PAINTING STANDARDS MANUAL

For

JACKUPS

SEMI-SUBMERSIBLES

DRILLSHIPS

NOBLE CORPORATION

PAINTING STANDARDS MANUAL

Document Control List

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Appendix A	Coatings Cross Reference	0	01/Jul/03
Appendix B	Coatings Estimating Sheet	0	01/Jul/03
Appendix C	Coating Approval Procedure	0	01/Jul/03
Appendix D	CHLORID*RID Data	0	01/Jul/03
Appendix E	Corporate Identity – Admin Policy Manual	0	23/Jun/03
Appendix F	Noble Safety Marking Program	0	01/Jul/03
Appendix G	Rig Communication & Safety Sign Standard	0	10/Oct/02
Appendix H	Surface Preparation Standards	0	01/Jul/03

Reviewed by:_____ Date:_____

Approved by:_____ Date: _____

Note:

This Manual supersedes the following Noble Corporation publications:

- Painting Standards for Jack-ups
- Painting Standards for Semi-Submersibles

GENERAL TERMS & CONDITIONS

1.0 PURPOSE

1.1 To provide a standard for preserving hull structure, jacking legs, equipment, and fittings on jackup rigs by the application and maintenance of coating systems.

2.0 SCOPE

2.1 This standard provides policies, procedures and guidelines for surface preparation, and the purchase, application, and inspection of coatings used on jack-up rigs during major coating repair projects undertaken by third party CONTRACTOR personnel only. Maintenance standards covering other applicable activities and methods of corrosion control are referenced herein.

2.2 This standard applies to all jackup rigs owned or operated by Noble Drilling Services (NOBLE) as it applies to major coating repairs when extensive removal of existing coatings and the reapplication of new coatings is conducted by third parties.

2.3 For reference purposes, this standard specifies coatings manufactured by International Paint. Appendix A of this standard provides a listing of International coating products along with a blank column for insertion of alternate products that may be approved in accordance with Section 7.1 as fully described in Appendix C of this specification. A preferred paint manufacturer will be utilized in most all areas of the company's operations as determined by Noble Engineering/Operations based on pricing agreements to maximize cost effectiveness. However, it is recognized that a single paint manufacturer may not have the capability of providing adequate support services to all our geographical areas of operation. As such, it may be necessary to utilize coatings manufactured by a non-preferred paint manufacturer. Requests from the field or from third party CONTRACTORS to use coatings provided by a non-preferred paint manufacturer shall be submitted in writing to Vice President Project Engineering, prior to the purchase of any coatings. This will allow a technical evaluation to be made of the non-preferred products, and provide an opportunity for the preferred paint manufacturer to provide adequate service and support on an ad-hoc basis to meet the company's requirements. It is the responsibility of the NOBLE representative on site to ensure compliance with this standard, regardless of the final decisions on what coating products will be used. Neither field operations management, nor third party CONTRACTORS have the unilateral authority to make these decisions.

2.4 Manufacturers wishing to have their products approved on NOBLE general specifications shall provide documentation from independent testing agencies that their products meet the testing requirements of NACE TG260 as modified in Appendix C of this specification.

2.5 The coating systems specified herein have been selected to achieve a balance among several factors including but not limited to the following:

2.5a Simplicity of coating product application to minimize training requirements, and obtain a consistent high level of workmanship among third party CONTRACTORS utilized throughout the world.

2.5b Compatibility between several paint manufacturers' coating systems to provide flexibility in sourcing and applying various coating products in most all geographical areas of NOBLE rig operations.

2.5c Cost effectiveness through standardization of products to achieve maximum pricing advantages through high volume purchasing.

2.5d Surface tolerant coating systems that can be applied to surfaces that cannot be prepared to optimum quality levels in adverse offshore environments and still provide good service life.

2.6e Coating systems that can be used for both immersion and non-immersion service, provide acceptable long-term performance, and comply with environmental regulations.

3.0 RESPONSIBILITY

3.1 The Rig Manager/Superintendent is responsible through the normal Operations chain of command up to and including the Division Manager for requesting resources, and ensuring compliance with this policy for all rigs under their direct supervision.

3.2 The Division Manager is responsible to the Regional Vice President, Operations for approval of the necessary resources for compliance with this policy for all rigs under their management.

3.3 The Vice President, Project Engineering is responsible for ensuring that this standard is maintained in accordance with good corrosion control practices as they pertain to coatings and their application. Exceptions to this policy shall be approved by the Vice President, Project Engineering.

3.4 The Vice President, Materials Management for compliance with this policy insofar as the purchase of coatings and other materials specified in this standard. Requests for exceptions or substitutions shall be submitted in writing to the Vice President, Project Engineering, to ensure any substitute products or materials are equal in quality to those specified herein.

4.0 DEFINITIONS

4.1 *NOBLE Representative*

The person who is assigned the responsibility for ensuring the on-site work is carried out in accordance with this standard, and within the time and budget constraints approved by Operations management.

4.2 *Soft Coatings*

Soft coatings include, but are not limited to brand names such as Eureka, Rustkote, Clearkin, Esgard or Magnakote, which may have been used as in lieu of the hard coating systems specified herein. As of the issuance of this standard, soft coatings may not be used on any NOBLE drilling rig without prior written approval of the Vice President, Operations.

4.3 *Exposed to Weather Surfaces*

Any surface that will be continuously subjected to salt-water atmosphere with the rig in normal operating condition, including, but not limited to the interior of foundations which have openings to the atmosphere, weather deck control boxes and storage boxes (inside and out), the interior of weather deck ventilation ducts for a distance of about 8-feet from the opening, and other similar surfaces subject to the environment.

4.4 *Fresh Water*

Potable clean water with a chloride content of less than 10 ppm.

4.5 *Low-Pressure Water Cleaning (LP WC)*

Cleaning performed at pressures less than 34 Mpa (5,000 psi.)

4.6 *High-Pressure Water Cleaning) (HP WC)*

Cleaning performed at pressures from 34 to 70 Mpa (5,000 to 10,000 psi).

4.7 *High-Pressure Water Jetting (HP WJ)*

Cleaning performed at pressures from 70 to 170 Mpa (10,000 to 25,000 psi)

4.8 *Ultra-High Pressure Water Jetting (UHP WJ)*

Cleaning performed at pressures above 170 Mpa (25,000 psi).

4.9 *Dry Film Thickness (DFT)*

Measurements taken in microns or mils at the conversion ratio of 25 μm = 1 mil.

4.10 *Brush Off Blast (Sweep Blast)*

A surface finish blasting technique that removes all visible oil, grease, dirt, rust, mill scale, paint, or other coatings, with the exception that tightly adhering rust, mill scale, paint, or other coatings may remain, provided that portions of the underlying metal are uniformly exposed over the surface. (Note; Section 4.1 of NACE 4 / SSPC-SP 7 / ISO Sa 1.0 Brush Off Blast Cleaning standard requires that visible deposits of oil or grease be removed in accordance with SSPC-SP1 or other agreed upon method prior to Brush-Off Blast Cleaning.

4.11 *Commercial Blast*

A surface finish blasting technique that removes all visible oil, grease, dirt, rust, mill scale, paint, or other coatings such that at least 67% of each 9 square inch units of the surface area is free of all visible residues, without the aid of a magnifier, and the remainder of the surface has only stains and shadows of rust, scale or old coatings. (Note; Section 4.1 of NACE 3 / SSPC-SP 6 / ISO Sa 2.0 Commercial Blast Cleaning standard requires that visible deposits of oil or grease be removed in accordance with SSPC-SP 1 or other agreed upon method prior to Commercial Blast Cleaning.

4.12 *Near White Blast*

A surface finish blasting technique that removes all visible oil, grease, dirt, rust, mill scale, paint, or other coatings such that at least 95% of each 9 square inch unit of the surface area is free of all visible residues, without the aid of a magnifier, and the remainder of the surface is only lightly discolored. . (Note; Section 4.1 of NACE 2 / SSPC-SP 10 / ISO Sa 2.5 Near White Blast Cleaning standard requires that visible deposits of oil or grease be removed in accordance with SSPC-SP 1 or other agreed upon method prior to Near White Blast Cleaning.

4.13 *Scope of Work (SOW)*

A detailed description of the scope of work that is agreed to between the CONTRACTOR and the NOBLE Representative that is planned, contracted, and carried out on a particular rig

4.14 *Critical Hold Points*

Certain stages of the surface preparation and coating of surfaces that require an assessment to be made in accordance with certain quality standards contained within this standard, including but not limited to that which is defined in Section 11.3.

4.15 *Abbreviations*

ASA	American Society for Aesthetics
ASTM	American Society for Testing and Materials
DFTR	Dry Film Thickness Range
NOBLE	Noble Drilling Services, Inc.
IACS	International Association of Classification Societies
ISO	International Standards Organization
NACE	National International, The Corrosion Society
SSPC	The Society for Protective Coatings
ISO	The Society for International Standardization

5.0 REFERENCE DOCUMENTS

The following reference documents are a part of this standard in addition to the requirements contained herein. ***Unless otherwise noted, the current edition of the reference documents shall be used.*** Other recognized codes and standards meeting or exceeding the referenced documents may be substituted or added by the NOBLE Representative in the agreed scope of work (SOW). The CONTRACTOR is responsible for gaining access to, understanding, and complying with all of the requirements contained in the reference documents listed below:

ASA A13.1	Bulletin for recommendations on color coding for types of materials
ASTM A-123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
IACS RP 47	Part A - Shipbuilding and Repair Quality Standard for New Construction
ISO 14726-1	Ships and marine technology – Identification of content of piping systems – Part 1: Main colors
ISO 14726-2	Ships and marine technology – Identification of content of piping systems – Part 2: Secondary colors
SSPC AB1-91	Written standard for mineral and slag abrasives
NACE2 / SSPC SP 10 ISO Sa 2.5	Written standard for near white metal abrasive blast standard
SSPC SP1	Written standard for solvent cleaning
SSPC SP3	Written standard for power tool cleaning
SSPC SP11	Written standard for power tool cleaning to Bare Metal
NACE4 / SSPC SP 7 ISO Sa 1.0	Written standard for brush blast cleaning
SSPC-VIS 5 / NACE VIS 9	Visual standard for wet abrasive blast cleaning
SSPC-VIS 4 / NACE VIS 7	Visual Standard for Water Jetting (International Hydroblasting Standards may be used as an alternative source)
NACE / SSPC Viz-1	Visual Standards for Abrasive cleaned surfaces

NACE / SSPC Viz-3	Visual Standards for Hand or Power Tool cleaned surfaces.
SSPC SP-COM-91	Surface preparation commentary

6.0 GENERAL POLICY REQUIREMENTS

6.1 This standard provides the requirements and specifications for cleaning, surface preparation, and application of the coating systems specified in this standard. Coating systems specified herein shall not be used for any area other than those set forth in this standard without prior approval by the NOBLE Vice President Project Engineering.

6.2 When corrosion is discovered in the bottom of jackup preload tanks, and the application of hard coatings cannot be performed within a short period of time, anodes shall be installed only when the amount of variable load available provides a sufficient margin to allow 2 or more inches of salt water to remain in the tanks without causing operational difficulties. In such cases the anodes shall be shall be installed per recommendations of Corporate Engineering.

6.3 The information contained in Attachments A and B are provided for material and cost estimations only. Specifications contained herein shall be adhered to regardless of area being repainted.

6.4 All replacement steel installed on or into the rig shall be coated in accordance with this standard, and shall be coated with coatings compatible with existing coating systems.

7.0 SPECIFIC REQUIREMENTS FOR THIRD PARTY CONTRACTORS

7.1 NOBLE shall furnish all coatings unless stated otherwise in the contract documents. Exceptions to this provision may be granted by the NOBLE Vice President Project Engineering ONLY if:

7.1a The coating products equal or exceed the quality of those specified in this standard, as verified by independent testing in accordance with NACE TG260, and

7.1b Delivery of coatings that would otherwise be supplied by NOBLE prohibits project execution in the time frame required to meet rig operational requirements

In the event the CONTRACTOR provides any coatings, the CONTRACTOR may assess a fee to cover procurement, handling, and nominal freight costs from local suppliers that shall be negotiated and agreed to by the NOBLE Representative. The CONTRACTOR shall submit a list of coatings to be provided, along with the volumes of each product, and the net prices to be charged for supplying the coatings along with the Paint Schedule and Scope of Work (SOW) for review and approval by the NOBLE Representative.

