



Watford Bridge Handrail Painting

Bermuda

Annex D Drawings and Reference Documents

Date: January 11, 2016

Project No. 44-11-75



Figure 1 : Watford Bridge Looking North, Handrails to be Painted



Figure 2: Watford Bridge Looking South, Handrails to be Painted

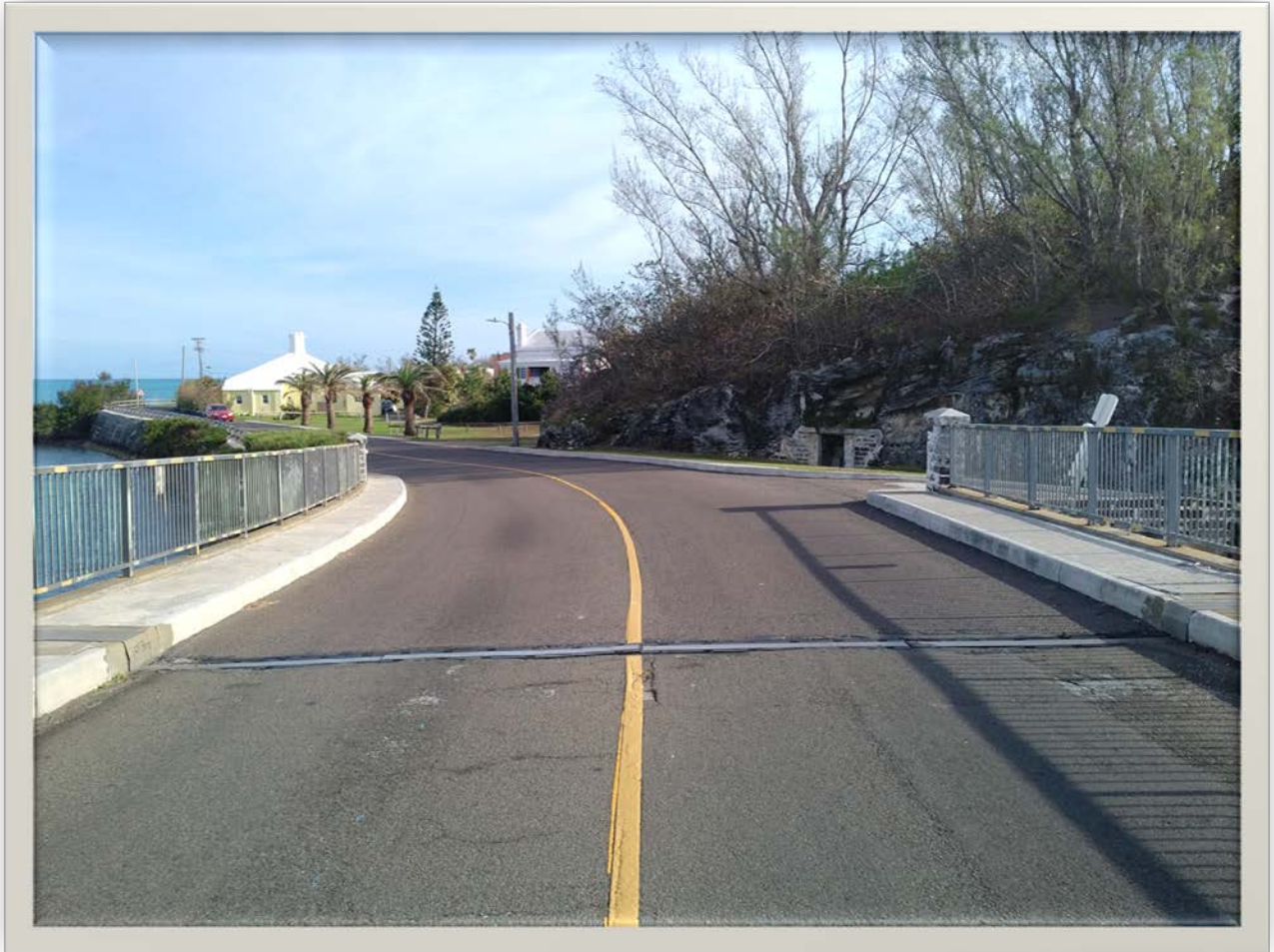


Figure 3: Watford Bridge Approaches Looking North, Handrails to be Painted



Specification and Standard

for the

Painting of Metal Surfaces.

Issued by: The Ministry of Public Works

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Revision	Section	Page	Description	Date
1			General revision, typos and content.	July 16, 2003
2	4.4.1	15	Reference clauses changed.	Nov. 28, 2003
2	4.4.2	15	Reference clauses changed.	Nov. 28, 2003
2	4.12.1	19	Reference clauses changed.	Nov. 28, 2003
3				

Amendments Reissue and Distribution

This Specification is subject to periodical review to reaffirm its adequacy and conformance with current requirements. The maximum period for review of this specification is one year.

Amendments to the specification are made as required to reflect current painting practice. The amendments are made by replacement page(s). An amendment number and date of amendment identify each amended page.

Amendments are numbered consecutively until such times as a new issue incorporates all such changes. When changes affect a considerable number of pages, and in any case after not more than ten amendments to one issue, the manual is reissued. Issues are identified by numbers in numerical sequence. Each issue cancels and replaces all previous issues and amendments.

The amendment list indicates all the amendments to the latest issue of the specification.



It shall be the responsibility of all registered holders to update the specification assigned to them and destroy obsolete copies of all amended pages.

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Foreword - General

This Standard is controlled by the Ministry of Public Works. A reference in this Standard to other codes and standards invokes the latest published issue or amendment unless otherwise stated

Paint application shall be done according to the paint manufacturer's recommendations. In case of conflict between this Standard and the manufacturer's recommendation, the more stringent shall apply.

Use of Language

Throughout this document, the words "will", "may", "should", "shall" and "must" when used in the context of actions, by others, have specific meanings as follows: -

- a) "Will" is used normally in connection with an action by the Ministry of Public Works, rather than by a Contractor or supplier.
- b) "May" is used where alternatives are equally acceptable.
- c) "Should" is used where provision is preferred.
- d) "Shall" is used where provision is mandatory.
- e) "Must" is used only where a provision is a statutory requirement.



