

DEP SPECIFICATION

PROTECTIVE COATINGS FOR ONSHORE AND OFFSHORE FACILITIES

DEP 30.48.00.31-Gen.

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DESIGN AND ENGINEERING PRACTICE



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All administrative queries should be directed to the DEP Administrator in Shell GSI.

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1. INTRODUCTION

1.1 SCOPE

This DEP is a performance-based painting and coating standard applicable for both onshore and offshore facilities including subsea items. The DEP specifies painting and coating for new construction, modifications and maintenance of ferrous and non-ferrous metals.

For carbon steel and stainless steel items with a design life of 15 years or more, which cannot undergo maintenance painting without shutdown, Thermal Spray Aluminium (TSA) coating is recommended for long term protection against external corrosion and corrosion under insulation (CUI). Refer to DEP 30.48.40.31-Gen. for specification of TSA coatings.

This DEP is not applicable to:

- a. Buried pipelines;
- b. Internal coatings of tubing or drill pipes;
- c. Fusion bonded powder coatings;
- d. Equipment and components with a (continuous) service temperature below $-100\text{ }^{\circ}\text{C}$ ($-212\text{ }^{\circ}\text{F}$) or above $600\text{ }^{\circ}\text{C}$ ($1112\text{ }^{\circ}\text{F}$);
- e. Temporary construction items for which only zinc primer should be applied;
- f. Coatings for buildings.

The general requirements such as the supply of labour, equipment, personnel safety gear or the use of Sub-Contractors have not been included in this DEP. They should be included under the General Terms and Conditions of a contract.

This DEP shall be quoted as part of any contractual document where such coating work is involved.

This DEP is a revision of the DEP of the same number dated January, 2009, see (1.5) regarding the changes. This DEP includes content that was previously in DEP 70.48.11.30-Gen. (which is now withdrawn).

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
Abrasive blast cleaning	The impingement of a high kinetic-energy stream of blast cleaning abrasive onto the surface being prepared.
Anchor profile	Contour of a blast-cleaned surface on a plane perpendicular to the surface.
Atmospheric zone in offshore facility	That part of an offshore facility structure 6 m (19.7 ft) above HAT.
Coating renovation	Coating maintenance programme based on complete removal of existing coatings followed by the overall application of a full coating system.
Chalking	The appearance of a loosely adherent fine powder on the surface of a paint coating, arising from the degradation of one or more of its constituents, typically caused by UV attack.
Cracking	The splitting of a dry paint film.
Holiday/Pinhole	Pinhole or very small size defect in a coating system, penetrating the entire thickness of the coating.
Hot dip galvanizing	Formation of a coating of zinc and/or zinc-iron alloys produced by dipping prepared steel in molten metallic zinc.
Offshore facilities	Facilities installed in open sea and the coastal waters.
Pore	Pinhole or very small size defect in a coating system, penetrating the entire thickness of the coating.
Splash zone	Zone from 3 m (10 ft) below LAT up to 2 m (6.5 ft) above HAT.
Shop primer	Primers applied in a shop or manufacturing facility to provide temporary protection to steel sheet or components during transport and/or fabrication.
Shot	Particles that are predominantly round, that have a length of less than twice the maximum particle width and that do not have edges, broken faces or other sharp surface defects.
Submerged zone	Zone below the splash zone (i.e., permanently submerged).
Thinner	Volatile liquid added to lower the viscosity of the paint to ease application.

Term	Definition
Wetted and intermittently wetted parts	Parts in the tidal and splash zone and parts that are intermittently wetted by wave and spray action up to 6 m (19.7 ft) above HAT.

1.3.3 Abbreviations

Term	Definition
CUI	Corrosion Under Insulation
DFT	Dry Film Thickness; the thickness of the dried or cured paint or coating film
HAT	Highest Astronomical Tide level
LAT	Lowest Astronomical Tide level
MSDS	Material Safety Data Sheet
NDFT	Nominal (specified) Dry Film Thickness
SBM	Single Buoy Mooring
TDFT	Total Dry Film Thickness; the overall thickness of the total number of coats in a paint system
TSA	Thermally Sprayed Aluminium
WFT	Wet Film Thickness; the thickness of the wet paint or coating

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (11).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated January 2009. It uses the new format of DEP Specification and Informative. This DEP now covers content that was in former DEP 70.48.11.30-Gen. (which is now withdrawn) including maintenance painting. The coating systems for subsea items are also included.