7.2 In all cases, the CONTRACTOR shall submit a Paint Schedule itemizing the coating products to be used, surface preparation standards, and coating application specifications that are to be complied with for each area, along with the Scope of Work (SOW) to the NOBLE Representative for review and approval. These documents shall be submitted to allow sufficient time for review and approval by the NOBLE Representative, and the procurement and delivery of the coatings and other materials necessary to commence and carry out the work within the time frame specified by the NOBLE Representative. CONTRACTORS wishing to avoid being eliminated from being considered for work on NOBLE rigs shall prepare a standard bid package for surface preparation and coating system application as specified in this standard for the following areas:

7.2a Deep tanks (this work will invariably require dehumidification)
7.2b Double-bottom tanks (same note as 7.2a)
7.2c Above-deck structures
7.2d Quarters exterior
7.2e Below-deck machinery spaces, storerooms, etc.
7.2f External decks
7.2g Internal decks
7.2h Jacking Legs (access to all surfaces assumed to be done via spiders)
7.2i Helideck undersides (access assumed to be via scaffolding)
7.2j Raw Water Towers
7.2k Shaker House interiors
7.2l Mud pits
7.2m Hull exterior (specify separate rates for side shell, bottom shell, and leg wells. Means of access to bottom shell to be specified and agreed to prior to commencement of work)
7.2n Potable Water tanks
7.2o Handrails (quote per linear foot, assuming three (3) horizontal rails of 2” diameter pipe, and vertical columns spaced every 6 ft. – finish to be painted yellow)

The above areas shall be quoted on a cost per square foot or square meter basis including all labor, equipment and materials including but not limited to scaffold materials, spiders, tools, tarps, brushes and rollers, paint mixing and spraying equipment, ventilation fans and temporary plastic ducting, dehumidification and heating equipment, cleaning supplies, chloride testing and removal materials, blasting equipment and media (specify rates for both dry grit and high pressure water blasting), personal protective equipment (PPE), and insurance. Items to be included from these rates shall be all coatings and thinners, compressed air, power, water, waste disposal costs, mobilization/demobilization expenses, and any standby time. Scaled general arrangement drawings of NOBLE rigs shall be provided upon request. The above quotation shall be renewed on an annual basis, or upon request by the NOBLE Vice President Project Engineering.

7.3 Appendix F specifies the finish colors for all areas and equipment on all NOBLE rigs and is referenced and made a part hereof. All finish coatings shall be applied to meet the dry film thickness range specified in this specification. Primer and intermediate coating colors shall be as stated in this specification. However, other contrasting colors of the same coating product may be used for primer and intermediate coats when necessary to avoid delaying completion of a painting project. Finish coats specified for ambient surfaces in this standard shall not be applied to surfaces that are subject to immersion service.

7.4 Unless otherwise approved on a case-by-case basis, stripe coats shall be applied by brush to a minimum DFT of 75 microns (3 mils). Requests for exceptions, wet on wet or roller application shall be submitted to Vice President-Project Engineering prior to conducting any work.

7.5 Diesel fuel oil tanks that were not coated originally shall not be re-coated. Where the original coating in fuel tanks is beginning to fail, the coating shall be removed in accordance commercial blasting standards, and the entire internal surface of the tank (s) shall be vacuum cleaned of all abrasive grit material, and immediately applied with diesel fuel.

7.6 Where only partial removal of existing coatings is required, and the existing coating system consists of products that differ from those specified in the Paint Schedule, the CONTRACTOR shall perform “test patches” to determine the compatibility between the existing coatings and the new coatings. The minimum cure time of the “test patch” for purposes of testing compatibility shall be seven (7) days. If the “test patches’ show that the new coatings are not compatible, the CONTRACTOR shall test other products agreed to by the NOBLE Representative until acceptable products are identified and agreed to. The NOBLE Representative may, at his discretion, allow the CONTRACTOR to supply substitute coating products identified by such testing based on availability if NOBLE cannot procure and deliver the same products in time to meet project schedule demands.

7.7 On galvanized surfaces, the first coat specified in this standard shall be thinned up to but not exceeding 15% (by volume) with the paint manufacturer’s recommended thinner and shall be applied by brush or roller only. Subsequent coats may be applied by conventional or airless spray.

7.8 All raw steel plates and shapes used for replacement steel or new structure shall be ordered from the mill or steel supplier coated with Interzinc 52 Organic Zinc Rich Epoxy or Interplate 937 Inorganic Zinc pre-construction primer as directed by Owner’s Representative. The Interzinc 52 shall be applied at a DFT of 2.0-3.0 mils (50 – 75 μm). The Interplate 937 shall be applied at a maximum DFT of 18 microns (0.7 mils). Both products shall be applied on a surface prepared in accordance with NACE2/SSPC-SP-10/ISO SA 2.5 Near White Metal blasted surface. NOTE: Surface anchor patterns produced from abrasive blasting and wheelabrators have a profile that is typically deeper than the maximum DFT of Interplate 937. Therefore, it is to be expected that measurements of the DFT of this product when it is applied

to these surfaces will have DFT measurements greater than 18 microns (0.7 mils), but not greater than 1.0 mils. Exceptions to this requirement shall be submitted to the NOBLE Representative prior to awarding the contract.

7.9.a When structural modules are pre-fabricated before sending them to the rig, **and** assuming the steel plates and shapes used to fabricate the module were primed with Interplate 937 Inorganic Zinc Pre-Construction Primer, **and** the surfaces of the module are going to be subjected to ***immersion service***, all surfaces of the module shall be cleaned in accordance with Section 8.6, and sweep-blasted in accordance with Section 8.8 of this standard prior to the application of the first coat of the coating system specified. At a minimum, the first permanent coat of paint shall be applied to such modules prior to shipment to the rig.

7.9.b If such modules are **not** going to be subjected to immersion service, then the module surfaces need only be cleaned after all hotwork is completed in accordance with Section 8.6 prior to the application of the first permanent coat of paint.

7.9.c If prefabricated modules are not made with plate and shapes that were primed with Interplate 937 Inorganic Zinc Pre-Construction Primer, the entire module must be grit-blasted to near white metal after all hotwork is completed in accordance with Section 8.10 prior to the application of the first permanent coat of paint.

7.9.d If the first coat of paint is specified to be a zinc-rich epoxy or inorganic zinc, the second full coat of paint shall be applied over these types of primers prior to shipment of the module to the rig in accordance with Section 7.15.

7.9.e All module edges that are to be welded shall be taped back 3 inches prior to any coating application after fabrication is completed. Completion of the application of the coating system shall be performed on the rig after erection and all hot work and non-destructive examination (NDE) is completed.

7.10 All coatings shall be applied in accordance with IACS RP 47 and the paint manufacturer's instructions, including but not limited to instructions for thinning, mixing, method of application, minimum and maximum overcoat time limits, and environmental conditions.

7.11 The CONTRACTOR shall touch up areas where the existing painting system has been damaged during the course of work unless otherwise directed by the NOBLE Representative. If steel clips are installed for scaffolding supports, they shall be removed and the area repaired in accordance with the coatings coating specifications for that area.

7.12 Obstructions such as tools, air hoses, electric cables, and scrape buckets shall be removed from each area being painted to preclude a patch work finish.

7.13 Non Destructive Examination (NDE)

All NDE shall be completed and approved prior to application of a painting system, including but not limited to air tests, hose tests, hydrostatic testing, and magnetic particle inspection (MPI) or ultra-sonic (U.T.) inspection of all welds, as required by the vessel classification society/regulatory bodies for the rig's structure or piping system being coated.

7.14 Protection of finished work areas

The CONTRACTOR shall completely cover finished work areas and existing equipment while adjacent areas are being painted to prevent deposits of spray, drips or spills. In addition, the CONTRACTOR shall protect fixtures, label plates, name-plates, rubber gaskets, working threads, gauge boards, and other nearby items during painting. The CONTRACTOR shall remove smudges and spills upon completion of coating applications at no additional cost using tools, equipment, and cleaners that do not harm the surfaces being cleaned.

7.15 Electrical and electronic equipment

The CONTRACTOR shall protect all electrical, electronic, and mechanical equipment in proximity of the work from paint and overspray. CONTRACTOR shall, at its own expense, restore such equipment to a condition that is satisfactory to the NOBLE Representative if such paint and overspray has been incurred.

7.16 Zinc Coatings

If either inorganic zinc, or zinc-rich epoxies are specified in special cases as approved by the NOBLE Representative and Vice President, Engineering, they shall be applied immediately after blasting and vacuum dust removal. If a delay is encountered such that the surface no longer meets the blast-cleaning standard for these coatings as specified by this standard, then re-blasting will be required to meet the original blast cleaning specification. No grease, oil, or other organic matter shall be allowed to contact the blasted surfaces prior to the application of these coatings. Special attention shall be given to final erection weld areas and any spots or areas where these zinc coatings have been damaged due to burning, welding, corrosion or other cause. Such areas shall be thoroughly cleaned by power tool cleaning to bare metal (SSPC-SP11), or spot blasting, cleaned of dust, and re-coated with the product specified to the required DFT thickness. If power tool cleaning removes the original anchor profile, the damaged profile shall be restored by dry abrasive blasting. Zinc coatings shall be overcoated with the next coat of paint as specified in this standard as soon as possible to minimize the amount of surface contamination that may occur.

7.17 Inaccessible areas

Newly fabricated structures and the area upon which they will be installed that are subject to weather exposure and that will be inaccessible for proper

sandblasting and coating after installation shall be blasted and coated prior to final installation. After final installation, all disturbed areas shall be prepared and coated in accordance with the applicable parts of sections 8.0 and 9.0. as approved by the NOBLE Representative.

7.17 High Temperature Coatings

The High Temperature Coatings specified in Appendix A shall be used on surfaces where operating temperatures exceed 200°F (93^{0}C).

7.18 Identifying hazards

Tripping and overhead hazards shall be identified with colors in accordance with the NOBLE Safety Markings Program contained in the NOBLE Safety Manual SPM205 to the satisfaction of the NOBLE Representative.

7.19 DFTR (Dry Film Thickness Range) measurements

Where DFTR has been specified, the actual film thickness shall be determined with a magnetic type gauge, such as Microtest, Elcometer, Positector, Quanix, etc. DFT gauges shall be calibrated against the manufacturer's recommended film gauge over steel of the same thickness as that under consideration at least once at the beginning of each day of use.

7.20 Existing surface conditions

Acceptance criteria for surface preparation specified in this standard depends on the initial surface conditions. The CONTRACTOR is responsible for assessing these initial surface conditions in accordance with the requirements of this section, and accounting for all work required to achieve acceptable surface appearance after surface preparation work is completed in accordance with SSPC VIZ-1 for abrasive blasted surfaces, SSPC VIZ-3 for power tool cleaned surfaces, SSPC VIZ 4 for wet abrasive blasted surfaces, and SSPC VIZ 5 for water jetted surfaces, or International Hydroblasting Standards as listed in section 5.0 Reference Documents.

7.20a New Fabrications – new steel not previously painted:

Grade A	Steel surface covered completely with adherent mill scale
Grade B	Steel surface covered with both mill scale and rust
Grade C	Steel surface completely covered with rust, little or no pitting is visible
Grade D	Steel surface completely covered with rust, pitting is visible

7.20b Maintenance / Repair – previously painted steel

Grade E	Paint almost intact, some primer may be visible, rust covers less than 1/10 of 1% of the surface.

Grade F Finish coat slightly weathered, some primer may be visible, slight staining or blistering; after stains are wiped off less than 1% of the area shows rust, blistering, loose mill scale or loose paint.

Grade G Paint thoroughly weathered, blistered or stained. Up to 10% of the surface is covered with rust, rust blisters, hard scale or loose paint, very little pitting is visible.

Grade H Large portions of the surface is covered with rust, pits, rust nodules and non-adherent paint. Pitting is visible.

NOTE: The progression from Grade E through Grade H is a logarithmic scale, with each successive grade being worse than the previous by a factor of 10.

7.21 Preferred Surface Preparation Methods

CONTRACTOR shall assume that surface preparation shall be achieved via dry grit blasting in all cases unless local laws or other considerations dictate high pressure water jetting. Whenever grit-blasting operations are conducted on a NOBLE rig, the work areas where grit blasting is conducted shall be encapsulated with tarps to minimize the contamination of rig machinery and equipment, the surrounding atmosphere, and incidental overboard discharge. Used abrasive media shall be swept-up and bagged, followed by vacuum removal of all remaining blasting media.