List of Reference Codes and Standards

ISO 8501-1	Preparation of Iron & Steel – incl 7079 Supplement
Guide to SSPC-VIS 1-89	Visual Standard for Abrasive Blast Cleaned Steel
Guide to SSPC-VIS 2	Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces
Guide to SSPC-VIS 3	Visual Standard for Power- and Hand-Tool Cleaned Steel
Guide to SSPC-VIS 4/NACE No. 7	Visual Reference Photographs for Steel Cleaned by Water Jetting
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 5/NACE No. 1	White Metal Blast Cleaning
SSPC-SP 10/NACE No. 2	Near-White Blast Cleaning
SSPC-SP 11	Power Tool Cleaning to Bare Metal
SSPC-SP 12/NACE No. 5	Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-PA 1	Shop, Field, and Maintenance Painting of Steel
SSPC-PA 2	Measurement of Dry Coating Thickness with Magnetic Gages
SSPC-PA Guide 3 SSPC-PA Guide 5	A Guide to Safety in Paint Application Guide to Maintenance Painting Programs
SSPC-Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC – Guide 7	Guide for the disposal of lead contaminated surface preparation debris
SSPC-Guide 12	Guide for the Illumination of Industrial Painting Products
SSPC-Guide 14	Guide for Repair of Imperfections in Galvanized or Inorganic Zinc- Coated Steel Using Organic Zinc-Rich Coating
ASTM A123	Zinc (hot galvanised) coatings on products fabricated from rolled, pressed and forged shapes, plates, bars and strip.



The Health and Safety of Work Act 1982

Paint Manufacturers Product Safety Sheets, Data Sheets and Specifications

Paintmakers Association of Great Britain Ltd. - Personnel Protection Advice for the use of Marine Paints and Compositions.

The Control of Lead at Work Regulations (S1. 1980 No. 1248) HMSO.

Health and Safety Commission, Control of Lead at Work. Approved Code of Practice. HMSO.

Health and Safety Executive Guidance Note EH28 Control of Lead. Air Sampling Techniques and Strategies.

Health and Safety Executive. Guidance Note EH29 Control of Lead. Outside Workers.

Abbreviations and Units

BS British Standard

CP Code of Practice (appropriately prefixed)

ASTM American Society for Testing and Materials

SSPC The Society for Protective Coatings

NACE National Association of Corrosion Engineers

ISO International Standards Organization

This Standard employs SI (Système International d'Unités) metric units, but the Imperial equivalents given in brackets are equally applicable.



Definitions

For the purposes of this specification the following definitions apply.

Amplitude	Peak to valley height in a steel surface profile following surface preparation.
Atmospheric Zone	The part of a structure above the splash zone.
Company	The Ministry of Public Works
Company representative	Any person appointed by the Company who is responsible for ensuring work is carried out in accordance with the specification
Contaminated water	Any water other than “Potable” or Seawater
Contractor	The person or firm or Company with whom the Ministry of Public Works enters into contract to which this specification applies, and include the Company’s personal representative, successors and permitted assigns.
Dewpoint	The temperature of a given air-water vapour mixture at which condensation starts, that is the temperature at which air has reached saturation point.
DFT	The dry film thickness of a coating in its dry state.
E.A.R.	Manufacturer of foam earplug inserts for noise suppression. Any OSHA or HSE approved inserts may be substituted or in noisy conditions ear defenders should be worn. Blast cleaning processes constitute a noise hazard.
Engineer	Any person in the employment of the Company responsible for the project.
Holidays	Pinholes and small size defects in the coating system which penetrate through the thickness of the paint film.
Hot Dip Galvanised	A process whereby steel articles are Zinc coated by immersion in a molten Zinc.
Induction Time	For certain two pack materials the mixed materials must be allowed to stand for a period of time before they are applied to the substrate. Manufacturers data sheets should be referred to as this time period will vary from product to product and will also be influenced by ambient



Inspector	temperature. As Company Representative.
Microns	One thousandth of a mm.
M.I.O.	Micaceous Iron Oxide Pigment (A specular Haematite)
Pigment	Solid colouring agent in a paint.
Potlife	The length of time that a 2-pack paint will remain usable at a given temperature.
Profile	Cross section of a steel surface contour.
shall	Indicates a mandatory requirement.
Site	The location of painting operations approved by the Ministry of Public Works
Shelf Life	The manufacturers recommended maximum storage time for a given product under recommended storage conditions. In the case of two component materials this also refers to the materials before mixing.
Shop	The work carried out in a Vendor's, or his sub-contractors, factory.
Substrate	The surface to be coated or be prepared.
Submerged	Continuously immersed steel work
Thinner	Liquid added to ease application of paint or adjust viscosity.
Vendor	The supplier of materials or equipment.
VOC	Volatile Organic Compound – Any organic compound which participates in atmospheric petro-chemical reactions or that is measured by approved measures.
W.F.T.	The wet film thickness of a coating prior to evaporation of any solvent.



GOVERNMENT OF BERMUDA

Ministry of Public Works

Works and Engineering

Reference Document

Project No. 44-11-75

Watford Bridge – Handrail Painting



1. Scope.

- 1.1. This Standard specifies the general requirements of the Ministry of Public Works for the protection of iron, steel and galvanised steel surfaces from corrosion by the use of paint coatings, and includes requirements for both new construction and maintenance coating.
- 1.2. In all applications covered by this Standard, iron surfaces shall be treated in an identical manner to steel surfaces subjected to the same conditions.
- 1.3. The contents of this Standard define essential requirements of surface preparation and painting. In addition, the Contractor shall carry out the work in accordance with good practice generally, but not in exclusivity, as laid down in such publications as the SSPC manual - volume 1.
- 1.4. This specification is divided into sections to facilitate indexing, however it shall be read and interpreted as a document and not on an individual section basis.



2. General

- 2.1. Reference to any action by the Ministry of Public Works shall be taken to include action by an agent of the Ministry of Public Works.
- 2.2. **Prior to the commencement of the work the Contractor shall submit for the approval of the Ministry of Public Works fully detailed proposals as to how he intends to carry out the work within the framework of this Standard.**
- 2.3. A quality plan containing these details shall include the manufacturers minimum recommended cure time (after final coat application) prior to transportation and handling. The Contractor shall provide full details regarding the use of subcontractor, location of work, choice of materials and any such further information that the Ministry of Public Works may request to clarify his work intentions.
- 2.4. All work shall be carried out in strict compliance with any safety regulations made by the Ministry of Public Works for the site and any relevant requirements of national or local law. In particular, when working in restricted areas. The Contractor shall ensure that all plant, equipment and tools meet the appropriate regulations controlling work in such areas and are approved by the Ministry of Public Works. It shall be the Contractor's responsibility to ensure by whatever means appropriate that all precautions to prevent grit, dust, solvents, and cleaning agents are contained within the designated work areas. It is of paramount importance that contaminated water is prevented from entering any body of water.
- 2.5. Blast Cleaning and spray-painting equipment, working in locations where an explosive atmosphere may be present at any time, shall be continuously bonded from the nozzle to the compressor, which shall be earthed. Compressors used in these locations, which will be subject to approval by the Ministry of Public Works, shall meet any safety requirements that may be specified by the Ministry of Public Works.
- 2.6. Compressors and any associated pressure vessels shall be protected against over-pressure. Pressure test certificates shall be held on site for inspection. Note also that any local statutory requirements in this respect shall be complied with.
- 2.7. The Contractor shall provide and maintain in good condition all plant, equipment and tools necessary to carry out the work in an efficient manner and provide lubricating oils, greases, consumable materials and parts as necessary to maintain the plant, equipment and tools in good working order.