An attempt has been made to rationalize this DEP with various regional standards and specifications such as Shell Deepwater Standards and Shell Operating Units in Upstream and Downstream.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

2. GENERAL REQUIREMENTS

2.1 GENERAL

All paint and coating systems shall meet the qualification requirements and the minimum coating system requirements as specified in this DEP.

For carbon steel and stainless steel items with a design life of 15 years or more, which cannot undergo maintenance painting without shutdown, a Thermal Spray Aluminium (TSA) coating is recommended for long term protection against corrosion under insulation (CUI). TSA coatings are specified in DEP 30.48.40.31-Gen.

The selected environmental classification for atmospheric environments is C5-M of ISO 12944-2. This is designed for corrosive coastal exposure with aggressive industrial environment.

In case of any discrepancies noted in this DEP and other relevant documents, the Contractor shall obtain written clarification from the Principal before proceeding with the affected work.

2.2 SAFETY

This DEP may call for the use of hazardous substances and procedures. Handling for application and the subsequent disposal of all surface preparation consumables and coating materials specified in this DEP shall conform to all relevant local regulatory requirements and bylaws.

2.3 WARRANTY

Contractors undertaking painting and/or coating work, which is to be carried out in accordance with this DEP, shall guarantee the quality of their coating work in due consultation with coating materials Manufacturer and Principal. Before any painting or coating work shall commence, the warranty period and associated coating condition shall be agreed with the Principal by the Contractor.

The following warranty periods for various coating systems shall be followed as a minimum requirement.

- a. Five (5) years for liquid coating systems for external atmospheric exposure, as per the coating condition specified in (2.3.1) below,
- b. Ten (10) years for internal coating of tanks and vessels and,
- c. Ten (10) years for thermally sprayed aluminium (TSA) coatings.

The Contractor shall also obtain a written warranty from paint/coating Manufacturers that the supplied coating materials shall be of good quality, suitable for the intended service and capable of providing a life as per the above specified warranty period.

The use of coating systems as described in this DEP and approved by the Principal shall not affect the warranties agreed by the contract parties involved.

Surfaces that have deteriorated beyond the specified level of breakdown within the warranty period shall be repaired by the Contractor. The contractor shall bear the cost of materials, equipment, labour, onshore/offshore transport, onshore/offshore lodging and onshore/offshore storage necessary for the repair.

Only surfaces that have suffered from mechanical damage or chemical spillage as a result of operational activities fall outside this warranty.

Initial acceptance of any new coating work by the Principal shall not relieve the Contractor of his obligations under this section until the final inspection has been carried out and acceptance of the completed work has been agreed in writing.

An end-of-warranty inspection shall be carried out by a party agreed between the Contractor and the Principal before expiry of the period of a warranty agreement regarding the coating work.

In case of a dispute on the condition of the coating work that has been inspected, an agreed independent expertise body shall conduct a review inspection at the Contractor's cost. Both the Principal and the Contractor shall accept the findings of the inspection by this independent consultant.

2.3.1 New construction and large scale maintenance

Five (5) years after the acceptance date of the completed coating work for atmospheric exposure and ten years for internal coating of tanks and vessels.

- d. The degree of rusting shall be in accordance with ISO 4628-3 and shall not be worse than Ri 2 (0.5 % rusting) for new construction and large-scale maintenance. This degree of rusting shall only be allowed in localised areas and not be scattered over the total surface area coated;
- e. For thermally sprayed coating systems, the acceptable degree of rusting shall be in accordance with ISO 4628-3 and shall not be worse than Ri 0 (0 % rusting);
- f. The quality of adhesion between the coating system and the steel substrate, and of the adhesion between the coating layers, shall not be less than 70 % of the values specified in (6.8.5);
- g. Visual cracking, mud-cracking or flaking of the coating systems is not allowed. Full attention shall be given to areas such as corners where overlaps are difficult to avoid;
- h. Blistering is not allowed;
- i. No conspicuous discolouration or excessive loss of gloss shall be observed in the topcoats specified for the atmospheric zone. The topcoat on steel floors is not included but the topside of the helideck shall be included. The requirements on colour retention as described in subsection of this DEP shall be observed.

2.3.2 Spot repair

For spot repair of coating systems no longer under warranty, the applicable duration of the warranty period shall be five years after completion of the applied repair coating. The other requirements given in (2.3.1) are applicable.