7.22 Protection of Personnel and the Environment

CONTRACTOR shall request the NOBLE Representative to provide a listing of the coatings that are to be removed by grit or high pressure water blasting under the agreed SOW. If the chemical make-up of the coatings that are to be removed is unknown, scrapings of the unknown existing coatings shall be analyzed by the CONTRACTOR to identify the compounds and other constituents that make-up the coating. In any case, if any of the compounds or constituents of existing coatings that are to be removed are identified as a hazard to personnel or the environment as defined by applicable laws where the coatings work is being done, the CONTRACTOR shall specify and quote the cost of:

7.22a Protecting personnel who are performing coating removal work, as well as others working in the general area who may also be exposed.

7.22b Containing blast media to minimize incidental discharge, and monitoring contamination levels, including but not limited to blast water collection and sample testing as well as testing airborne contamination levels both within the immediate area of blasting operations, as well as surrounding areas.

In the absence of any applicable laws in any given geographical area where paint removal is carried out, the CONTRACTOR shall assume that current regulations

in effect by the U.S. Occupational Safety and Health Agency (OSHA) as well as the U.S. Environmental Protection Agency (EPA) shall be complied with to the fullest extent, unless otherwise approved in writing by the NOBLE Vice President, Engineering. As stated in this specification, the provision of air filtering units does not relieve the CONTRACTOR from providing PPE that is suitable for the work defined by the Scope of Work (SOW) for all of their employees and sub-CONTRACTORS.

8.0 SURFACE PREPARATION

8.1 Surfaces shall be prepared for painting in accordance with the requirements of this section and the paint manufacturer's published instructions. In case of any conflicts between the requirements contained herein, and the manufacturer's written recommendations, the more stringent of the two shall apply. In all cases, bare metal shall be immediately protected after grit blasting and dust removal with the primer coat of the coating system that will be applied to each individual area in accordance with this standard and the NOBLE Representative's instructions.

8.2 When sweep-blasting surfaces for repainting, all loose paint shall be removed. Thick edges of remaining old paint shall be feathered to a minimum of 2 inches into the existing sound coating so that the repainted surface can have a smooth appearance. If an existing coating cannot be feathered properly with normal equipment, such coating shall be removed in its entirety. The remaining old coating shall have sufficient adhesion so that it cannot be lifted as a layer by inserting the blade of a dull putty knife under it.

8.3 Weld spatter and Gouges

Weld splatter and gouges shall be removed by power tools until a uniform surface free of edges and sharp protrusions is achieved. Gouges shall be removed and/or welded in accordance with classification society rules.

8.4 Edges

All sharp edges of structural shapes, brackets, weld seams, and plate edges shall be ground to a minimum of 1/8 inch radius prior to abrasive blasting.

8.5 Faying surfaces

Faying surfaces are created when two flat surfaces are brought into physical contact with each other, such as a flange bolted up to a flat surface without a gasket, or when there is overlapping structure in contact. This allows water to creep into the crevices between these surfaces, and promotes "crevice" corrosion. The best preventive action for eliminating corrosion for faying surfaces of steel-to-steel contact is to seal-weld the entire lapped area. When this is not possible, the surfaces should be prepared and spot-coated with an inorganic zinc primer and coated to match the surrounding area before they are placed into contact with each other in their final position. Faying surfaces of aluminum-to-aluminum shall be protected by a Metal Prep or Deoxidine pre-treatment and a coating of International Intercure 200. For faying surfaces of aluminum alloys to dissimilar metals, the aluminum shall be pre-treated, both faying surfaces given two coats of Intercure 200, and the faying surface of

aluminium alloy shall be insulated with Alumilastic, Permagum, PAW, or other suitable material as approved by the NOBLE Representative in accordance with recommendations issued by Technical Operations - Houston.

8.6 Chemical Cleaning

Surfaces to be painted shall be cleaned by one or more of the following methods to the satisfaction and prior approval of the NOBLE Representative, depending on the condition of the surface and in accordance with NACE, SSPC, or ISO guidelines. Specific requirements are contained in the tables in Section 10 for each specific area.

8.6a Oil and grease shall be washed off with International 950 (GMA571) biodegradable cleaner or equivalent in accordance with SSPC-SP1 (latest revision).

8.6b Hand washing is only intended for small areas. Contamination residues of chemicals, salts, and dirt (heavy deposits) shall be removed by scrubbing with stiff bristle brushes and fresh water or a mix of Chlor-Rid and water at a dilution rate of 3 oz: 1 gallon water and rinse water at 1: 100 ratio. (See Product Description in Appendix D.

8.6c Large areas should be pressure washed with a minimum of 3,000 psi. The wash water must be of potable quality and Chlor*Rid is to be added by means of a pressure pump or injector capable of overcoming the inlet line pressure, or from a pre-mixed holding tank. A back flow prevention device shall be installed in the supply line prior to the chemical introduction location. Chlor*Rid must be introduced at the approximate dilution of 1 US gallon per 100 US gallon of wash water. The operator shall apply the wash solution at the rate of approximately 300 square feet of surface area per 100 US gallons of wash solution. The pressure washer must be equipped with a 0 to 15-degree flat fan nozzle held a minimum of 4” to a maximum of 10” from the surface being washed.

8.6d Potable water containing less than 10 PPM of chlorides may be used without addition of Chlor*Rid provided that the cleaned surface meets the requirements of Section 8.6.e.

8.6e Residual chlorides shall not exceed 20 mg/cm^2 on atmospheric areas, 5 mg/cm^2 for immersion and tank lining areas as tested with Chlor-Test or Bresle kits.

8.7 Power tool cleaning

Power tool cleaning with power wire brushes, power impact tools, power grinders, power sanders, or by a combination of these methods in accordance

with SSPC SP3 or ISO 8501 ST 2/3 may be used to remove loose mill scale, rust, and paint after chemical cleaning. In particular, rivet heads, cracks, crevices, lap joints, fillet welds and re-entrant angles shall be cleaned by the use of power wire brushes, needle guns, sharp chisels used in chipping, scaling hammers, rotary grinders or sanders, or by a combination of such tools. In all cases the finished surface must meet the anchor profile defined in SSPC-SP11. All tools shall be operated in such a manner that no burrs or sharp ridges are left on the surface and no sharp cuts are made into the steel. If sharp cuts and/or ridges exist, they must be ground to a uniform finish.

8.8 Brush-off blasting (Sweep Blasting)

Before conducting a brush-off or sweep blast, visible deposits or oil and grease shall be removed by solvent cleaning in accordance with section 8.6. The compressed air used for blasting shall be free of water and oil. Adequate traps and separators shall be provided at the compressor with automatic dumps equipped with an adjustable timer. Additionally, the NOBLE Representative shall approve the abrasive medium prior to procurement of the blasting materials. Where this specification requires removal of loose rust, loose scale, loose paint, and other loose coatings prior to painting, these surfaces may be brush blasted in accordance with NACE 4/SSPC SP7/ISO 1.0, provided that the brush blasted area meets the requirements for residual chlorides specified for each individual area specified in the tables contained in Section 10.

8.9 Commercial Blast Cleaning

Before conducting commercial blasting all visible deposits of oil, grease shall be removed by chemical cleaning in accordance with section 8.6. The compressed air used for blasting shall be free of water and oil. Adequate traps and separators shall be provided at the compressor. Additionally, the NOBLE Representative shall approve the abrasive medium prior to procurement of the blasting materials. Where this specification requires removal of all mill scale, rust, paint, or other coatings, but allows stains and shadows of rust, scale and existing coatings, that area shall be abrasive blasted to Commercial Blast standards in accordance with NACE 3 / SSPC-SP6 / ISO 2.0 provided that the commercial blasted area meets the requirements for residual chlorides specified for each individual area specified in the tables contained in Section 10.

8.11 Near white metal blasting

Before conducting near white metal blasting, visible deposits of oil and grease shall be removed by chemical cleaning in accordance with section 8.6. The compressed air used for blasting shall be free of water and oil. Adequate traps and separators shall be provided at the compressor. Additionally, the NOBLE Representative shall approve the abrasive medium prior to procurement of blasting materials. Where this specification requires complete removal of all mill scale, rust, paint, or other

coatings; that area shall be near white metal blasted in accordance with NACE 2 / SSPC-SP 10 / ISO 2.5 provided that the near white blasted area meets the requirements for residual chlorides specified for each individual area specified in the tables contained in Section 10.

8.12 Surface profile

The profile of surfaces to be painted shall be prepared in accordance with SSPC-SP COM and the paint manufacturer's specifications for the coating being applied. The CONTRACTOR shall prepare sample areas to demonstrate the effectiveness of the preparation and painting system prior to commencement of any work to the satisfaction of the NOBLE Representative. In particular, the following factors shall be considered:

8.12a The maximum and minimum allowable roughness
8.12b The minimum and maximum thickness of the paint to be applied
8.12c The size, type, and hardness of the blasting abrasive
8.12d The velocity and angle of blast abrasive impact
8.12e The hardness of the surface to be painted
8.12f Degree of recycling the blasting abrasive
8.12g Air pressure or wheel speed of the abrasive blast equipment

NOTE: In general, the paint system thickness to be achieved will dictate the maximum allowable particle size of the blasting abrasive medium. Where heavy mill scale is present, larger abrasives must be applied and the number of prime coats in those areas may need to be adjusted to ensure total surface coverage.

8.13 Feather edging around coating repairs

All transition areas between bare steel that have been properly prepared and the surrounding area of sound coating systems must be feather-edged from the bare steel area into the sound coating by a minimum of 2 inches. Feather edging must be accomplished by utilizing appropriate power tools such as 3M Clean-N-Strip impregnated fiber discs, or equal, approved by the NOBLE Representative. Feather edging with abrasive blast media is not acceptable.

8.14 Removal of soft coatings (Eureka/Rustkote/Magnakote/Clearkin/Esgard) prior to application of an epoxy system shall be conducted prior, to painting as follows:

8.14a Apply water based biodegradable detergent type cleaner (Impact II, Naturalizer VC, Super Safe Clean, Corrosolgras, International 950 (GMA 571) or as approved by NOBLE Representative and let stand as long as recommended by manufacturer of the cleaner.

8.14b Wash with high-pressure fresh water (5,000 psi to 10,000 psi). Scrape with putty knives or scrub with bristle brushes as necessary to remove heavy grease deposits.

8.14c Large areas of thick, tight scale, may be removed by power tool cleaning to bare metal (see section 8.7)

8.14d If large sheet scale removal exposes new areas contaminated with soft coatings, repeat the cleaning process specified in 8.14a above followed by washing with low-pressure fresh water. Survey the internal tank surfaces with a black light, which will reveal areas where oil and grease still exist, and mark same. Repeat the cleaning process specified in 8.14a above followed by washing with low- pressure fresh water, and test again with a black light. If all oil and grease has been removed, proceed to the next step.

8.14e Grit blast all surfaces to the specifications of the paint manufacturer for the coating being applied, or this specification, whichever is most stringent.

8.14f Apply the coating system in accordance with the paint manufacturer's instructions and this specification.

8.15 Removal of old hard coatings in tanks and immersion areas

The CONTRACTOR shall provide the NOBLE Representative with quotations for surface preparation work based on the following options to remove old coatings and corrosion deposits, and establish the angular surface profile as required for the coating system that will be applied to each individual area. The NOBLE Representative shall approve the appropriate option for each individual area.

8.15a Option 1 - Dry Abrasive Method (where allowed by environmental regulations or NOBLE operating management)

Step 1 Conduct pre-cleaning utilizing approved cleaners as shown in Section 8.6 followed by High pressure fresh water cleaning (HP WC) at 5,000 to 10,000 psi utilizing Chlor*Rid in make up water or with Dosmatic pump at a ratio of 1-100. Residual chlorides on final cleaned surface must not exceed 5 $\mu g/cm^2$ for immersion and intermittent wet surfaces such as decks and interior areas subject to high humidity such as but not limited to the mud pit room, and 20 $\mu g/cm^2$ for other exterior and interior ambient/atmospheric surfaces.

Where necessary, Step 1 may be preceded by hand or power tooling to remove extremely heavy rust scale.

Step 2 Dry abrasive blast entire surface at nozzle pressures of 90-100 psi to remove any residual coatings or corrosion, while establishing an angular surface profile that meets the requirements of the coating system that will be applied to the each individual area.