- 2.8. The Contractor shall provide and select, unless otherwise instructed, all equipment, paints and thinners as necessary to carry out the works in accordance with this Specification.
- 2.9. The Contractor shall purchase such paint from a list of approved manufacturers provided by the Ministry of Public Works. The Contractor shall provide all blasting abrasives necessary to carry out the work.
- 2.10. The Contractor shall provide skilled and experienced personnel to carry out the work together with competent and qualified supervision. The size of the work force may at their discretion be regulated by the Ministry of Public Works to the requirements and the scheduling of the work.
- 2.11. The Contractor shall comply fully with this Standard, unless otherwise approved by the Ministry of Public Works. Additionally, the work may be subject to continuous inspection by the Ministry of Public Works who will be at liberty to check every stage of the work is being carried out in accordance with all aspects of this Standard.
- 2.12. Unless otherwise specified by the Ministry of Public Works stainless steel and non-ferrous alloys shall not be painted.



3. Paints

3.1. Generalised Composition

- 3.1.1. All paints used shall conform to the following generalised composition clauses. In meeting these composition clauses, the paint manufacturer shall produce premium quality paint with the full performance required by this Standard.
- 3.1.2. Zinc Phosphate two-pack primer may be based on polyamide cured two-pack epoxy media and may contain a minimum of 40% Zinc Phosphate pigment, and a minimum of 20% Zinc Phosphate by weight in the dry film.
- 3.1.3. Two pack epoxy finishing paints may be based on polyamide or amine adduct cured two pack epoxy media and may be pigmented with suitable light fast coloured pigments to provide the necessary opacity, film build and weather resistance. A matt finish is required unless otherwise specified.
- 3.1.4. Alternative curing agents shall be allowed where necessary to provide low temperature cure.
- 3.1.5. Two component Polyurethane materials shall utilise “Bayer™” raw materials. Aliphatic Poly Iso-cyanate curing agents i.e. Desmodur 75™ to be reacted with OH containing Polyacrylic resin i.e. Desmophen™ series.
- 3.1.6. Wherever possible materials shall be VOC compliant

3.2. Thinners

- 3.2.1. Only thinners as specified by the paint Vendor shall be used. Mixing and thinning directions as furnished by the paint Vendor shall be followed.



4. Surface Preparation by Abrasive Blasting Cleaning.

4.1. General.

- 4.1.1. Steel surface preparation prior to painting shall be by dry grit blasting or slurry blasting unless otherwise specified by the Ministry of Public Works.
- 4.1.2. Manual or power tool preparation shall only be used where blast cleaning is not permitted and with specific approval of the Ministry of Public Works.
- 4.1.3. Steel surfaces shall be prepared to ISO8501-1, BS 7079, NACE or SSPC to the preparation grades detailed in these specifications and attached schedules.
- 4.1.4. Ministry of Public Works approved mastic sealant material compatible with the selected coating system shall be used on all components, fittings, attachments or bonds where a surface is likely to create an intimate contact.
- 4.1.5. In crevices or intimate metal contact points where dismantling is not possible, desirable or at the discretion of the Ministry of Public Works, suitable Ministry of Public Works approved penetrating oil or corrosion inhibitive grease shall be injected into the crevice. Inhibitive grease shall be suitable for use at ambient temperatures up to 40 deg C.
- 4.1.6. Friction grip surfaces shall not be sealed or treated with oil/grease injection.

4.2. Environmental Conditions.

- 4.2.1. Surface preparation shall not take place at temperatures below 5 deg C and above 35 deg C, when the relative humidity is greater than 95% or when the metal surface temperature is less than 3 deg C, above the ambient dew point or outside daylight hours or exterior locations. (Except when a paint system is recommended by a manufacturer at these temperature and humidity levels). Coatings shall not be applied to surfaces exceeding 40 deg C.
- 4.2.2. Items on which blasting is to be carried out shall be enclosed and protected from the environment.

4.3. Preparation prior to blasting.



- 4.3.1. Surface preparation of steel/iron surfaces shall remove all irregularities together with all rust and surface contaminants, such as grease, dirt and solid pollution.
- 4.3.2. Heavy scale and corrosion deposits shall be removed by suitable and appropriate impact tools.
- 4.3.3. Prior to surface preparation for painting, all steel work shall be inspected for any surface irregularities. Surface laminations and laps shall be immediately reported to the Ministry of Public Works and shall at their discretion be removed or made smooth prior to commencement of surface preparation.
- 4.3.4. The responsibility for the removal of such irregularities shall be defined by the Ministry of Public Works. Such irregularities, which become apparent after surface preparation by blast cleaning or any other method, shall be similarly treated.
- 4.3.5. Grease and oil contamination shall be removed by either wiping or scrubbing the surface with rags or brushes wetted with an approved Biodegradable degreaser, the surface then washed down with clean potable water. Surfaces contaminated with chlorides shall receive a wash down with potable water prior to abrasive blast cleaning. The surface shall be allowed to dry out before proceeding with further preparation and painting.

4.4. Preparation prior to blasting - Previously Coated Steelwork.

- 4.4.1. Prior to commencement of any surface preparation of previously painted surfaces, the existing paintwork shall be thoroughly examined and all areas of deterioration, loosened paint and rust formation noted, so that the work can be concentrated on such areas. If such areas cannot be exactly defined or extent of breakdown in the area precludes spot or patch blasting, overall preparation shall be carried out, or as specifically defined in specific Government of Bermuda Project Specifications.
- 4.4.2. The preparation of the surface shall ensure that all loosened paintwork is removed and feathered back to a firm edge and that all other surface irregularities and contaminants are also removed as specified in 4.3, or as specifically defined in specific Government of Bermuda Project Specifications.
- 4.4.3. Surface preparation of areas of existing sound paintwork prior to blasting shall comprise of removing any oil or grease contamination followed by scrubbing with a non-flammable proprietary emulsifying agent and rinsing with fresh potable water.



4.4.3. In areas where this is not possible the contamination should be solvent washed and shall be recorded for future reference. This shall be conducted prior to blasting or mechanical cleaning.

4.5. Grit containment and equipment protection.

4.5.1. All equipment, structures, electrical cabling and any other item required or defined by the Ministry of Public Works shall be fully protected from overblast and grit and dust contamination.