3. PAINTING CONTRACTOR RESPONSIBILITY

3.1 GENERAL

The Contractor, in addition to his responsibilities under the general conditions of the contract, is responsible for the quality of the work which shall be performed in strict accordance with this DEP and all other relevant documents, such as site regulations, safety rules and requirements, product data sheets, safety data sheets, referenced standards and codes.

3.2 SAFETY AND ENVIRONMENT

The Contractor shall be responsible for all aspects of safety and personal protection related to the proposed painting work. Environmental regulations and rules shall be met.

All personnel shall be provided with approved personnel protection, e.g., protective clothing, safety glasses, safety shoes, hard hats, goggles, respirators, earplugs, fresh-air-fed hood and any other necessary safety equipment. All safety equipment shall be maintained to a good working condition. Protective clothing for abrasive blasters shall comply with ISO14877.

Adequate warning signs shall be prominently displayed at all access points to areas where abrasive blasting and painting is in progress.

Handling and disposal of hazardous waste resulting from the Contractor's painting activities shall be in accordance with regulations and specific contract requirements.

3.3 HAZARDOUS COATING COMPONENTS

The Contractor shall ensure that all layers of a coating system and all abrasive blasting materials comply with any local and/or regional standards or regulations on banned materials such as lead, chromate, crystalline silica or coal tar. Any coating system shall fully comply with any local and/or regional air quality or Volatile Organic Compounds (VOC) levels or emission standards or regulations.

Coatings shall contain a maximum 0.1 % (by mass) monomeric isocyanate at the time of painting. Any anti-fouling coating system shall be free from tributyltin (TBT) compound.

Before commencing any surface preparation, the composition of any existing coating system shall be reviewed and, if necessary checked for hazardous components.

Handling and disposal of hazardous waste resulting from the Contractor's painting activities shall be in accordance with regulations and specific contract requirements. Moreover, the Principal's regulations on chemical management or banned materials shall also be strictly adhered to.

3.4 QUALITY OF COATING WORK

The Contractor is fully responsible for all Quality Assurance and Control activities.

The Contractor should schedule a pre-job meeting to ensure that the job and quality requirements are fully understood. Attendees should include a representative of the Principal, the Contractor's job superintendent, coating supervisor, and coating inspector and should also include the coating Manufacturer's representative.

For all coatings work, the Contractor should submit work programmes, method statements, and quality plans for implementing the requirements of this DEP for review by the Principal.

Copies of this DEP, the work plans and the quality plan should be made available to the coating Contractor's representative at the site and the Contractor should be familiar with their contents.

3.5 PERSONNEL

Only professional skilled blasters and painters shall be used. Blasters and painters working on every painting job should be certified in accordance with a scheme approved by the Principal (e.g., ASTM D4228). A certified foreman should supervise the blasters and painters. Before any work is commenced or a contract is awarded, the certificates should be submitted to the Principal. Certifying bodies shall comply with ISO 17024.

The Principal reserves the right to witness all tests.

3.6 PROTECTION OF EQUIPMENT AND STRUCTURAL MEMBERS

The painting Contractor shall protect all equipment, structures and any other areas from mechanical damage, environmental damage, blockage or obstruction, damage caused by over blasting, dripping paint, paint splashes and overspray.

3.7 BLASTING AND SPRAYING EQUIPMENT

Blasting and painting equipment shall fully comply with the requirements of local and/or regional regulations.

The compressed air shall be free of water and oil. Adequate separators and traps shall be provided, installed in the coolest part of the system. The presence of oil and water shall be determined in accordance with ASTM D 4285 at least two (2) times per 12 hours and following every compressor start-up. In no case shall the temperature of the compressed air be allowed to exceed 100 °C (212 °F).

Blasting nozzles shall be discarded and replaced when the nozzle diameter has increased through wear by more than 50 % of the original diameter and when the specified minimum pressure, surface cleanliness and surface profile can no longer be achieved.

3.8 WEATHER PROTECTION

Unless otherwise agreed, the Contractor shall supply all the weather protection, scaffolding and any other equipment necessary to ensure that the work is carried out in accordance with this DEP and the agreed programme. This includes, for example, heating and dehumidifying equipment.

4. SURFACE PREPARATION

4.1 GENERAL

All edges shall be ground to a minimum radius of 2 mm (0.078 in) or as otherwise agreed with the Principal. Flame cut areas and weld spatter shall have been ground flush with the requirements of ISO 8501-3, preparation Grade P3. This activity shall be performed primarily during fabrication by mechanical Contractor. However, if any minor points are left over, the same shall be carried out by painting Contractor. Cleaning of surfaces shall, as a general rule, be done by dry blast cleaning (hereafter referred to as blast cleaning) as outlined in ISO 8504-2.