Abrasive mesh size shall be between 20/40 and 40/80 or as specified on manufacturer's Product Data Sheet for the product being applied to that area. Residual chlorides on final cleaned surface must not exceed 5 $\mu g/cm^2$ for immersion surfaces and 20 $\mu g/cm^2$ for ambient surfaces.

8.15b Option 2 - Slurry Blasting Method

Step 1 Conduct pre-cleaning utilizing approved cleaners as shown in Section 8.6 followed by High pressure fresh water cleaning (HP WC) at 5,000 to 10,000 psi utilizing Chlor-Rid in make up water or with Dosmatic pump at a ratio of 1:100 until residual chlorides on surface do not exceed 5 $\mu g/cm^2$. Where necessary, Step 1 may be preceded by hand or power tooling to remove extremely heavy rust scale.

Step 2 Wet-abrasive or slurry-abrasive blast entire surface to remove any residual coatings or corrosion while establishing an angular surface profile that meets the requirements of the coating system that will be applied to the each individual area. Nozzle pressures must meet the optimum range of the manufacturer of the wet-abrasive or slurry-abrasive equipment being utilized. Residual chlorides on final cleaned surface must not exceed 5 $\mu g/cm^2$ for immersion surfaces and 20 $\mu g/cm^2$ for ambient surfaces.

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8.15c Option 3 - High Pressure Water Jetting Method

Step 1 Remove old paint or rust scale by High Pressure Water Jetting 10,000 to 25,000 Psi (HP WJ) using a fresh water / Chlor*Rid wash solution at a dilution of 1 part Chlor*Rid to 100 parts fresh water (see note b). HP wand must have a 0-degree rotating nozzle and be held a maximum of 4 inches from the surface during scale and paint removal. Where necessary, Step 1 may be preceded by hand or power tooling to remove extremely heavy rust scale.

Step 2. Test for soluble salts with Chlor-Test or Bresle kits. Immersion Areas containing more than 5 $\mu g/cm^2$, must be re-cleaned with the fresh water /Chlor*Rid wash solution until they meet this limit. Then allow surface to dry to visual cleanliness standard C WJ-2 as contained in SSPC-VIS 4 / NACE 7 Water Jetting Standard prior application of paint. Angular surface profile must meet the requirements of the coating system being applied to each individual area.

Step 3. Whenever the water-jetted surface does not meet the angular surface profile requirements of the coating system being applied, the

area must receive a final dry abrasive blasting to meet those requirements.

9.0 COATING APPLICATION

9.1 General

Coatings shall be applied in accordance with paint manufacturer's recommendations and may be subject to inspection at all times by NOBLE Representative and/or the paint manufacturer's representative. The CONTRACTOR shall submit a "List of critical hold points" to the NOBLE Representative for approval a minimum of 14 working days before commencing work.

9.2 Coating Application Equipment

9.2a The NOBLE Representative or the manufacturer's representative shall approve all paint spray equipment prior to painting.

9.2b A moisture trap shall be placed in-line from air supply to pressure pot and spray gun. This trap shall be opened slightly to provide a continuous bleed.

9.2c Regulators and gauges shall be provided for both the pressure pot and spray gun.

9.2d Dehumidification (DH) equipment shall be provided by the CONTRACTOR and maintained at all times that blasting and painting operations are being conducted inside of tanks, and for a minimum of 48 hours after application of the entire coating system. The DH equipment must be properly sized and operated to maintain a range of 30 to 50% relative humidity in all the compartments of the tank.

9.3 Application Procedures

9.3a All abrasive and dust from blasting operations shall be removed from surfaces before paint application is begun. All tank surfaces shall be vacuum cleaned immediately before application of the first coat of the coating system. If abrasive blasting occurs after application of any part of the coating system, vacuuming shall be conducted again before application of the next coat in the system.

9.3b Blasted surfaces shall be coated with one prime coat during the same day that blasting is completed except where blasted area is kept below 50% relative humidity. The prime coat shall not be applied closer than 6 inches to a non-blasted area and subsequent blasting operations shall not result in abrasive particles becoming embedded in the paint film.

9.3c Spray nozzles must be held perpendicular to the surface being painted, and handled and adjusted in such a manner that dry over spray is kept to a minimum.

9.3d The sequence to be followed in painting shall be such that a minimum of damage to finished coatings will result.

9.4 Environmental Conditions During Application

No painting shall take place when the atmospheric temperature is below 40 ºF, or when the surface temperature is within 3^0C, or 5(^{0}F) of the dew point, unless approved in writing by the NOBLE Representative.

9.5 Ventilation

When paint is being applied to the interior of tanks or confined areas, sufficient blowers and fans shall be installed to prevent physiological affects from the paint on the painters and to facilitate drying. Appropriate heaters and/or dehumidification equipment shall be employed to meet the requirements of the coatings manufacturer's environmental conditions contained in the product data sheet for the product being applied.

9.6 Personnel Breathing Apparatus

The CONTRACTOR shall provide purification systems for breathing air that meets the requirements of NOBLE or OSHA standards, and maintain this equipment in complete working order at all times during a painting project on a NOBLE rig, or in shipyard or fabrication shops doing work on NOBLE rigs and/or equipment.

10.0 COATING SYSTEMS

10.1 General painting scheme

10.1a Coatings will be applied to the Rig as described in Tables 10.1 through 10.14. The NOBLE Representative shall approve all deviations from the listed coatings.

10.1b Upon completion of all work, all areas specified by the Scope of Work (SOW) shall be completely coated to the satisfaction of the NOBLE Representative, with either an existing coating system which is to be protected and touched up by the CONTRACTOR as required; or with a new system applied by the CONTRACTOR as described herein. Any spaces, fittings, attachments or other items not specifically described herein shall be painted in accordance with one of the following described systems to suit the required service and to be compatible with similar or adjoining spaces.

10.2 Metal joiner doors

Metal joiner doors and metal furniture shall have baked enamel finish over rust proof primer, applied at the manufacturer's premises. In addition, joiner doors to wet spaces shall have a 12 in. stainless steel kick plates at bottom on both sides. Maintenance painting of these doors shall require solvent cleaning in accordance with SSPC-SP1 followed by a universal primer that has been applied in a test patch and allowed to cure for 7 days to determine compatibility with the OFE (OEM) coating applied to the doors.

10.3 Machinery and Equipment

When directed by the NOBLE Representative, owner-furnished equipment (OFE) not covered by this standard shall be painted in accordance with either the equipment manufacturer’s (OEM) specifications, or in accordance with a specification to be provided by the NOBLE Representative which shall be suited for the location and service intended. Unless directed otherwise by the NOBLE Representative, CONTRACTOR shall not repaint OFE other than to touch-up areas that are disturbed as a result of conducting the Scope of Work (SOW). When directed by the NOBLE Representative, touch-up and maintenance painting of this equipment shall require chemical cleaning in accordance with section 8.6 of this standard, followed by a universal primer that has been applied in a test patch and allowed to cure for 7 days to determine compatibility with the existing coating.

10.4 Piping

Piping shall be coated in accordance with surrounding area, i.e. white room/white piping, gray structure/gray piping. Color coded tapes shall be applied in accordance with Noble Safety Policy Manual (SPM205) and Noble Safety Markings Program. The CONTRACTOR is responsible for masking-off all color code markings and arrows indicating the direction of flow on all piping that is to be recoated, and removing such masking when all paint work is completed.

10.5 Helideck Markings

Helidecks shall be painted in accordance with the requirements in this standard and NOBLE Engineering for the area in which the rig is operating.

10.6 Coating System Specification

The following tables specify the coating systems that shall be applied to various areas of a jackup rig.

Table 10.1.A – Hull Bottom & Side Shell, Leg Wells, Underside of Heliport & Superstructure, Underside of Pipe Rack Deck, Underside of Drill Floor & Substructure, Skid Base & Cantilever Skid Beams

NOTE: THIS IS THE PREFERRED SYSTEM APPLIED BY PROFESSIONAL OR RIG CREWS

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color, on seams, corners, and edges	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, or White	100 to 150 / 4 to 6
Third Coat	Interseal 670 HS Pearl Gray (#H017), Buff, or Contrasting color to Second Coat	100 to 150 / 4 to 6
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**350 to 550 / 14 to 22**

Table 10.1.AA - Spot Repair of Exterior Surfaces specified in Tables 10.1.A		
Surface Preparation	Same as Table 10.1.A, except surrounding areas with sound paint that are to be coated shall be brush blasted to NACE 4/SSPC-SP7/ISO Sa1.0 using 60-80 mesh abrasive and 40-60 psi pressure at the nozzle. Anchor Pattern of spot blasted areas shall be 50 to 75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, or White	100 to 150 / 4 to 6
Third Coat	Interseal 670 HS Pearl Gray (#H017), Buff, or Contrasting color to Second Coat	100 to 150 / 4 to 6
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**350 to 550 / 14 to 22**

Table 10.1.B – Hull Bottom & Side Shell, Leg Wells, Underside of Heliport & Superstructure, Underside of Pipe Rack Deck, Underside of Drill Floor & Substructure, Skid Base & Cantilever Skid Beams **WHERE TIME OR WEATHER CONDITIONS WARRANT – PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 (#H017) Pearl Grey, Buff or Contrasting color to Surf Gray with stripe coat applied “wet on wet”	500 to 600 / 20 to 24
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**600 to 750 / 24 to 30**

Table 10.1.BB - Spot Repair of Exterior Surfaces specified in Tables 10.1.B		
Surface Preparation	Same as Table 10.1.B, except surrounding areas with sound paint that are to be coated shall be brush blasted to NACE 4/SSPC-SP7/ISO Sa1.0 using 60-80 mesh abrasive and 40-60 psi pressure at the nozzle. Anchor Pattern of spot blasted areas shall be 75 to 200 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Pearl Gray (#H017), Buff or Contrasting color to Surf Gray	375 to 500 / 15 to 20
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR		**475 to 650 / 19 to 26**

Table 10.2 – Topsides Exterior – Bulkheads, Wind Walls & Roof, Generator Building, Life Boat Davits, Crane Pedestal, P-Tanks, Handrails (Black Iron), Stairways, and Piping & Vents **PROFESSONAL CREW OR RIG CREW APPLICATION**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Buff, Red Oxide, or White	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, White	125 to 175 / 5 to 7
Finish Coat	Interfine 979 Color as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Note: Stripe coat applied by brush only**	**275 to 425 / 11 to 17**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.3.A – Decks & Floors, Main Deck, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors - 2 Coat System (High Abrasion Areas) **PREFFERED SYSTEM – PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 505 Gray	375 to 500 / 15 to 20
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, damp climates	100 to 150 / 4 to 6
Total DFTR	**Non-skid additive required on walking areas**	**475 to 650 / 19 to 26**

Table 10.3.B – Decks & Floors, Main Deck, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors - 2 Coat System (High Abrasion Areas) **BEST FOR COLD/DAMP CLIMATES – PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
First Coat	Interzone 954 (#H017) Gray, Buff or Contrasting Color with stripe coat of same applied “wet on wet”	375 to 500 / 15 to 20
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, climates	100 to 150 / 4 to 6
Total DFTR	**Broadcast Non-Skid additive over Interzone 954 on walking areas**	**475 to 650 / 19 to 26**

Table 10.3.C– Decks & Floors, Main Deck, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors **PROFESSIONAL CREW OR RIG CREW APPLICATION**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4 mils
Stripe Coat	Interseal 670HS Contrasting color	50 to 100 / 2 to 4 mils
Second Coat	Interseal 670 HS Gray contrasting color to Surf Gray	150 to 200 /6 to 8 mils
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, climates	100 to 150 / 4 to 6
Total DFTR	**Broadcast Non-Skid additive over Second Coat on walking areas**	**300 to 450 / 12 to 18**

Table 10.4.A – Heliport Deck with Non-Skid (High Abrasion Areas) – Steel "Only" **PREFERRED SYSTEM – PROFESSONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Intergard 251 Red	50 to 100 / 2 to 4
Second Coat	Interzone 505 Grey with Non-Skid Added	400 to 500 / 16 to 20
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Interzone 505 w/non-skid can be applied with a bottom feed pot or broadcast non-skid on wet Interzone 505**	**550 to 750 / 22 to 30**