4.5.2. Items on which blasting is to be carried out shall be enclosed, dust extraction, water collection facilities and equipment should be employed to eliminate contamination of the site, adjacent plant, protective coatings, etc. and injury to all persons on or near the site.

4.5.3. Blast cleaning shall not be done in areas close to painting operations or wet coated surfaces to prevent dust and grit contamination.

4.5.4. The Contractor shall be responsible and take such action for preventing blast abrasive ricochet damaging, or interfering with vehicular movement on or under bridge structures.

4.6. Blasting Standard.

4.6.1. Steel surfaces shall be prepared by blast cleaning to ISO 8501-1. A Sa 2.5 preparation grade shall be achieved for all paint schedules in this specification where blasting is specified.

4.6.2. The surface amplitude or profile shall be as specified in the paint schedules in this specification. However, the profile shall be generally within the range of 50-70 microns with rogue peaks of maximum amplitude of 100 microns.

4.6.3. Where surface preparation is carried out in such a manner that the edge will butt up to the existing coating then the surface preparation shall extend 50mm into sound paintwork or at least until a firm feathered edge is found. A further 50mm shall then be lightly blasted to etch the surface.

4.6.4. When the Contractor is satisfied that the surface preparation meets the requirements of the Specification he shall inform the Ministry of Public Works Inspector who shall inspect the blast cleaned area.



- 4.6.5. Any areas not conforming to the Specification shall be re-cleaned to the original standard and reinspected.
- 4.6.6. After acceptance of the blast standard by the Ministry of Public Works Inspector, the work and containment area including but not limited to deck and floors shall be cleaned down thoroughly.
- 4.6.7. Spent abrasives and dust residues shall be completely removed from the prepared surface by brushing and vacuum cleaning or blowing with clean, dry compressed air.
- 4.6.8. Following blast cleaning the surfaces shall be tested for the presence of soluble iron salts in the form of Fe^{++} and Fe^{+++} . The approved test method is that defined in ISO 8025 Bresle method. The maximum permitted tolerance is 25mg/ltr. Any surfaces found in excess of this level will require high-pressure water washing as defined in clause 4.11.1 followed by a reblast in accordance with 4.6.
- 4.6.9. Within four hours of commencement of blast cleaning and before any deterioration of the blast standard occurs, paint application shall be carried out.

4.7. Abrasives and Air Supply.

- 4.7.1. Selection of abrasives for blast cleaning shall give a surface profile or anchor pattern generally in the range of 50-75 microns with rogue peaks of maximum amplitude 100 microns.
- 4.7.2. Abrasives used for blasting shall be Garnet or approved equivalent. The abrasive shall be free from dust, salts, silica and other impurities and shall be used only once.
- 4.7.3. The pressure and volume of the compressed air supply for blast cleaning shall meet the work requirement and shall be sufficiently free from oil and water contamination to ensure that the cleaning process is not impaired. Traps, separators and filters shall be emptied and purged regularly.

4.8. Equipment and Operation.

- 4.8.1. All equipment used for blasting shall be conductive and earthed to prevent a build up of static electricity.



- 4.8.2. An after cooler may be employed with each compressor and shall have adequate and efficient water traps. The after cooler shall be suitable for the size of compressor employed.
- 4.8.3. Dead man handles shall be fixed and fully functioning to the blast line as close as is practical to the blast nozzle and any person found securing these handles in the on position by any other means than normal hand pressure shall be removed from the site immediately. The dead man shall be held by the blaster and NOT by any other person.
- 4.8.4. The nozzles used for blast cleaning should ideally have a maximum orifice size of 12mm and shall be of the venturi design. Any nozzles that are worn or damaged should be replaced to maintain efficient cleaning and pressures. Should the bore of the nozzle be worn to the degree that the bore is elliptical, it shall be discarded.
- 4.8.5. For maintenance work nozzle liner materials should normally be of the tungsten or silicon type.
- 4.8.6. To achieve specified finish as detailed in 4.6.1, blasting will generally be carried out at 90-120 psi at the nozzle and under these circumstances the Contractor should consider the employment of receivers between the compressor and the site of actual blasting.
- 4.8.7. Nozzle blasting pressure shall be measured at the blast nozzle by the use of the Hypodermic Needle Gauge. This need only be performed if there are problems attaining consistent surface profile readings or progress.
- 4.8.8. Prior to blasting all equipment to be used shall be inspected and any defective equipment shall be replaced.
- 4.8.9. The Contractor shall ensure that all compressed air and blast hose coupling seals are replaced when a defect is discovered. All couplings shall be wired together to prevent hose burst.
- 4.8.10. The Contractor shall employ angle blast nozzles where necessary to successfully blast difficult areas to the required standard.

4.9. Areas which cannot be blasted.

- 4.9.1. For areas where blast cleaning is impractical or cannot be permitted, power tool cleaning shall be employed. Needle gunning, scraping, chipping and sheet wire



brushing using power driven tools cannot remove firmly adherent mill scale and shall only be used with the approval of the Ministry of Public Works Engineer.

4.9.2. Power tool cleaning shall be performed in accordance with the section 5 in this standard.

4.10. Slurry Blasting.

4.10.1. The use of slurry blasting (abrasive injection into air/water stream) shall be subject to approval by the Ministry of Public Works prior to use. The equipment to be utilized shall be the “Falcon 60 Kwikblast System®” or approved equivalent.

4.10.2. Alternative equipment should have the following technical specification: -

Water Consumption rate	1 – 1.5ltrs per minute
Abrasive consumption	1kg per minute
Water pressure feed	Standard potable water mains pressure
Air pressure –supply	100psi /250cfm
Nozzle size	1 inch
Fittings	In line water filtration, air and water pressure gauges. Suitable shutdown-failsafe devices compliant with OSHA or other recognised international safety legislation authorities.

4.11. High Pressure Water Jetting/Hydro blasting

4.11.1. Surface preparation by High Pressure Water Jetting (10000 psi /680 Bar) and Ultra High Pressure Water Blasting (>30,000 psi/2000 Bar) shall be undertaken in accordance with SSPC SP-12 in certain environments, subject to the approval of the Ministry of Public Works. Similar standards to those defined in 4.6. should be achieved. Where possible selection of High Pressure Water Jetting equipment shall take into account individual control of all variables including air pressure, and water media. Special attention shall be paid to all pressure rated equipment.

Important Note

The manufacturers guidelines and operating instructions together with any safety instructions shall be strictly adhered to. Only **skilled and trained** operatives approved by the Ministry of Public Works may be permitted to use this equipment.



