assessment of the first 'A' samples may take 3 to 4 weeks. Unless therefore special arrangements can be made with DRD (Northern Ireland) Roads Service, through the Divisional Office, for priority in testing samples, the Contractor cannot be expected to start painting under 4 weeks from the time of awarding the Contract.

Once the Contract has been awarded, the Contractor should order paint early enough to enable the first 'A' samples to arrive at the specified testing house at least 4 weeks before painting is due to start, or sooner if possible, so that the results of the analysis can be assessed in time. Also, throughout the Work, the remaining paint should be ordered sufficiently in advance to allow time for testing subsequent 'A' samples.

About 2 weeks is required for testing 'B' samples.

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7 (05/05) Painting may be permitted to be started before the results of testing 'A' samples have been received only if postponing the painting would mean an unacceptable delay in the Work; however, such permission should not relieve the Contractor of his obligations under the Contract. When a first 'A' sample is rejected, an 'A' sample of the replacement batch of paint should be submitted for testing as soon as possible. If painting is allowed to proceed with a replacement batch or a subsequent batch still under test, such permission should not relieve the Contractor of his obligations under the Contract.

'B' Samples

8 (05/05) Control or 'B' samples are to be taken, in the case of single component paint, from a painter's kettle or from the airless spray gun nozzle, in order to ensure that paint actually being applied will be tested. Samples should be taken as spot checks, with a minimum of, say, one batch in three being sampled. 'B' samples of mixed two-pack materials can only be tested in situ and before any reaction has taken place. In addition, for two-pack materials, separate samples are to be taken of the components.

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

9 (05/05) It should be ensured that there are an adequate number of tins, lids and lid clips at the start of the Work, to enable samples to be taken.

10 Unless tin lids are clipped down securely, and the tins properly packed, the contents may be spilled. Even if only one tin leaks, the spilled contents may obliterate markings on other tins, testing thus being delayed until new samples are checked and delivered.

11 The selected 'A' or 'B' samples should be labelled correctly as described in Appendix 50/4NI and dispatched promptly throughout the Contract. Not only should the Contractor dispatch samples promptly, but his transport arrangements should be such that the samples reach the testing laboratory without delay, particularly in the case of the first 'A' or 'B' samples.

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APPENDIX 50/4NI

(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 1

Contract Title……

Structure Name or No. ……

Client Name ……(DRD NI)

Supervising
Firm……

Supervising Firm's Representative Name: ……. Tel No. ……

Address: ……

Painting Inspection Firm:……

Paint Manufacturer ……

Inspector's Name: ……. Inspector's Signature ……

Samples Dispatched From: ……. (Note 1) Date Dispatched ……

SAMPLES: (Numbered A1, A2 etc. or B1, B2 etc.) (Note 2)				
Sample No.	**Item No.**	**Manufacturer's Reference No.**	**Batch No.**	**Sp.G. (Notes 3 & 4)**

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APPENDIX 50/4NI

(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 2

INSPECTOR to complete Form HA/P3 and within 24 hours of dispatch of samples by the Contractor forward a single copy to Department for Regional Development. Additionally, if compositional analysis is required a single copy of Form HA/P3 should be forwarded to Scientifics Ltd. and if compositional analysis is not required a single copy of Form HA/P3 should be forwarded to either Department for Enterprise, Trade and Investment or the chosen approved local paint testing firm, as appropriate. (Addresses as given below).

INSPECTOR to forward Form(s) HA/P1 Paint System Sheet(s) with the first Form HA/P3 to the addresses indicated above.

INSPECTOR to select 'A' samples and to ensure that manufacturer's labels on tins comply with the Specification.

INSPECTOR to take and mark each 'B' sample tin with Item No., manufacturer's name and brand reference No., batch No. and sample No. (Note 2)

CONTRACTOR to CLIP DOWN LIDS of all tins and to pack, address and dispatch samples.

In addition to address, CONTRACTOR to label each case (or tin sent loose):
'DRD NI (State structure name) and DATE (date of dispatch as noted above)'.

Notes

1. (05/05) State whether from workshop or site (give name and address).
2. Batch samples comprising unopened tins to be marked A1, A2, etc. Control samples in 0.5 litre tins to be marked B1, B2, etc. Samples No. to run consecutively, i.e. A1 and B1 onwards.
3. For 'A' samples specific gravity (Sp.G.) to be measured by Inspector from separate tins of the same batch. For 'B' samples Sp.G. to be measured by Inspector when taking samples. Samples will be rejected unless Sp.G. is filled in above by Inspector.
4. If Sp.G. differs appreciably from data sheet do not dispatch 'A' or 'B' samples.
5. Addresses referred to above:

   i. Department for Enterprise, Trade and Investment,
   Industrial Research and Technology Unit
   17 Antrim Road
   LISBURN
   Co Antrim
   BT28 3AL

   ii. Department for Regional Development
   Roads Service Headquarters
   Clarence Court
   10-18 Adelaide Street
   BELFAST
   BT2 8GB

   iii. Scientifics Ltd
   500 London Road
   Derby DE24 8BQ.

APPENDIX 50/4NI

(SPECIFICATION FOR HIGHWAY WORKS)
FORM HA/P3 PAINT SAMPLE DESPATCH LIST: SHEET 2

INSPECTOR to complete Form HA/P3 and within 24 hours of dispatch of samples by the Contractor forward a single copy to Department for Regional Development. Additionally, if compositional analysis is required a single copy of Form HA/P3 should be forwarded to Scientifics Ltd. and if compositional analysis is not required a single copy of Form HA/P3 should be forwarded to either Department for Enterprise, Trade and Investment or the chosen approved local paint testing firm, as appropriate. (Addresses as given below).

INSPECTOR to forward Form(s) HA/P1 Paint System Sheet(s) with the first Form HA/P3 to the addresses indicated above.

INSPECTOR to select 'A' samples and to ensure that manufacturer's labels on tins comply with the Specification.

INSPECTOR to take and mark each 'B' sample tin with Item No., manufacturer's name and brand reference No., batch No. and sample No. (Note 2)

CONTRACTOR to CLIP DOWN LIDS of all tins and to pack, address and dispatch samples.

In addition to address, CONTRACTOR to label each case (or tin sent loose):
'DRD NI (State structure name) and DATE (date of dispatch as noted above)'.

Notes

1. State whether from shop or site (give name and address).
2. Batch samples comprising unopened tins to be marked A1, A2, etc. Control samples in 0.5 litre tins to be marked B1, B2, etc. Samples No. to run consecutively, i.e. A1 and B1 onwards.
3. For 'A' samples specific gravity (Sp.G.) to be measured by Inspector from separate tins of the same batch. For 'B' samples Sp.G. to be measured by Inspector when taking samples. Samples will be rejected unless Sp.G. is filled in above by Inspector.
4. If Sp.G. differs appreciably from data sheet do not dispatch 'A' or 'B' samples.
5. Addresses referred to above:
   i. Department for Enterprise, Trade and Investment,
   Industrial Research and Technology Unit
   17 Antrim Road
   LISBURN
   Co Antrim
   BT28 3AL
   ii. Department for Regional Development
   Roads Service Headquarters
   Clarence Court
   10-18 Adelaide Street
   BELFAST
   BT2 8GB
   iii. Scientifics Ltd
   500 London Road
   Derby DE24 8BQ.

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