Fabrication should be complete before surface preparation begins. Prefabrication primers are allowed. However, after assembly these primers shall be removed by blasting and the surface shall be blasted to the initial specified surface cleanliness unless otherwise agreed with the Principal.

Alternative surface preparation such as power tool cleaning is not acceptable under any circumstances for areas exposed to water (immersion), subsea items, insulated steelwork or buried items and the internal surfaces of equipment and tanks. Alternative surface preparation is only acceptable after written approval of the Principal in specific cases excluding the above.

Stainless steel surfaces shall not be treated with carbon steel cleaning tools or any tools previously used on carbon steel.

4.2 PRE-CLEANING

Prior to the blast cleaning and/or prior to any painting operation, the surface shall be free of any contamination and any excessive rust scale shall be removed. Excessive salt contamination of parts that have been stored in and exposed to the open air should be removed prior to blast cleaning. Salt contamination shall be assessed as specified in (6.7.2).

All boltholes shall be solvent cleaned prior to the commencement of blast cleaning. Solvent cleaning shall be carried out in accordance with SSPC SP1.

When emulsion or detergent type degreasers or Teepol/fresh water solutions are used, this treatment shall be followed by copious rinsing using fresh and clean potable water or pressure water/steam wash. All degreasers shall be proven as biologically degradable.

Maintenance coating projects should always start with high pressure steam/detergent cleaning to remove dirt, grease and/or salt deposits. Such washing shall also be carried out between coats where the surface has become contaminated following a storm or as a result of an extended over-coating interval.

All welded areas and appurtenances shall be given special attention for removal of welding flux in crevices. Welding spatter, slivers, laminations and underlying mill scale not removed during fabrication and exposed before and during blast cleaning operations shall be removed by the best mechanical means. Edges shall be smoothed or rendered flush.

Where rectification has been necessary on blast-cleaned surfaces, the dressed areas shall be pre-cleaned as initially specified.

Particular care shall be taken to dry areas which are not self draining, so that any water collected is removed and not allowed to evaporate leaving salt deposits on the surface.

For the treatment of stainless steels, attention shall be given to the level of free halides in materials shall used. If un-coated austenitic type of stainless steels require hot water cleaning; the temperature of the water shall not be higher than 60 °C (140 °F).

Detergents with a pH > 9 shall not be used on aluminium substrates.

4.3 CLEANING OF SURFACES

4.3.1 General

To prevent dust and abrasive contamination, blast cleaning shall not be done close to painting operations or wet coated surfaces. Environmental restrictions shall be observed. Rough grit blasting can be allowed during the night providing that the surface is subsequently blasted under good light conditions to the specified standard. Minimum lighting requirement for abrasive blasting, painting and inspection is 500 lux.

Blast cleaned steel surfaces shall not be touched by bare hands.

If the surface being cleaned lies adjacent to a coated surface, which is not part of repair, the blast cleaning shall overlap the coated surface by at least 50 mm (2 in). The edges of the existing coating system shall be feathered. The remainder of the existing coated surface shall be properly protected with shields or screens to prevent any over blast damage.

No acid washes, cleaning solvents or other chemical treatments shall be used on metal surfaces after they have been blast cleaned. This restriction includes inhibitive washes intended to prevent rusting.

The surface profile and the anchor pattern for steel surfaces shall be in accordance with recommendations of the paint Manufacturer given in product data sheet. When not specified by the paint Manufacturer or when otherwise specified in this DEP, the surface profile shall be between 40 µm and 70 µm (1.5 – 3 mils) for coating system up to 500 µm (20 mils) and between 70 to 125 µm (3 to 5 mils) for coating system over 500 µm (20 mils), e.g., glass flake filled coating system. The anchor pattern shall have a sharp angular profile.

When stainless steel galvanised or non-ferrous metal surfaces are painted then blast cleaning shall be carried out by smooth sweep blasting, using a fine non-iron containing abrasive (e.g., aluminium oxide). No defects such as break through or crisping of the zinc layer shall occur on galvanized surfaces. The surface roughness shall be in the range of 20 µm to 30 µm (0.75 to 1.2 mils) or as recommended by the paint Manufacturer.

In addition, when aluminium or galvanised components are painted, zinc or aluminium corrosion products (white rust) and/or rust present shall be removed.