4.12. Galvanised Surfaces.

- 4.12.1. Galvanised surfaces shall not be treated unless specifically required by the Ministry of Public Works or as specifically defined in specific Government of Bermuda Project Specifications.



5. Power and Manual Surface Preparation.

5.1. General.

- 5.1.1. For areas where blast cleaning is impractical or cannot be permitted, power tool cleaning shall be employed. Needle gunning, scraping, Flap Wheels™ chipping and steel wire brushing using power driven tools cannot remove firmly adherent mill scale and shall only be used with the approval of the Ministry of Public Works.

5.2. Preparation Prior to Power Tool Cleaning.

- 5.2.1. Preparation prior to power tool cleaning on new and previously coated steelwork shall be as detailed in section 4.3. of this specification.

5.3. Preparation Standard.

- 5.3.1. Steel surfaces shall be prepared by power tool cleaning to SSPC SP 3 and 11 preparation grades this shall be achieved for all paint schedules in this specification where power tool cleaning is specified.
- 5.3.2. Where welds occur within the area to be prepared or where a power disc or power wire brush cannot be used, impact tools shall be applied (vibratory or rotary hammers, needle guns, chisels etc.) followed by brush cleaning.
- 5.3.3. Misuse of some power tools can produce a burnished slick on the surface and care shall be taken to ensure that this is avoided and that the substrate does not become polished during power tool cleaning.
- 5.3.4. Where surface preparation is carried out in such a manner that the edge will butt up to the existing coating then the surface preparation shall extend 50mm into sound paintwork or at least until a firm edge is found. A further 50mm shall then be lightly abraded to reveal fresh material and provide a suitable key for further coating. This joint area edge shall be carefully feathered out to prevent lifting of the coating.
- 5.3.5. When the Contractor is satisfied that the surface preparation meets the requirements of the Specification he shall inform the Ministry of Public Works who shall inspect the mechanically prepared area. Any areas not conforming to the Specification shall be re-cleaned to the original standard.



- 5.3.6. After acceptance of the preparation standard by the Ministry of Public Works Inspector the area shall be cleaned down thoroughly. Loose material and dust residues shall be completely removed from the prepared surface by brushing and vacuum cleaning or blowing with clean, dry compressed air.
- 5.3.7. Following cleaning the surfaces shall be tested for the presence of soluble iron salts in the form of Fe^{++} and Fe^{+++} . The approved test method is that defined in ISO 8502-6 Bresle method. The maximum permitted tolerance is 25mg/ltr. Any surfaces found in excess of this level will require high-pressure water washing as defined in clause 4.11.1 followed by re-cleaning in accordance with 5.3.
- 5.3.8. Paint application shall be carried out as soon as practical after mechanical cleaning and before the onset of fresh surface rusting.

5.4. Equipment and Operation.

- 5.4.1. All equipment used for power tool cleaning shall be air driven. All items including but not limited to grinding wheels and power wire brushes shall not be used in excess of their designed specification.
- 5.4.2. All power equipment shall be used in a manner that no burns, sharp edges or cuts are left on the surface.

5.5. Areas That Cannot Be Power Tool Cleaned.

- 5.5.1. For areas which blast cleaning or power tool cleaning is impractical or cannot be permitted, hand tool cleaning shall be used.
- 5.5.2. Preparation prior to painting shall be as detailed in section 5.3.
- 5.5.3. Loose mill scale, loose rust, weld flux, spatter and loose paint shall be removed from the surface by hand brushing, scraping, chipping or other hand impact tools or by a combination of these methods. Stratified rust or scale shall be removed by chipping or hammering. When prepared surfaces are taken up to an existing painted surface the joint shall be carefully feathered out to prevent lifting of the old coating and provide a sound base for new coating. Final preparation standard shall be as detailed in section 5.3



6. Application of Coatings.

6.1. General.

6.1.1. The paint shall only be applied in the manner detailed by the manufacturer (e.g. brush, roller, conventional or airless spray). Roller application does not ‘wet’ the surface as efficiently as spray or brush application and this method shall only be used if it is the sole application method recommended by the manufacturer.

6.2. Spray Application.

6.2.1. Lines and pots shall be thoroughly cleaned before addition of new materials with the manufacturers’ recommended cleaner. The spray gun shall be held between 450mm and 600mm from the surface to be coated at right angles to the surface. Uniform, parallel passes shall be made with the spray gun. In application of material, each spray pass shall overlap the previous pass by 50%. Large surfaces shall always receive passes in two directions at right angles to each other. Spray width adjustments on the gun and the re-adjustment of atomising pressure at the regulators shall be made until an acceptable spray pattern is found.

6.2.2. A complete range of tips with the varying spray angles and orifices, as recommended by the paint manufacturers’ for each specific steel configuration to be coated, shall be available.

6.2.3. Each Coat is to be applied uniformly and completely over the entire surface. All runs and sags shall be brushed out immediately.

6.3. Brush Application.

6.3.1. Coatings shall, with the prior approval of the Ministry of Public Works be brushed onto all areas that cannot be properly spray coated.

6.3.2. Brushes used in paint application shall be of a type and quality that will permit proper application of paint. Round or oval brushes generally are considered most suitable for rivets, bolts, irregular surfaces and rough or pitted steel. Wide flat brushes are suitable for large flat areas but they should not have a width of over 120mm. No extending handles shall be allowed on paintbrushes.

6.3.3. The brushing shall be done so that a smooth coat, as nearly uniform in thickness as possible, is obtained. There should be no deep or detrimental brush marks.



Paint shall be thoroughly worked into all crevices, corners or previously coated surfaces. Runs or sags shall be brushed out.

- 6.3.4. When brushing any of the solvent type coatings, care must be taken so that no lifting of coats occurs.
- 6.3.5. Where brush application is the main method of paint application e.g. maintenance painting of congested steelwork, paint shall be delivered only in no greater than 5 litre containers.

6.4. Coating thickness.

- 6.4.1. Minimum DFT's (Dry Film Thicknesses) are specified in the paint schedules attached to this Specification (unless otherwise stated).
- 6.4.2. All Contractors personnel shall possess and use wet film thickness gauges and it shall be their responsibility to ensure that the specified wet film thickness is achieved. These gauges shall be of the metal variety.
- 6.4.3. If the minimum dry film thickness of each coat is not achieved then subsequent coats of the same generic type shall be applied until the specified thickness is reached.
- 6.4.4. The maximum dry film thickness of each coat should not exceed the specified thickness for each coat by more than 30%. If excessive film thickness is found the area should be re-prepared and re-coated to specification.