Table 10.4.B – Heliport Deck with Non-Skid (High Abrasion Areas) – Steel "Only" **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Buff, White, or Oxide Red with stripe coat of same applied "wet on wet"	400 to 500 / 16 to 20
Second Coat	Interzone 954 Green (#L549) or Contrasting Color	250 to 375 / 10 to 15
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into first coat of Interzone 954**	**750 to 1025 / 30 to 41**

Table 10.4.C– Heliport Deck with Non-Skid (High Abrasion Areas) – Aluminum "Only" **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Red, or White w/ stripe coat of same applied wet on wet	100 to 150 /4 to 6 mils
Second Coat	Interseal 670 HS Green (#L549) or Contrasting Color	150 to 200 /6 to 8 mils
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into second coat 670 HS**	**350 to 500 / 14 to 20**

Table 10.4.D – Heliport Deck with Non-Skid (High Abrasion Areas) – Steel & Aluminum **RIG CREW REPAIRS ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Oxide Red, or White	150 to 200 / 6 to 8 mils
Second Coat	Interseal 670 HS Green (#L549) or Contrasting Color	150 to 200 / 6 to 8 mils
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into second coat 670 HS**	**400 to 550 / 16 to 22**

Table 10.5.A – Legs of Jackups and Raw Water Towers **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
First Full Coat	Interseal 670 HS Buff, White, or Oxide Red	250 to 250 / 8 to 10
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS Surf Grey (#F684)	200 to 250 / 8 to 10
Total DFTR	**1. Brush stripe coat required on all critical areas** **2. Back roll pitted areas thinning 10% for better flow into pits**	**400 to 500 / 16 to 20**

Table 10.5.B – Legs of Jackups and Raw Water Towers **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Buff, Red Oxide or White, with stripe coat applied wet on wet	250 to 300 / 10 to 12
Finish Coat	Interzone 954 Surf Gray (# F684)	250 to 300 / 10 to 12
Total DFTR	**Back roll pitted areas thinning 10% for better flow into pits**	**500 to 600 / 20 to 24**

Table 10.6 – Manufacturer's Equipment (OEM) – Crane, Anchor Windlass, Draw Works, Mud Pumps, Choke Manifold, & Traveling Equipment **PROFESSIONAL OR RIG CREW APPLICATION**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 Buff, Red Oxide or White	150 to 200 / 6 to 8
Finish Coat	Interfine 979 Color as per OEM color	100 to 150 / 4 to 6
Total DFTR		**300 to 450 / 12 to 18**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.7- Engine Exhaust Line, Mufflers, and other high temperature lines over 200^0 F		
PROFESSIONAL CREW ONLY		
Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 38-65 μm (1.5 -2.5 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 22	50 to 100 / 2 to 4
Second Coat	Intertherm 875 Black	25 to 40 / 1.0 to 1.6
Finish Coat	Intertherm 875 Black	25 to 40 / 1.0 to 1.6
Total DFTR	**1. Apply a mist coat of 875 over Interzinc 22 to prevent pin holing prior to applying a full coat of Intertherm 875. 2. Intertherm 50 Aluminum may be used where Intertherm 875 is not available or service above 500°F is desired.**	**100to 180 / 4.0 to 7.2**

Table 10.8 - All Galvanized Surfaces (To Be Painted)		
PROFESSIONAL OR RIG CREW APPLICATION		
Surface Preparation	Degrease using International 950 Cleaner (GMA571) or equal making sure to rinse off thoroughly. Do not allow cleaner to dry on surface. Etch surface using a suitable etch primer such as Galvaprep 5 or equal. A light abrasive sweep is permissible in place of "etching" when approved by Noble Management. Low pressure (LP WC) water clean with potable water and Chlor*Rid to achieve a maximum of 20 μg/cm^2 of surface chlorides. Hand or Power Tool Clean (SSPC-SP2/3 or ISO St2/3)	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff or contrasting color, thinned up to 15%	100 to 150 / 4 to 6
Stripe Coat	Interseal 670 HS Black or Contrasting color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 color as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Note: Prime and stripe coats must be applied by brush only, unless spray application approved by Noble Management.**	**200 to 300 / 8 to 12**

Table 10.9.A - Mud Pit Room, Shale Shaker Room, & Sack Storage Room Interior Walls, Overhead, & Piping

Note: New Steel or Steel in Good Condition

PROFESSIONAL OR RIG CREW APPLICATION – PREFERRED SYSTEM

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Primer	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray, or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**300 to 450 / 12 to 18**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.9.B - Mud Pit Room, Shale Shaker Room, & Sack Storage Room Interior Walls, Overhead, & Piping

Note: Must be used when steel is moderately to severely pitted

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Aluminum (preferred), Buff or White	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**400 to 550 / 16 to 22**

Table 10.10.A - Interior Machinery Spaces – Mud Pump Room, Storage Rooms, Shops & Work Rooms, Engine Room – Walls, Overhead & Piping

Note: New Steel or Steel in Good Condition

PREFERRED SYSTEM - PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray or Contrasting Color	125 to 175 / 5 to 7
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**275 to 425 / 11 to 17**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.10.B - Interior Machinery Spaces – Mud Pump Room, Storage Rooms, Shops & Work Rooms, Engine Room –Walls, Overhead & Piping

Note: Must be used when steel is moderately to severely pitted

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670HS Aluminum (Preferred) Buff, Oxide Red	125 to 175 / 5 to 7
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray, Oxide Red (contrast color)	125 to 175 / 5 to 7
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**350 to 500 / 14 to 20**

Table 10.11.A - Mud Pits – Interior Walls, Floor, & Piping

PREFERRED SYSTEM - PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzone 505, with stripe coat applied "wet on wet"	300 to 375 / 12 to 15
Finish Coat	Interzone 505, with stripe coat applied "wet on wet"	300 to 375 / 12 to 15
Total DFTR		**600 to 750 / 24 to 30**

Note: If "white finish" is desired, apply one full coat of Interseal 670HS at 5 – 7 mils. Make sure to follow proper overcoat intervals.

Table 10.11.B Mud Pits – Interior Walls, Floor, & Piping

ALTERNATE SYSTEM - PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Buff, Oxide Red or Contrasting Color	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS White	150 to 200 / 6 to 8
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling is required on moderate and heavily pitted areas. Thin first coat 10% if back rolling is required due to pitting.**	**300 to 400 / 12 to 16**

Table 10.12.A - Internal Surfaces in Ballast, Preload, Drill Water, and Void Tanks Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL OR RIG CREW APPLICATION – PREFERRED SYSTEM

Surface Preparation:	If Eureka, Rustkote, Clearkin, Esgard or Magnakote exists, remove in accordance with requirements of 8.14. Otherwise, clean in accordance with Section 8.6. Abrasive blast all surfaces to Near-White Blast (NACE 2/SSPC-SP10/ISOSa2.5. Anchor pattern (surface profile) should be between 50-75 microns (2 – 3 mils). Maximum surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
First Coat	Interseal 670 HS Buff, Oxide Red, or Contrasting Color	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS – Black or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS - White	150 to 200 / 6 to 8
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling is required on moderate and heavily pitted areas. Thin first coat 10% if back rolling is required due to pitting.**	**300 - 400 / 12 - 16**

Table 10.12.B Internal Surfaces in Ballast, Preload, Drill Water, and Void Tanks Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	If Eureka, Rustkote, Clearkin, Esgard or Magnakote exists, remove in accordance with requirements of 8.14. Otherwise, clean in accordance with Section 8.6. Abrasive blast all surfaces to Near-White Blast (NACE 2/SSPC-SP10/ISOSa2.5. Anchor pattern (surface profile) should be between 75-100 microns (3 – 4 mils). Maximum surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Single Coat	Interzone 954 Off White, with stripe coat applied “wet on wet”	450 to 550 / 18 to 22
Total DFTR	**Note: For use where time, temperature or humidity is a factor. Back rolling is required on moderate and heavily pitted areas. Do not thin this material past required for spraying. See product data sheet.**	**450 - 550 / 18 - 22**

Table 10.13.A Potable Water Tanks – Interior Walls, Tanktop, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interline 850 Gray	100 to 150 / 4 to 6
Stripe Coat	Interline 850 White	50 to 100 / 2 to 4
Finish Coat	Interline 850 White	100 to 150 / 4 to 6
Total DFTR	**Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for maximum thinning limits, recoat interval, and cure time before filling.**	**200 - 300 / 8 - 12**

Note: Where available, Interline 850, Color TLA852 Buff can be substituted for gray to provide better light reflectance .

Table 10.13.B Potable Water Tanks – Interior Walls, Tanktop, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Stripe Coat	Interline 925 Cream	50 to 100 / 2 to 4
Finish Coat	Interline 925 White	375 to 425 / 15 to 17
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for recoat interval, and cure time before filling. "Do not" thin.**	**375 to 425 / 15 to 17**

Table 10.13.C Potable Water Tanks – Interior Walls, Tanktop, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670HS, Buff (EGA093)	125 to 150 / 5 to 6
Stripe Coat	Interseal 670 HS, Black EGA002	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS, White (EGA010)	125 to 150 / 5 to 6
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for maximum thinning limits, recoat interval, and cure time before filling. Only colors above are approved by NSF.**	**250 - 300 / 10 - 12**

Table 10.14 Interior Surfaces of Lube Oil, Dirty/Waste Oil, Oily Water, Base Oil, Hydraulic Oil, Live Oil Tanks, Brine Tanks, and internals of water-based BOP Control System Fluid Tanks

(Steel Tanks Only – Do Not Paint If Tanks Are Stainless Steel)

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.14. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Use 20/40 to 40/80 mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interline 850 Epoxy Phenolic Gray	100 to 150 / 4 to 6
Stripe Coat	Interline 850 Epoxy Phenolic White	50 to 100 / 2 to 4
Finish Coat:	Interline 850 Epoxy Phenolic White	100 to 150 / 4 to 6
Total DFTR	**Note: Stripe coat applied by brush only Contact International Paint prior to application in Hydraulic Oil Tanks to verify compatibility.**	**200 to 300 / 8 to 12**

Note: Where available, Interline 850, Color TLA852 Buff can be substituted for gray to provide better light reflectance .

11.0 Inspection and commissioning

11.1 The CONTRACTOR shall conduct pre-inspections prior to final inspection by NOBLE Representative. The NOBLE Representative shall not be called for inspection until such time as the CONTRACTOR'S inspector has certified that the work meets the requirements of this specification. In addition, the CONTRACTOR shall provide staging and lighting (minimum 20-foot candles for application, 50-foot candles for inspection) to accommodate a safe and thorough inspection.

11.2 All inspections shall be carried out by NACE Certified Coating Inspectors unless approved by the NOBLE Representative before commencement of any work. The approval or rejection of surface preparation shall be based on the written standard specified for each work area. Visual standards may be used for guidance when interpreting the written standard.

11.3 Stages of the surface preparation and coating process that represent logical inspection points include, but are not limited to:

11.3a After cleaning but prior to blasting
11.3b After blasting but before final cleaning
11.3c After final cleaning, but prior to application of the first coat
11.3d During all paint mixing operations
11.3e During application of each coat
11.3f After application of each stripe coat
11.3g After application of each full coat
11.3h After adequate drying time, but prior to application of next coat
11.3i After final cure including holiday inspection of immersion areas

11.4 All newly applied coating systems in immersed areas, whether in tanks, voids, or hull, shall be holiday tested after the final coat is applied. Coatings that have already been immersed shall not be holiday detected (Absorbed water will give false readings). A low voltage detector shall be used for DFT's of 20 mils or less. A high voltage detector set at 100 volts per mil of the coating system shall be used for DFT's of more than 20 mils. All holidays shall be marked with a non-greasy marker and repaired with the same coating system at no charge to NOBLE.

11.5 NOBLE and the CONTRACTOR shall conduct an inspection of the completed painting work prior to final acceptance. The CONTRACTOR shall correct any defective work at no additional cost to NOBLE.

10.0 COATING SYSTEMS

10.1 General painting scheme

10.1a Coatings will be applied to the Rig as described in Tables 10.1 through 10.14. The NOBLE Representative shall approve all deviations from the listed coatings.

10.1b Upon completion of all work, all areas specified by the Scope of Work (SOW) shall be completely coated to the satisfaction of the NOBLE Representative, with either an existing coating system which is to be protected and touched up by the CONTRACTOR as required; or with a new system applied by the CONTRACTOR as described herein. Any spaces, fittings, attachments or other items not specifically described herein shall be painted in accordance with one of the following described systems to suit the required service and to be compatible with similar or adjoining spaces.