The requirements for materials for surface treatments are specified in (4.2).

Where rectification has been necessary on blast-cleaned surfaces, the dressed areas shall be re-blasted to the initially specified surface cleanliness.

For quality assurance and control requirements refer to (6).

4.3.2 New construction and modifications

The surfaces of carbon and low alloy steelwork for new construction and modifications to existing installations shall be blast-cleaned to the visual standard of Sa 2½ in accordance with ISO 8501-1 at the time of coating. However, for internal coating of equipment, the more stringent Sa 3 should be applied. For the blast cleaning of vessel and tank internal surfaces, an inert blasting abrasive material (for example, aluminium oxide) shall be used.

In addition to the requirements of ISO 8501-1, blasted-cleaned carbon steel surfaces shall be tested for presence of any mill scale. Particular attention shall be given to shop blasted steel work (i.e., blast cleaning using wheel blast machines).

The surface preparation for touch-up painting of welds (including field welds) and corroded or chemically polluted or damaged areas shall be by blast cleaning (e.g., vacuum blasting). All surfaces shall have a surface profile after blast cleaning.

4.3.3 Maintenance

Maintenance painting shall be organized and carried out in accordance with the requirements in this DEP. Surface preparation requirements for maintenance are specified in more detail in (4.3.7).

To carry out proper maintenance, all parts of a facility shall be made accessible for maintenance painting operations in consultation with the Principal. This shall include the removal of insulation and U-bolts, and the lifting of piping from their supports, as necessary.

4.3.4 Abrasives**4.3.4.1 International standards and characteristics of abrasives**

Abrasives for use in blast cleaning steels shall be in accordance with ISO 8504-2 and Table 1. The properties of abrasives used shall meet the requirements of the relevant parts of ISO 11124 and ISO 11126 respectively. Test methods shall be in accordance with the tests specified in ISO 11127. Each batch of abrasive should be tested to check that the abrasive meets the requirements as specified in the relevant ISO standard.

The conductivity of abrasives for stainless steels shall be a maximum of 150 $\mu\text{S}/\text{cm}$. The Principal shall approve the use of alternative abrasive materials.

Table 1 Abrasives specification

Type	Generic Name	Characteristics	Standard
Metallic	Iron grit	> 1.7 % carbon	ISO 11124-2
	Steel grit	0.8 % to 1.2 % carbon	ISO 11124-3
Natural mineral	Staurolite	Iron/aluminium silicate	ISO 11126-9
	Specular haematite	Crystalline Fe_2O_3	
	Garnet	Calcium iron silicate	ISO 11126-10
Synthetic mineral	Coal slag	Aluminium silicate	ISO 11126-4
	Aluminium oxide	Crystalline corundum	ISO 11126-7

4.3.4.2 Selection of abrasives

Steel or iron grit is commonly used as recyclable abrasives. In general, when steel shot is used, it shall be used together with steel grit and approved by the Principal. The shot content in such a mix shall not exceed 67 %.

The abrasives shall be free from oil, grease, moisture, chloride contamination, etc., and supplied with certification documentation traceable to batches of material.

4.3.5 Grades of surface finish

The recognised surface finish grades are summarised in Table 2.

Table 2 Surface finish grades

Surface finish grade	ISO 8501	SSPC	NACE
White metal	Sa 3	SP-5	No 1
Near-white metal	Sa 2½	SP-10	No 2
Sweep blast cleaning	Sa 1	SP-7	No 4
Solvent cleaning	-	SP-1	-
Power tool cleaning	St 3	SSPC SP-3	
Power tool cleaning to bare metal	-	SSPC SP-11	-

Water jetting	-	SSPC SP-12	No5
Wet abrasive blasting	-	TR 2	NACE 6G198

4.3.6 Removal of residual salts from pitted areas

Where pitting corrosion has been located, pressure water/steam wash with fresh water shall be performed after the initial abrasive blasting. The surface shall be left for 30 min before re-blasting and priming. Should "rust-back" or black-spotting occur, the pressure wash shall be repeated to remove the residual salts residing in the micro pits. This requirement is limited to onshore installations in view of practical difficulty in offshore locations.

4.3.7 Alternative methods of surface cleaning

4.3.7.1 General

Alternative surface cleaning is only acceptable after written approval of the Principal but the restrictions specified in (4.3.1) shall be adhered to. The alternate surface cleaning methods are mainly intended for maintenance painting when the dry abrasive blast cleaning is difficult or not feasible to perform.