7. Painting.

7.1. Manufacturers' Recommendations.

- 7.1.1. All painting shall be carried out in conformity both with this Standard and with the paint manufacturers' recommendation. In the event of divergences or discrepancies the Ministry of Public Works will decide the requirements probably after reference to the manufacturer. All paints in any one particular system, shall originate from one paint manufacturer.
- 7.1.2. Particular attention shall be paid to the manufacturers' instructions on storage, mixing, thinning and pot life. The paint shall only be applied in the manner detailed by the manufacturer e.g. brush, conventional or airless spray and shall be applied under the manufacturers' recommended conditions.
- 7.1.3. Minimum and maximum time intervals between coats shall be closely followed. This is of particular importance at high ambient temperatures (around or above 35 deg. C). In general, over coating time should be kept to a minimum to prevent contamination. If maximum over coating times are exceeded, reference should be made to the manufacturer.

7.2. Environmental Conditions.

- 7.2.1. Coating operations shall not take place at temperatures below 5 deg C and above 40 deg C, when the relative humidity is greater than 95% or when the metal surface temperature is less than 3 deg C, above the ambient dew point or outside daylight hours (Except when a paint system is recommended at these temperature and humidity levels). Coatings shall not be applied to surfaces exceeding 40 deg C. Painting may also be suspended due to wind speed or at the direction of the Ministry of Public Works.
- 7.2.2. Items on which painting is to be carried out shall be enclosed and protected from the environment whenever possible.

7.3. Protection of Equipment.

- 7.3.1. The Contractor shall ensure that adequate masking and protection is given to all items not being coated to prevent contamination from overspray. (Refer to 4.5.)
- 7.3.2. The Contractor shall avoid contamination of any adjacent items of plant from overspray, drips or spillage, and provide appropriate protection where necessary.



If any such contamination does occur the Contractor shall remove it in a manner that is acceptable to the Ministry of Public Works ensuring that no defect in the system occurs in consequence. Should this not be possible then the surface is to be suitably re-prepared and coated to the Ministry of Public Works's satisfaction.

7.4. Surface Preparation Prior to application of any Coating.

- 7.4.1. Prior to over coating any surface the substrate shall be inspected for the presence of contamination and, in particular, chlorides. If, after testing, levels above 25mg/ltr are found the substrate shall either be cleaned using a water pressure washer or in another manner acceptable to the Ministry of Public Works.
- 7.4.2. Ministry of Public Works approved mastic sealant material compatible with the selected coating system shall be used on all newly assembled components, fittings, attachments or bonds where a surface is likely to create an intimate contact.
- 7.4.3. In crevices or intimate metal contact points where dismantling is not possible, desirable or at the discretion of the Ministry of Public Works, suitable Ministry of Public Works approved penetrating oil or corrosion inhibitive grease shall be injected into the crevice. Inhibitive grease shall be suitable for use at ambient temperatures up to 40 deg C.
- 7.4.4. Friction grip surfaces shall not be sealed
- 7.4.5. Washing should take place where required by the Ministry of Public Works and practicably between all coats of paint. Atmospheric contaminated surfaces shall be rinsed with potable water.
- 7.4.6. Where surfaces have been contaminated by hydrocarbon containing fluids surfaces shall be cleaned with solution of non-flammable Biodegradable degreaser (or equivalent) followed by rinsing with clean potable water.
- 7.4.7. Prior to application of any paint films, damage to preceding coats shall be repaired to the requirements of this specification.
- 7.4.8. The surface preparation and painting specification on previously painted surfaces shall be specified in the specific Government of Bermuda Project Specifications.
- 7.4.9. Where previously painted surfaces are to be over painted for maintenance coating purposes, the dry film thickness shall be measured and recorded prior to coating.



7.5. Mixing.

- 7.5.1. Hand mixing or “boxing” of paints shall only be permitted for containers up to 5 litres. All larger containers shall be mixed by mechanical agitators and brought to a uniform consistency.
- 7.5.2. Two-pack paints shall be mixed in strict accordance with manufacturers’ instructions. The pot life and Induction times of such paints shall be specifically noted. Any mixed paint that has exceeded its pot life shall be discarded, irrespective of its apparent condition.
- 7.5.3. Paint that has livered, gelled or otherwise deteriorated during storage shall not be used however; thixotropic materials that have to be stirred to normal consistency are acceptable.

7.6. Painting Procedure.

- 7.6.1. Application of primer or any subsequent coat shall not be carried out until the Ministry of Public Works is satisfied that all requirements relating to surface cleanliness, surface condition, mixing, environmental conditions, methods or application equipment and the Ministry of Public Works’s safety procedures are being strictly adhered to.
- 7.6.2. The methods of application shall be selected to ensure that the paint is applied in a uniform manner to the prescribed film thickness without any runs, sags, drips or other imperfections.
- 7.6.3. The pressure and volume of the compressed air used for spray application shall meet the work requirement and be free from oil and water contamination. Traps, separators and filters shall be emptied and cleaned regularly. Brush application of primers shall be carried out on mechanically prepared surfaces.
- 7.6.4. During maintenance painting, the first coat applied to a mechanically prepared substrate where the surface has been roughened by external corrosion shall be brush applied. The primer shall be thoroughly brushed into the surface to ensure adequate wetting of pitted or rough areas.
- 7.6.5. The paint system shall be as detailed in the schedules, which show the minimum dry film thickness unless otherwise specified.
- 7.6.6. A brush applied stripe coat of the specified coating material shall be applied to all areas of restricted access, bolt holes, edges of flanges, ends of sections, rivets,



irregular surfaces, rough or pitted surfaces, mouse holes, weld areas, abutments, welds and corners prior to application of the first coat. Subsequent coating will be carried out with the stripe coat being applied before the full coat.

- 7.6.7. Following the application of each further coat, a stripe coat will be applied in a contrasting shade. Under no circumstances will it be permitted for a full coat or stripe coat to receive a coating of identical shade.
- 7.6.8. Stripe coats shall be applied for each coat of paint specified and they shall be subjected to the same conditions of application and inspection that applies to any other coating process.
- 7.6.9. In all instances where two or more coats of the same paint are specified, such coatings shall be of contrasting colours so that each stage of the work can be readily identified and film thickness determined accordingly.
- 7.6.10. A holding primer or temporary protective primer may be used to facilitate protection of a blast-cleaned substrate. Such primers shall in no way replace the function or part of the film thickness of the priming coat and shall be subject to approval by the Ministry of Public Works prior to use.

7.7. Colour Coding.

- 7.7.1. The final colour of all coatings shall be as detailed in the “the Ministry of Public Works Identification Colours” of Section 11 of this specification.