10.2 Metal joiner doors

Metal joiner doors and metal furniture shall have baked enamel finish over rust proof primer, applied at the manufacturer's premises. In addition, joiner doors to wet spaces shall have a 12 in. stainless steel kick plates at bottom on both sides. Maintenance painting of these doors shall require solvent cleaning in accordance with SSPC-SP1 followed by a universal primer that has been applied in a test patch and allowed to cure for 7 days to determine compatibility with the OFE (OEM) coating applied to the doors.

10.3 Machinery and Equipment

When directed by the NOBLE Representative, owner-furnished equipment (OFE) not covered by this standard shall be painted in accordance with either the equipment manufacturer’s (OEM) specifications, or in accordance with a specification to be provided by the NOBLE Representative which shall be suited for the location and service intended. Unless directed otherwise by the NOBLE Representative, CONTRACTOR shall not repaint OFE other than to touch-up areas that are disturbed as a result of conducting the Scope of Work (SOW). When directed by the NOBLE Representative, touch-up and maintenance painting of this equipment shall require chemical cleaning in accordance with section 8.6 of this standard, followed by a universal primer that has been applied in a test patch and allowed to cure for 7 days to determine compatibility with the existing coating.

10.4 Piping

Piping shall be coated in accordance with surrounding area, i.e. white room/white piping, gray structure/gray piping. Color coded tapes shall be applied in accordance with Noble Safety Policy Manual (SPM205) and Noble Safety Markings Program. The CONTRACTOR is responsible for masking-off all color code markings and arrows indicating the direction of flow on all piping that is to be recoated, and removing such masking when all paint work is completed.

10.5 Helideck Markings

Helidecks shall be painted in accordance with the requirements in this standard and NOBLE Engineering for the area in which the rig is operating.

10.6 Coating System Specification

The following tables specify the coating systems that shall be applied to various areas of a semi-submersible rig.

Table 10.1.A – Hull Below Waterline

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Buff, Red, or White	200 to 250 / 8 to 10
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS Black	200 to 250 / 8 to 10
Total DFTR	**Note: Back rolling is required on moderate and heavily pitted areas. Thin first coat 10% if back rolling is required due to pitting.**	**400 to 500 / 16 to 20**

Table 10.1.B – Hull Below Waterline **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Buff, Red Oxide or White, with stripe coat applied wet on wet	250 to 300 / 10 to 12
Finish Coat	Interzone 954 Black	250 to 300 / 10 to 12
Total DFTR	**Note: For use where time, temperature or humidity is a factor. Back rolling is required on moderate and heavily pitted areas. Do not thin this material past required for spraying. See product data sheet.**	**500 to 600 / 20 to 24**

Table 10.2.A Hull Side Shell, Columns, Braces, Underside of Main Deck Above Waterline **NOTE: THIS IS THE PREFERRED SYSTEM APPLIED BY PROFESSIONAL OR RIG CREWS**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color, on seams, corners, and edges	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, or White	100 to 150 / 4 to 6
Third Coat	Interseal 670 HS Pearl Gray (#H017), Buff or Contrasting color to Second Coat	100 to 150 / 4 to 6
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**350 to 550 / 14 to 22**

Table 10.2.AA - Spot Repair of Exterior Surfaces specified in Tables 10.2.A		
Surface Preparation	Same as Table 10.2.A, except surrounding areas with sound paint that are to be coated shall be brush blasted to NACE 4/SSPC-SP7/ISO Sa1.0 using 60-80 mesh abrasive and 40-60 psi pressure at the nozzle. Anchor Pattern of spot blasted areas shall be 50 to 75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, or White	100 to 150 / 4 to 6
Third Coat	Interseal 670 HS Pearl Gray (#H017), Buff or Contrasting color to Second Coat	100 to 150 / 4 to 6
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**350 to 550 / 14 to 22**

Table 10.2.B – Hull Side Shell, Columns, Braces, Underside of Main Deck Above Waterline WHERE TIME OR WEATHER CONDITIONS WARRANT – PROFESSIONAL CREW ONLY		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 (#H017) Pearl Gray, Buff or Contrasting color to Surf Gray with stripe coat applied “wet on wet”	500 to 600 / 20 to 24
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**600 to 750 / 24 to 30**

Table 10.2.BB - Spot Repair of Exterior Surfaces specified in Tables 10.2.B		
Surface Preparation	Same as Table 10.2.B, except surrounding areas with sound paint that are to be coated shall be brush blasted to NACE 4/SSPC-SP7/ISO Sa1.0 using 60-80 mesh abrasive and 40-60 psi pressure at the nozzle. Anchor Pattern of spot blasted areas shall be 75 to 200 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Pearl Gray (#H017), Buff or Contrasting color to Surf Gray (F684)	375 to 500 / 15 to 20
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR		**475 to 650 / 19 to 26**

Table 10.3 – Topsides Exterior – Bulkheads, Wind Walls & Roof, Windlass Control Houses, MCC Buildings, Life Boat Davits, Crane Pedestal, P-Tanks Handrails & Stairways (Black Iron), and Piping & Vents **PROFESSONAL CREW OR RIG CREW APPLICATION**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, White, Oxide Red or Grey	125 to 175 / 5 to 7
Finish Coat	Interfine 979 Color as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Note: Stripe coat applied by brush only**	**275 to 425 / 11 to 17**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.4.A – Main Deck, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors - 2 Coat System (High Abrasion Areas) **PREFFERED SYSTEM – PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 505 Gray, with stripe coat applied "wet on wet"	375 to 500 / 15 to 20
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, damp climates	100 to 150 / 4 to 6
Total DFTR	**Broadcast Non-skid additive into Interzone 505 on walking areas**	**475 to 650 / 19 to 26**

Table 10.4.B - Decks & Floors, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors - 2 Coat System (High Abrasion Areas) **BEST FOR COLD/DAMP CLIMATES – PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
First Coat	Interzone 954 (#H017) Gray, Buff or Contrasting Color with stripe coat of same applied "wet on wet"	375 to 650 / 15 to 20 mils
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, climates	100 to 150 / 4 to 6
Total DFTR	**Broadcast Non-Skid additive into Interzone 954 on walking areas**	**475 to 650 / 19 to 26**

Table 10.4.C - Decks & Floors, Main Deck, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors

PROFESSIONAL CREW OR RIG CREW APPLICATION

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4 mils
Stripe Coat	Interseal 670HS Contrasting color	50 to 100 / 2 to 4 mils
Second Coat	Interseal 670 HS Gray contrasting color to Surf Gray	150 to 200 /6 to 8 mils
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, climates	100 to 150 / 4 to 6
Total DFTR	**Broadcast Non-Skid additive into Second Coat of Interseal 670 HS on walking areas**	**300 to 450 / 12 to 18**

Table 10.5.A - Heliport Deck with Non-Skid (High Abrasion Areas) – Steel "Only"

PREFERRED SYSTEM – PROFESSONAL CREW ONLY

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Intergard 251 Red	50 to 100 / 2 to 4
Second Coat	Interzone 505 Grey with Non-Skid Added	400 to 500 / 16 to 20
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Interzone 505 w/non-skid can be applied with bottom feed pot or broadcast non-skid wet on wet Interzone 505.**	**550 to 750 / 22 to 30**

Table 10.5.B – Heliport Deck with Non-Skid (High Abrasion Areas) – Steel "Only" **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Buff, White or Oxide Red	400 to 500 / 16 to 20
Second Coat	Interzone 954 Green (#L549) or Contrasting Color	250 to 375 / 10 to 15
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into first coat of Interzone 954**	**750 to 1025 / 30 to 41**

Table 10.5.C – Heliport Deck with Non-Skid (High Abrasion Areas) – Aluminum "Only" **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Red, or White w/ stripe coat of same applied wet on wet	100 to 150 /4 to 6 mils
Second Coat	Interseal 670 HS Green (#L549) or Contrasting Color	150 to 200 /6 to 8 mils
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into second coat 670 HS**	**350 to 500 / 14 to 20**

Table 10.5.D – Heliport Deck with Non-Skid (High Abrasion Areas) – Steel & Aluminum **RIG CREW REPAIRS ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Oxide Red, or Off White	150 to 200 /6 to 8 mils
Second Coat	Interseal 670 HS Contrasting Color	150 to 200 /6 to 8 mils
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	Broadcast non-skid aggregate into second coat of 670 HS	**400 to 550 / 16 to 22**

Table 10.6 – Manufacturer's Equipment (OEM) – Crane, Anchor Windlass, Draw Works, Mud Pumps, Choke Manifold, & Traveling Equipment **PROFESSIONAL OR RIG CREW APPLICATION**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 Buff, Red Oxide or White	150 to 200 / 6 to 8
Finish Coat	Interfine 979 Color as per OEM color	100 to 150 / 4 to 6
Total DFTR		**300 to 450 / 12 to 18**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.7 - Engine Exhaust Line, Mufflers, and other high temperature lines over 200^0 F **PROFESSIONAL CREW ONLY**		
Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 38-65 μm (1.5-2.5 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzinc 22	50 to 100 / 2 to 4
Second Coat	Intertherm 875 Black	25 to 40 / 1.0 to 1.6
Finish Coat	Intertherm 875 Black	25 to 40 / 1.0 to 1.6
Total DFTR	**1. Apply a mist coat of 875 over Interzinc 22 to prevent pin holing prior to applying a full coat of Intertherm 875.** **2. Intertherm 50 Aluminum may be used where Intertherm 875 is not available or service above 500°F is desired.**	**100 to 180 / 4.0 to 7.2**

Table 10.8 - All Galvanized Surfaces (To Be Painted) **PROFESSIONAL OR RIG CREW APPLICATION**		
Surface Preparation	Degrease using International 950 Cleaner (GMA571) or equal making sure to rinse off thoroughly. Do not allow cleaner to dry on surface. Etch surface using a suitable etch primer such as Galvaprep 5 or equal. A light abrasive sweep is permissible in place of "etching" when approved by Noble Management. Low pressure (LP WC) water clean with potable water and Chlor*Rid to achieve a maximum of 20 μg/cm^2 of surface chlorides. Hand or Power Tool Clean (SSPC-SP2/3 or ISO St2/3)	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff or contrasting color, thinned up to 15%	100 to 150 / 4 to 6
Stripe Coat	Interseal 670 HS Black or Contrasting color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 color as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Note: Prime and stripe coats must be applied by brush only, unless spray application approved by Noble Management.**	**200 to 300 / 8 to 12**

Table 10.9.A - Mud Pit Room, Shale Shaker Room, & Sack Storage Room Interior Walls, Overhead, & Piping

Note: New Steel or Steel in Good Condition

PROFESSIONAL OR RIG CREW APPLICATION – PREFERRED SYSTEM

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Primer	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray, or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**300 to 450 / 12 to 18**

Note: For onshore projects or should availability dictate, Intergard 475 HS can be used in lieu of Interseal 670 HS.

Table 10.9.B - Mud Pit Room, Shale Shaker Room, & Sack Storage Room Interior Walls, Overhead, & Piping

Note: Must be used when steel is moderately to severely pitted

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Aluminum (preferred), Buff, or White	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**400 to 550 / 16 to 22**

Table 10.10.A - Interior Machinery Spaces – Mud Pump Room, Storage Rooms, Shops & Work Rooms, Engine Room – Walls, Overhead & Piping

Note: New Steel or Steel in Good Condition

PREFERRED SYSTEM - PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Black or Contrasting color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray or Contrasting Color	125 to 175 / 5 to 7
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**275 to 425 / 11 to 17**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.10.B - Interior Machinery Spaces – Mud Pump Room, Storage Rooms, Shops & Work Rooms, Engine Room – Walls, Overhead & Piping

Note: Must be used when steel is moderately to severely pitted

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670HS Aluminum (Preferred), Buff, Oxide Red	125 to 175 / 5 to 7
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray, Oxide Red (contrast color)	125 to 175 / 5 to 7
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**350 to 500 / 14 to 20**

Table 10.11.A - Mud Pits – Interior Walls, Floor, & Piping

PREFERRED SYSTEM - PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzone 505, with stripe coat applied "wet on wet"	300 to 375 / 12 to 15
Finish Coat	Interzone 505, with stripe coat applied "wet on wet"	300 to 375 / 12 to 15
Total DFTR		**600 to 675 / 24 to 30**

Note: If "white finish" is desired, apply one full coat of Interseal 670HS at 5 – 7 mils. Make sure to follow proper overcoat intervals.