Alternative primers such as surface tolerant primers may be required for alternative methods of surface cleaning.

4.3.7.2 Wet abrasive blasting

Wet abrasive blast cleaning techniques may be used to avoid dust or in cases where fire and/or explosion risks are present. The cleaned surface shall be dry at the time of painting. Particular care shall be taken to dry areas which are not self-draining, so that water collected is removed. Corrosion inhibitors may be used to prevent flash rusting, but only after approval of the Principal. Inhibitors containing chromates, nitrates or nitrites shall not be used. The paint manufacturer shall approve the use of any inhibitor and the method for removing inhibitor residues before painting.

4.3.7.3 Water jetting

High-pressure and ultrahigh pressure water jetting may be used where abrasive blasting is not permitted because of the risk of damage to process equipment. Water jetting is restricted to maintenance painting. It is a hazardous operation and requires the use of well trained, experienced operators.

Corrosion inhibitors may be used to prevent flash rust, but only after written approval of the Principal. The paint manufacturer shall approve the use of any inhibitor and the method for removing inhibitor residues before painting.

4.3.7.4 Vacuum blasting

Vacuum blasting may be used for spot repair of damaged or corroded areas. It may be used in the locations where open abrasive blasting is not permitted or desirable.

4.3.7.5 Power-tool cleaning

The electric or pneumatic power tool cleaning shall be confined to minor areas when abrasive blasting is not feasible when the area of the repair is less than 30 cm² (1 ft²). Unless otherwise specified it shall be carried out in accordance with the requirements of ISO 8504-3 and ISO 8501-1 grade St3. Power-tool cleaning (grinding) to bare metal shall be done in accordance with SSPC SP11. The recommended type of power tool is Montipower MBX bristle blaster or equivalent. This specially developed surface preparation tool can achieve the required anchor profile and near white metal cleanliness.

Wire brushing by hand or with power assistance shall not be used. Surface preparation of field closure welds shall be blast cleaned unless otherwise approved by Principal.

5. COATING APPLICATION

5.1 GENERAL

In general the requirements for the coating systems in this DEP cover their application to surfaces prepared by dry blast cleaning.

All coating systems shall be applied in accordance with this DEP and the paint Manufacturer's instructions and data sheets. Any conflicting requirements shall be brought to the attention of the Principal.

Zinc rich primers shall be applied over abrasive blast cleaned carbon and low alloy steel surfaces only.

Paints containing metallic zinc shall never be applied, over sprayed or dripped onto stainless steel components.

To ensure that only correctly blasted surfaces are coated, a minimum of 100 mm (4 in) around the edges of prepared areas shall be left uncoated, unless adjoining a coated surface.

No coating shall be applied within 50 mm (2 in) to areas that require welding later.

Successive coats shall have different colour or tints.

For quality assurance and control refer to (6).

5.2 MIXING AND THINNING

All coating materials shall be mixed and thoroughly stirred in accordance with the instructions of the paint Manufacturer.

Only thinners specified by the paint Manufacturer shall be used.

5.3 COMPATIBILITY WITH EXISTING COATING SYSTEMS

Before any painting work is commenced, the compatibility with existing coating systems or layers shall be checked. The paint Manufacturer shall be consulted. If there is any doubt about compatibility, the patch test in accordance with ASTM D 5064 shall be conducted to evaluate the inter-coat adhesion. For new construction, modifications and areas under renovation, all coating materials in a coating system shall be made by the same Manufacturer.

5.4 OVERCOATING

Coatings shall be dried and cured in accordance with the paint Manufacturer's recommendations, prior to over-coating. Before over-coating, over-runs, drips and smears shall be removed and any coating damage or imperfection shall be repaired. If the DFT does not meet the requirements of this DEP, corrective action shall be taken.

If a zinc primer is specified in coating systems, it shall be over-coated as soon as possible but only after sufficient cure if the primer is an inorganic zinc primer. The paint Manufacturer's maximum over-coating times shall not be exceeded.

Zinc salts (white rust) that have formed during the intervening period shall be removed in accordance with the paint Manufacturer's instructions prior to over-coating.

5.5 SPRAY APPLICATION

Spraying is recommended method of application. Airless spray equipment and plural component spray equipment are suitable for high solids and solvent free coating systems to achieve maximum DFT/coat. The painting Contractor, as recommended by the paint Manufacturer, shall supply a complete range of tips with varying spray angles and sizes.