7.8. Patch Repairs.

- 7.8.1. All points of damage to paintwork incurred at any stage of the work, including site welding operations, shall be re-prepared by blast cleaning with the specified priming coat and finish coat to restore the film thickness. In all such instances preparation shall extend 50mm (2 ins) into the sound paintwork and a further 50mm (2 ins) of sound paintwork shall be lightly blasted to etch the surface. All coatings shall be feathered back to a firm edge. Repainting shall then cover the prepared surface and the etched paintwork. Where blast cleaning cannot be carried out surface preparation of points of damage by scraping and power tool cleaning is acceptable providing specific approval is given by our the Ministry of Public Works In such instances, modification of the originally specified primer may be necessary to suit the changed method of surface preparation



8. Inspection.

8.1. Delineation of Responsibility.

- 8.1.1. The Contractor is responsible for all quality control on the project including inspection, testing, laboratory services and supervision, as well as carrying out special quality control test set-ups and measures, as described herein.
- 8.1.2. Full time or part-time inspection of the entire preparation and paint application process may be undertaken by the Ministry of Public Works. Such Inspection shall not relieve the Contractor from his quality control responsibilities.
- 8.1.3. The Ministry of Public Works may during the contract inspect plant; equipment, accessories etc. associated with any aspect of the contract and shall reject any item considered unserviceable, unsuitable or inadequate.
- 8.1.4. The Contractor shall replace to the satisfaction of the Ministry of Public Works such rejected equipment.
- 8.1.5. All inspections by the Ministry of Public Works will be carried out when in the opinion of the Ministry of Public Works such inspections are justified.
- 8.1.6. The Contractor shall give the Ministry of Public Works 24 hours notice prior to commencement of surface preparation and/or painting operations.

8.2. Hold Points.

- 8.2.1. The Ministry of Public Works operate a system of “Hold Points” - a system whereby a Contractor may not proceed until clearance by the Ministry of Public Works is given. The following “Hold Points” shall be established.

Hold Point

- a) The Contractor shall submit a detailed work plan including but not limited to surface preparation methods and equipment, painting methods and equipment quality control methods and equipment and environmental controls to be undertaken.
- b) Approval of dust preventive and equipment protection measures.
- c) Before surface preparation and before first coat application.
- d) Before application of each succeeding coat.
- e) After application of the final coat and Spark testing where appropriate.
- f) On completion of the remedial works.



8.2.2. All “Hold Points” shall be strictly observed and any surface preparation or coating undertaken without “Hold Point” clearance shall be re-worked at the Contractor’s expense.

8.2.3. Hold points shall be clearly detailed on any quality plans submitted.

8.3. Inspection Equipment and Calibration.

8.3.1. Every contractor’s employee in the position of painter, chargehand, foreman Inspector, and above will possess a metal wet film gauge of a type acceptable to the Ministry of Public Works. Plastic wet film gauges shall not be permitted to be used.

8.3.2. The Contractor shall have a comprehensive range of inspection equipment and traceable calibration plates at the site of any work in progress, which will be adequate to carry out inspection to a degree acceptable to the Ministry of Public Works on all surfaces being coated.

8.3.3. The Contractor shall have sufficient “sets” of inspection equipment to obviate any delays in inspection at any work site.

8.3.4. The Contractor shall on demand permit the Ministry of Public Works to use any inspection equipment. If the equipment is deemed inadequate or unsuitable to carry out inspections, alternative equipment will be provided by the Contractor to the satisfaction of the Ministry of Public Works.

8.3.5. The Contractor will provide a calibration certificate for instrumentation, if required by the Ministry of Public Works.

8.3.6. Inspection equipment, which cannot be calibrated, shall, if considered unserviceable or unsuitable by the Ministry of Public Works be replaced by the Contractor.

8.3.7. The Contractor and the Ministry of Public Works’s inspector when inspecting the dry film thickness of a paint film applied to a blasted surface will set up gauges using the relevant thickness of an insulative shim over a blasted surface i.e. a specimen plate or the blasted substrate which will be reblasted as required. The specimen plate will be of the similar material as the surface to be painted.

8.3.8. The thickness gauge shall be calibrated prior to use each day, using foils in the film thickness range being checked over the type of surface being coated. If used on a continuous basis, calibration shall be performed every two hours.



8.4. Physical Measurements.

- 8.4.1. The following physical measurements shall be carried out:
 - a. Surface Amplitude on blasted steel.
 - b. Relative Humidity - Dewpoint.
 - c. Wet Film Thickness.
 - d. Dry Film Thickness.
 - e. Soluble contaminants.
 - f. Holiday Detection.
- 8.4.2. Measurements are to be made jointly with a Ministry of Public Works Inspector. All results shall be accurately recorded and submitted to The Ministry of Public Works.
- 8.4.3. For field measurements of surface amplitude on blasted steel, replica tape (“Testex” ® or approved equivalent) and a portable micrometer shall be used. Alternatively Surface Profile Comparators may be used. Testex replicas shall be taken on commencement and ceasing blasting work each day or at each shift change. The frequency of additional profile readings shall be at the discretion of the Ministry of Public Works
- 8.4.4. A sling psychrometer or whirling hygrometer shall be used to measure relative humidity.
- 8.4.5. The wet film thickness shall be spot checked in random areas as an initial indication of the required film thickness.
- 8.4.6. The dry film thickness of individual coats and of the total coating system shall be checked by means of a suitable electronic thickness gauge with a recording facility or the Ministry of Public Works approved alternative instrument. However, below 50 microns, dry film thickness cannot be measured accurately. In the event that low dry film thickness cannot be recorded a “PIG or Tooke” destructive gauge may be utilised.
- 8.4.7. Dry film thickness measurements shall be taken covering each coat prior to application of following coats. The frequency of measurement shall be taken in accordance with SSPC PA2 (revised edition) or at the discretion of the Inspector but shall not be less than one (1) reading per five (5) square metres of flat surface, with additional readings on more complicated items and particularly at changes in section, corners or edges.



- 8.4.8. Surfaces washed by a Biodegradable degreaser and subsequently washed with potable water, or those washed after detecting high levels of soluble iron salts may be tested in order to ascertain the degree of soluble chlorides on the washed surface, the Contractor will provide “Quantab’s or Merckoquant ®” test papers to facilitate testing.
- 8.4.9. Holiday Detection will be carried out at the direction of the Ministry of Public Works to ascertain coating integrity. The calibration voltage shall be 125v per 25 microns of coating. All safety guidelines/rules shall be complied with when utilising this equipment. The Holiday Detector shall be of the DC non-pulse type unless otherwise authorised by the Ministry of Public Works
- 8.4.10. Surface cleanliness can be established via a “dust tape” test.