Table 10.11.B - Mud Pits – Interior Walls, Floor, & Piping

ALTERNATE SYSTEM - PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Buff, White or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS White	150 to 200 / 6 to 8
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling is required on moderate and heavily pitted areas. Thin first coat 10% if back rolling is required due to pitting.**	**300 to 400 / 12 to 16**

Table 10.12.A - Internal Surfaces in Ballast, Preload, Drill Water, and Void Tanks Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL OR RIG CREW APPLICATION – PREFERRED SYSTEM

Surface Preparation:	If Eureka, Rustkote, Clearkin, Esgard or Magnakote exists, remove in accordance with requirements of 8.14. Otherwise, clean in accordance with Section 8.6. Abrasive blast all surfaces to Near-White Blast (NACE 2/SSPC-SP10/ISOSa2.5. Anchor pattern (surface profile) should be between 50-75 microns (2 – 3 mils). Maximum surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
First Coat	Interseal 670 HS – Buff, White or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS – Pearl Grey or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS – White	150 to 200 / 6 to 8
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling is required on moderate and heavily pitted areas. Thin first coat 10% if back rolling is required due to pitting.**	**300 – 400 / 12 – 16**

Table 10.12.B - Internal Surfaces in Ballast, Preload, Drill Water, and Void Tanks Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	If Eureka, Rustkote, Clearkin, Esgard or Magnakote exists, remove in accordance with requirements of 8.14. Otherwise, clean in accordance with Section 8.6. Abrasive blast all surfaces to Near-White Blast (NACE 2/SSPC-SP10/ISOSa2.5. Anchor pattern (surface profile) should be between 75-100 microns (3 – 4 mils). Maximum surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Single Coat	Interzone 954 Off White, with stripe coat applied "wet on wet"	450 to 550 / 18 to 22
Total DFTR	**Note: For use where time, temperature or humidity is a factor. Back rolling is required on moderate and heavily pitted areas. Do not thin this material past required for spraying. See product data sheet.**	**450 to 550 / 18 to 22**

Table 10.13.A - Potable Water Tanks – Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interline 850 Gray	100 to 150 / 4 to 6
Stripe Coat	Interline 850 White	50 to 100 / 2 to 4
Finish Coat	Interline 850 White	100 to 150 / 4 to 6
Total DFTR	**Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for maximum thinning limits, recoat interval, and cure time before filling.**	**200 - 300 / 8 - 12**

Note: Where available, Interline 850, Color TLA852 Buff can be substituted for gray to provide better light reflectance .

Table 10.13.B - Potable Water Tanks – Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Stripe Coat	Interline 925 Cream	50 to 100 / 2 to 4
Finish Coat	Interline 925 White	375 to 425 / 15 to 17
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for recoat interval, and cure time before filling. "Do not" thin.**	**375 to 425 / 15 to 17**

Table 10.13.C - Potable Water Tanks – Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670HS, Buff (EGA093)	125 to 150 / 5 to 6
Stripe Coat	Interseal 670 HS, Black (EGA002)	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS, White (EGA010)	125 to 150 / 5 to 6
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for maximum thinning limits, recoat interval, and cure time before filling. Only colors above are approved by NSF.**	**250 - 300 / 10 - 12**

Table 10.14 - Interior Surfaces of Lube Oil, Dirty/Waste Oil, Oily Water, Base Oil, Hydraulic Oil, Live Oil Tanks, Brine Tanks, and internals of water-based BOP Control System Fluid Tanks

(Steel Tanks Only – Do Not Paint If Tanks Are Stainless Steel)

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.14. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Use 20/40 to 40/80 mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interline 850 Epoxy Phenolic Gray	100 to 150 / 4 to 6
Stripe Coat	Interline 850 Epoxy Phenolic White	50 to 100 / 2 to 4
Finish Coat:	Interline 850 Epoxy Phenolic White	100 to 150 / 4 to 6
Total DFTR	**Stripe coat applied by brush only. Contact International Paint prior to application in Hydraulic Oil Tanks to verify compatibility.**	**200 to 300 / 8 to 12**

Note: Where available, Interline 850, Color TLA852 Buff can be substituted for gray to provide better light reflectance .

Table 10.15.A – Risers (Steel) PROFESSIONAL OR RIG CREW APPLICATION		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Oxide Red, Buff, Contrasting Color	100 to 150 / 4 to 6
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 – 4
Second Coat	Interseal 670 HS Buff, Gray, or Contrasting Color	100 to 150/ 4 to 6
Finish Coat	Interseal 670 HS White	125 to 175 / 5 to 7
Total DFTR	**1. Auxiliary piping should be removed before blasting and painting. If this is not possible for any reason, advise Noble Drilling.** **2. Bolt holes and recessed areas must be brushed in conjunction with each full coat being sprayed in order to get paint into these tightly configured areas.** **3. For heavily pitted steel, first coat should be thinned 10% and back rolled into pits.** **4. With Owner's approval, areas that are power tool cleaned after initial blasting and painting should be cleaned to an SSPC-SP11 (bare metal with appropriate profile per SSPC specification). Otherwise, spot blasting of damaged areas is required.** **5. Make sure to featheredge surrounding intact coating.**	**325 to 475 / 13 to 19**

Table 10.16 – Void Spaces (With and Without Illumination)		
PROFESSIONAL OR RIG CREW APPLICATION		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Oxide Red, Contrasting Color	125 to 175 / 5 to 7
Second Coat	Interseal 670 HS Black or Contrasting Color	125 to 175/ 5 to 7
Finish Coat	Interseal 670 HS White	125 to 175 / 5 to 7
Total DFTR		**375 to 525 / 15 to 21**

Table 10.17 – Pontoon Mud Storage Tanks – Interior Walls, Floor, & Piping		
PREFERRED SYSTEM - PROFESSIONAL CREW ONLY		
Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 505, with stripe coat applied “wet on wet”	300 to 375 / 12 to 15
Finish Coat	Interzone 505, with stripe coat applied “wet on wet”	300 to 375 / 12 to 15
Total DFTR		**600 to 675 / 24 to 30**

11.0 Inspection and commissioning

11.1 The CONTRACTOR shall conduct pre-inspections prior to final inspection by NOBLE Representative. The NOBLE Representative shall not be called for inspection until such time as the CONTRACTOR’s inspector has certified that the work meets the requirements of this specification. In addition, the CONTRACTOR shall provide staging and lighting (minimum 20-foot candles for

application, 50-foot candles for inspection) to accommodate a safe and thorough inspection.

11.2 All inspections shall be carried out by NACE Certified Coating Inspectors unless approved by the NOBLE Representative before commencement of any work. The approval or rejection of surface preparation shall be based on the written standard specified for each work area. Visual standards may be used for guidance when interpreting the written standard.

11.3 Stages of the surface preparation and coating process that represent logical inspection points include, but are not limited to:

11.3a After cleaning but prior to blasting
11.3b After blasting but before final cleaning
11.3c After final cleaning, but prior to application of the first coat
11.3d During all paint mixing operations
11.3e During application of each coat
11.3f After application of each stripe coat
11.3g After application of each full coat
11.3h After adequate drying time, but prior to application of next coat
11.3i After final cure including holiday inspection of immersion areas

11.4 All newly applied coating systems in immersed areas, whether in tanks, voids, or hull, shall be holiday tested after the final coat is applied. Coatings that have already been immersed shall not be holiday detected (Absorbed water will give false readings). A low voltage detector shall be used for DFT's of 20 mils or less. A high voltage detector set at 100 volts per mil of the coating system shall be used for DFT's of more than 20 mils. All holidays shall be marked with a non-greasy marker and repaired with the same coating system at no charge to NOBLE.

11.5 NOBLE and the CONTRACTOR shall conduct an inspection of the completed painting work prior to final acceptance. The CONTRACTOR shall correct any defective work at no additional cost to NOBLE.

10.0 COATING SYSTEMS

10.1 General painting scheme

10.1a Coatings will be applied to the Rig as described in Tables 10.1 through 10.14. The NOBLE Representative shall approve all deviations from the listed coatings.

10.1b Upon completion of all work, all areas specified by the Scope of Work (SOW) shall be completely coated to the satisfaction of the NOBLE Representative, with either an existing coating system which is to be protected and touched up by the CONTRACTOR as required; or with a new system applied by the CONTRACTOR as described herein. Any spaces, fittings, attachments or other items not specifically described herein shall be painted in accordance with one of the following described systems to suit the required service and to be compatible with similar or adjoining spaces.

10.2 Metal joiner doors

Metal joiner doors and metal furniture shall have baked enamel finish over rust proof primer, applied at the manufacturer's premises. In addition, joiner doors to wet spaces shall have a 12 in. stainless steel kick plates at bottom on both sides. Maintenance painting of these doors shall require solvent cleaning in accordance with SSPC-SP1 followed by a universal primer that has been applied in a test patch and allowed to cure for 7 days to determine compatibility with the OFE (OEM) coating applied to the doors.

10.3 Machinery and Equipment

When directed by the NOBLE Representative, owner-furnished equipment (OFE) not covered by this standard shall be painted in accordance with either the equipment manufacturer’s (OEM) specifications, or in accordance with a specification to be provided by the NOBLE Representative which shall be suited for the location and service intended. Unless directed otherwise by the NOBLE Representative, CONTRACTOR shall not repaint OFE other than to touch-up areas that are disturbed as a result of conducting the Scope of Work (SOW). When directed by the NOBLE Representative, touch-up and maintenance painting of this equipment shall require chemical cleaning in accordance with section 8.6 of this standard, followed by a universal primer that has been applied in a test patch and allowed to cure for 7 days to determine compatibility with the existing coating.

10.4 Piping

Piping shall be coated in accordance with surrounding area, i.e. white room/white piping, gray structure/gray piping. Color coded tapes shall be applied in accordance with Noble Safety Policy Manual (SPM205) and Noble Safety Markings Program. The CONTRACTOR is responsible for masking-off all color code markings and arrows indicating the direction of flow on all piping that is to be recoated, and removing such masking when all paint work is completed.

10.5 Helideck Markings

Helidecks shall be painted in accordance with the requirements in this standard and NOBLE Engineering for the area in which the rig is operating.

10.6 Coating System Specification

The following tables specify the coating systems that shall be applied to various areas of a jackup rig.

Table 10.1.A – Hull – Keel to Deep Load Line

PROFESSIONAL CREW ONLY – DRYDOCK APPLICATION

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
First Coat	Intertuf 262 Oxide Red	125 to 175 / 5 to 7
Stripe Coat	Intergard 263 or Intergard 267 Buff	50 to 100 / 2 to 4
Second Coat	Intergard 263 or Intergard 267 Lt. Gray	100 to 150 / 4 to 6
Third Coat	Intersmooth 360 Dark Red	75 to 125 / 3 to 5
Fourth Coat	Intersmooth 360 Dark Brown	75 to 125 / 3 to 5
Finish Coat	Intersmooth 360 Dark Red	75 to 125 / 3 to 5
Total DFTR		**450 to 700 / 18 to 28**

Table 10.2.A Hull Side Shell – Deep Load Line to Rail

NOTE: THIS IS THE PREFERRED SYSTEM APPLIED BY PROFESSIONAL OR RIG CREWS

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color, on seams, corners, and edges	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, or White	100 to 150 / 4 to 6
Third Coat	Interseal 670 HS Pearl Gray (#H017), Buff or Contrasting color to Second Coat	100 to 150 / 4 to 6
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**350 to 550 / 14 to 22**

Table 10.2.AA - Spot Repair of Exterior Surfaces specified in Tables 10.2.A

Surface Preparation	Same as Table 10.1.A, except surrounding areas with sound paint that are to be coated shall be brush blasted to NACE 4/SSPC-SP7/ISO Sa1.0 using 60-80 mesh abrasive and 40-60 psi pressure at the nozzle. Anchor Pattern of spot blasted areas shall be 50 to 75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, or White	100 to 150 / 4 to 6
Third Coat	Interseal 670 HS Pearl Gray (#H017), Buff, or Contrasting color to Second Coat	100 to 150 / 4 to 6
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**350 to 550 / 14 to 22**