8.5. Adhesion Tests.

- 8.5.1. Paint adhesion tests shall be conducted on painted surfaces as directed by the Ministry of Public Works. Adhesion testing shall generally be applied to the completed, cured paint system, but with additional intermediate tests carried out at the Ministry of Public Works’s option wherever concern that adhesion may be inadequate due to improper surface preparation, contamination, inadequate or excessive curing between coats, or other reasons.
- 8.5.2. The adhesion test method shall be subject to approval of the Ministry of Public Works, and the acceptance level shall be set for each coating system by reference to panel test results and the paint manufacturer’s recommendations.



9. Safety.

9.1. General.

- 9.1.1. When the Contractor supplies paints, solvents or chemicals he shall ensure that product data sheets and product safety sheets (MSDS) are available at the worksite at all times.
- 9.1.2. The paint and equipment manufacturer's safety precautions for their products shall be considered as part of this specification. In cases of conflict, the manufacturer's recommendations apply.
- 9.1.3. All air hoses, blast hoses, spray lines and any other hoses that are subjected to any internal pressure shall be marked with cable identification digits showing the date they were first brought into service. Those hoses shall be provided with certificates of conformity or test certificate stating the safe working pressure, which shall NOT be exceeded.
- 9.1.4. The Contractor shall be responsible for checking all hoses and pressure items on at least a once weekly basis to establish wear and electrical conductivity. Any items showing signs of wear or a breakdown of its conductivity shall be replaced so as to prevent any possibility of bursts or static discharge etc.
- 9.1.5. The Contractor shall maintain a log that records the date, findings and action taken on all safety inspections carried out by his personnel on his equipment.
- 9.1.6. The Contractor shall ensure that all required fire-fighting equipment for development in high-risk areas including but not limited to paint mixing areas and close to any diesel driven plant is always in a position approved by the Ministry of Public Works
- 9.1.7. Where it is impossible to maintain the atmosphere free of flammable gas, extreme care shall be exercised to prevent ignition by the action of tools uses. Low energy-sparking tools are recommended, however even they can, under certain conditions, cause ignition of flammable or explosive atmospheres.
- 9.1.8. Impact of any metallic tool against iron or steel, which has been coated with a light metal such as aluminium, can be particularly hazardous. Surfaces known or suspected of being of this nature shall be kept wet while being brushed, scraped or chipped.



9.2. Personnel Protection.

- 9.2.1. The Contractor shall provide all items required by his personnel to ensure that they are adequately protected whilst carrying out their duties. Contractors' personnel working above water shall wear at all times a suitable life vest or approved flotation vest.
- 9.2.2. The recommendations for personal protection and for protective equipment, as given in the publication "Personal Protection Advice for the use of Marine Paints and Compositions" (published by the Paintmakers Association of Great Britain) shall be met in full.
- 9.2.3. Eye protection shall be worn at all times.
- 9.2.4. All persons employed in the blasting and spraying of coatings shall wear air-fed masks or helmets that shall be coupled to a clean air supply fed by an independent filtered source. The mask shall be ventilated by clean, cool air served through a regulator filter to prevent blasting residues or vapour from being inhaled by the operator. Filters shall be changed at suitable intervals and at least as recommended by equipment manufacturers. Masks or helmets shall be provided by the Contractor. The minimum requirement shall be one mask or helmet for each individual likely to perform blasting or spray-painting operations during normal working.
- 9.2.5. The blaster shall wear suitable ear protection E.A.R. earplugs or an approved equal.
- 9.2.6. Blast helmets and hoods will be cleaned and disinfected and action logged weekly.
- 9.2.7. All persons engaged in the mixing and application of paint shall wear appropriate protective clothing at all times, nylon overalls are not permitted.

9.3. Surface Preparation Operations.

- 9.3.1. Blast hoses shall be inspected prior to use on a daily basis by visual means and any defects assessed and repaired or hose replaced.



- 9.3.2. The deadman handle shall be attached to the blast hose as close to the blast nozzle as is practical and shall not in any circumstances be held in the “on” position by any means other than hand pressure.
- 9.3.3. The work area shall be adequately roped off and appropriately signed, such as “DANGER - GRIT BLASTING IN PROGRESS”.
- 9.3.4. Precautions shall be taken to ensure that drains are protected to avoid blockage or be contaminated with flammable materials. The Contractor shall take all necessary precautions and shall ensure that no damage will occur to adjoining structures, paintwork or plant by ricochet blast abrasives.
- 9.3.5. Spent grit shall be removed from the workplace in a timely and neat fashion and disposed of in a manner, which will not result in a safety hazard. Disposal methods shall be approved by the Ministry of Public Works. The Contractor shall assume that spent abrasive disposal will be shipped off island unless otherwise agreed.

9.4. Painting Operations.

- 9.4.1. Handling, mixing, and application of the paints and coating materials shall be done strictly in accordance with the Vendors recommended procedures to ensure personnel safety. Safety precautions shall be clearly described on the technical data sheets of paints and coating materials supplied, as well as on the containers. Where this Standard indicates restrictions on the use of certain materials, these limitations shall be adhered to strictly.
- 9.4.2. Solvent drums shall be grounded and containers receiving solvents shall be electrically bonded to the drums by a suitable cable and clamp.
- 9.4.3. The work area shall be adequately roped off and appropriately signed, such as ‘DANGER - EXPLOSION RISK MIXING AND APPLICATION OF PAINT IN PROGRESS’.
- 9.4.4. All oil, solvent or paint soaked rags shall be stored in closed containers. Clothes, overalls and other like materials shall be stored to prevent fire from spontaneous combustion.
- 9.4.5. In areas where power tools are being used to remove coatings or rust, precautions shall be taken to eliminate contamination of adjacent areas, and injury to personnel in close proximity to the operation.



- 9.4.6. Empty paint containers shall be stored and disposed of in a manner and place as required by the Waste Management Section of the Ministry of Public Works. All storage and disposal to be at the Contractor's expense.



10. Vendor and Contractor Responsibility.

10.1. Vendor Responsibilities.

10.1.1. The Vendor (which may be the paint manufacturer) shall ensure that all Contractors and Inspectors and the Ministry of Public Works are supplied with up to date data sheets before any painting and coating commences. The Ministry of Public Works shall be notified immediately when changes to data sheets, product number etc. occur.

10.2. Contractor Responsibility.

10.2.1. The painting Contractor shall ensure that up to date data sheets and MSDS sheets are obtained from the paint Vendor before commencing painting and coating.



11. Colour Codes

11.1. Primers and Holding Primers

Red Oxide or Yellow Colour

11.2. 1st Coats

Dark Grey

11.3. 2nd Coats (where defined)

Dark Red/Green

11.4. Finish Coats

Light Grey



GOVERNMENT OF BERMUDA

Ministry of Public Works

Works and Engineering

Reference Document

Project No. 44-11-75

Watford Bridge – Handrail Painting