Table 10.2.B – Hull Side Shell - Deep Load Line to Rail **WHERE TIME OR WEATHER CONDITIONS WARRANT – PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 (#H017) Pearl Gray, Buff or contrasting color to Surf Gray with stripe coat applied "wet on wet"	500 to 600 / 20 to 24
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR	**NOTE: If caulking required by Noble, use Intergard 821 or Intergard 822**	**600 to 750 / 24 to 30**

Table 10.2.BB - Spot Repair of Exterior Surfaces specified in Tables 10.2.A		
Surface Preparation	Same as Table 10.2.A, except surrounding areas with sound paint that are to be coated shall be brush blasted to NACE 4/SSPC-SP7/ISO Sa1.0 using 60-80 mesh abrasive and 40-60 psi pressure at the nozzle. Anchor Pattern of spot blasted areas shall be 75 to 200 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Pearl Gray (#H017), Buff or Contrasting color	375 to 500 / 15 to 20
Finish Coat	Interfine 979 Surf Gray (#F684)	100 to 150 / 4 to 6
Total DFTR		**475 to 650 / 19 to 26**

Table 10.3 – Topsides Exterior – Bulkheads, Wind Walls & Roof, Windlass Control Houses, MCC Buildings, Life Boat Davits, Crane & Pedestal, Handrails, (Black Iron), Drawworks, Mud Pumps, Stairways, Piping & Vents, & P-Tanks

PROFESSONAL CREW OR RIG CREW APPLICATION

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Red Oxide, White	125 to 175 / 5 to 7
Finish Coat	Interfine 979 Color as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Note: Stripe coat applied by brush only**	**275 to 425 / 11 to 17**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.4.A – Main Deck, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors - 2 Coat System (High Abrasion Areas)

PREFFERED SYSTEM – PROFESSIONAL CREW ONLY

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzone 505 Gray , with stripe coat of same applied “wet on wet”	375 to 500 / 15 to 20
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, damp climates	100 to 150 / 4 to 6
Total DFTR	**Non-skid additive required over 505 on walking areas**	**475 to 650 / 19 to 26**

Table 10.4.B – Decks & Floors, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors - 2 Coat System (High Abrasion Areas)

BEST FOR COLD/DAMP CLIMATES – PROFESSIONAL CREW ONLY

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
First Coat	Interzone 954 (#H017) Gray, Buff or Contrasting with stripe coat of same applied "wet on wet"	375 to 500 / 15 to 20 mils
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, climates	100 to 150 / 4 to 6
Total DFTR	**Non-Skid additive required over 954 on walking areas**	**475 to 650 / 19 to 26**

Table 10.4.C – Decks & Floors, Main Deck, Pipe Rack Deck, Quarters Decks, Drill Floor, & Interior Machinery Space Floors

PROFESSIONAL CREW OR RIG CREW APPLICATION

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4 mils
Stripe Coat	Interseal 670HS Contrasting color	50 to 100 / 2 to 4 mils
Second Coat	Interseal 670 HS (#H017) Pearl Gray, Buff or Contrasting color to Surf Gray	150 to 200 /6 to 8 mils
Finish Coat	Interfine 979 Surf Gray (#F684) Intergard 740 may be substituted in cold, climates	100 to 150 / 4 to 6
Total DFTR	**Non-Skid additive required on walking areas**	**300 to 450 / 12 to 18**

Table 10.5.A – Heliport Deck with Non-Skid (High Abrasion Areas) – Steel "Only" **PREFERRED SYSTEM – PROFESSONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Intergard 251 Red	50 to 100 / 2 to 4
Second Coat	Interzone 505 Grey with Non-Skid Added	400 to 500 / 16 to 20
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Interzone 505 w/non-skid can be applied with a bottom feed pot or broadcast non-skid on wet Interzone 505.**	**550 to 750 / 22 to 30**

Table 10.5.B– Heliport Deck with Non-Skid (High Abrasion Areas) – Steel "Only" **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 954 Buff, White, or Oxide Red with stripe coat of same applied "wet on wet"	400 to 500 / 16 to 20
Second Coat	Interzone 954 (#L549) Green or Contrasting Color	250 to 375 / 10 to 15
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into First Coat of 954**	**750 to 1025 / 30 to 41**

Table 10.5.C – Heliport Deck with Non-Skid (High Abrasion Areas) – Aluminum "Only" **PROFESSIONAL CREW ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Red, or White w/ stripe coat of same applied wet on wet	100 to 150 /4 to 6 mils
Second Coat	Interseal 670 HS Green (#L549) or Contrasting Color	150 to 200 /6 to 8 mils
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into second coat 670 HS**	**350 to 500 / 14 to 20**

Table 10.5.D – Heliport Deck with Non-Skid (High Abrasion Areas) – Steel & Aluminum **RIG CREW REPAIRS ONLY**		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Oxide Red, or White	150 to 200 / 6 to 8 mils
Second Coat	Interseal 670 HS (#L549) Green or Contrasting Color	150 to 200 / 6 to 8 mils
Finish Coat	Interfine 979 Color per Helideck Markings as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Broadcast non-skid aggregate into first coat of 670 HS**	**400 to 550 / 16 to 22**

Table 10.6 – Manufacturer's Equipment (OEM) – Crane, Anchor Windlass, Draw Works, Mud Pumps, Choke Manifold, & Traveling Equipment

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 Buff, Red Oxide or White	150 to 200 / 6 to 8
Finish Coat	Interfine 979 Color as per OEM color	100 to 150 / 4 to 6
Total DFTR		**300 to 450 / 12 to 18**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.7 Engine Exhaust Line, Mufflers, and other high temperature lines over 200^0 F

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 38-65 μm (1.5 – 2.5 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 22	50 to 100 / 2 to 4
Second Coat	Intertherm 875 Black	25 to 40 / 1.0 to 1.6
Finish Coat	Intertherm 875 Black	25 to 40 / 1.0 to 1.6
Total DFTR	**1. Apply a mist coat of 875 over Interzinc 22 to prevent pin holing prior to applying a full coat of Intertherm 875. 2. Intertherm 50 Aluminum may be used where Intertherm 875 is not available or service above 500°F is desired.**	**100 to 180 / 4.0 to 7.2**

Table 10.8 - All Galvanized Surfaces (To Be Painted)

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation	Degrease using International 950 Cleaner (GMA571) or equal making sure to rinse off thoroughly. Do not allow cleaner to dry on surface. Etch surface using a suitable etch primer such as Galvaprep 5 or equal. A light abrasive sweep is permissible in place of "etching" when approved by Noble Management. Low pressure (LP WC) water clean with potable water and Chlor*Rid to achieve a maximum of 20 μg/cm^2 of surface chlorides. Hand or Power Tool Clean (SSPC-SP2/3 or ISO St2/3)

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Buff or contrasting color, thinned up to 15%	100 to 150 / 4 to 6
Stripe Coat	Interseal 670 HS Black or Contrasting color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 color as designated in Appendix E	100 to 150 / 4 to 6
Total DFTR	**Note: Prime and stripe coats must be applied by brush only, unless spray application approved by Noble Management**	**200 to 300 / 8 to 12**

Table 10.9.A Mud Pit Room, Shale Shaker Room, & Sack Storage Room Interior Walls, Overhead, & Piping

Note: New Steel or Steel in Good Condition

PROFESSIONAL OR RIG CREW APPLICATION – PREFERRED SYSTEM

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Primer	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**300 to 450 / 12 to 18**

NOTE: For onshore projects, Intergard 475HS can be used in lieu of Interseal 670 HS with Noble Management approval.

Table 10.9.B - Mud Pit Room, Shale Shaker Room, & Sack Storage Room Interior Walls, Overhead, & Piping

Note: Must be used when steel is moderately to severely pitted

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Aluminum (preferred), Buff or White	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray or Oxide Red	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**400 to 550 / 16 to 22**

Table 10.10.A - Interior Machinery Spaces – Mud Pump Room, Storage Rooms, Shops & Work Rooms, Engine Room – Walls, Overhead & Piping

Note: New Steel or Steel in Good Condition

PREFERRED SYSTEM - PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzinc 52 Green	50 to 100 / 2 to 4
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray or Contrasting Color	125 to 175 / 5 to 7
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**275 to 425 / 11 to 17**

Note: For onshore projects or should availability dictate, Intergard 475 HS can be used in lieu of Interseal 670 HS.

Table 10.10.B - Interior Machinery Spaces – Mud Pump Room, Storage Rooms, Shops & Work Rooms, Engine Room – Walls, Overhead & Piping

Note: Must be used when steel is moderately to severely pitted

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.5.1, then abrasive to Near White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 20 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670HS Aluminum (Preferred), Buff, Oxide Red	125 to 175 / 5 to 7
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Second Coat	Interseal 670 HS Buff, Gray, Oxide Red (contrast color)	125 to 175 / 5 to 7
Finish Coat	Interfine 979 White	100 to 150 / 4 to 6
Total DFTR		**350 to 500 / 14 to 20**

Table 10.11.A - Mud Pits – Interior Walls, Floor, & Piping

PREFERRED SYSTEM - PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interzone 505, with stripe coat applied “wet on wet”	300 to 375 / 12 to 15
Prime Coat	Interzone 505. with stripe coat applied “wet on wet:	300 to 375 / 12 to 15
Total DFTR		**600 to 750 / 24 to 30**

Note: If “white finish” is desired, apply one full coat of Interseal 670HS at 5 – 7 mils. Make sure to follow proper overcoat intervals.

Table 10.11.B Mud Pits – Interior Walls, Floor, & Piping

ALTERNATE SYSTEM - PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670 HS Buff, Oxide Red or Contrasting Color	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS White	150 to 200 / 6 to 8
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling is required on moderate and heavily pitted areas. Thin first coat 10% if back rolling is required due to pitting.**	**300 to 400 / 12 to 16**

Table 10.12.A - Internal Surfaces in Ballast, Preload, Drill Water, and Void Tanks Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL OR RIG CREW APPLICATION – PREFERRED SYSTEM

Surface Preparation:	If Eureka, Rustkote, Clearkin, Esgard or Magnakote exists, remove in accordance with requirements of 8.14. Otherwise, clean in accordance with Section 8.6. Abrasive blast all surfaces to Near-White Blast (NACE 2/SSPC-SP10/ISOSa2.5. Anchor pattern (surface profile) should be between 50-75 microns (2 – 3 mils). Maximum surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
First Coat	Interseal 670 HS Buff, Oxide Red or Contrasting Color	150 to 200 / 6 to 8
Stripe Coat	Interseal 670 HS – Black or Contrasting Color	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS - White	150 to 200 / 6 to 8
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling is required on moderate and heavily pitted areas. Thin first coat 10% if back rolling is required due to pitting.**	**300 - 400 / 12 - 16**

Table 10.12.B - Internal Surfaces in Ballast, Preload, Drill Water, and Void Tanks Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	If Eureka, Rustkote, Clearkin, Esgard or Magnakote exists, remove in accordance with requirements of 8.14. Otherwise, clean in accordance with Section 8.6. Abrasive blast all surfaces to Near-White Blast (NACE 2/SSPC-SP10/ISOSa2.5. Anchor pattern (surface profile) should be between 75-100 microns (3 – 4 mils). Maximum surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Single Coat	Interzone 954 Off White, with stripe coat applied "wet on wet"	450 to 550 / 18 to 22
Total DFTR	**Note: For use where time, temperature or humidity is a factor. Back rolling is required on moderate and heavily pitted areas. Do not thin this material past required for spraying. See product data sheet.**	**450 - 550 / 18 - 22**

Table 10.13.A - Potable Water Tanks – Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interline 850 Gray	100 to 150 / 4 to 6
Stripe Coat	Interline 850 White	50 to 100 / 2 to 4
Finish Coat	Interline 850 White	100 to 150 / 4 to 6
Total DFTR	**Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for maximum thinning limits, recoat interval, and cure time before filling.**	**200 - 300 / 8 - 12**

Note: Where available, Interline 850, Color TLA852 Buff can be substituted for gray to provide better light reflectance .

Table 10.13.B - Potable Water Tanks – Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Stripe Coat	Interline 925 Cream	50 to 100 / 2 to 4
Finish Coat	Interline 925 White	375 to 425 / 15 to 17
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for recoat interval, and cure time before filling. "Do not" thin.**	**375 to 425 / 15 to 17**

Table 10.13.C Potable Water Tanks – Interior Walls, Tank-top, Overhead, & Piping

PROFESSIONAL CREW ONLY

Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Use 20/40 to 40/80-mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interseal 670HS, Buff (EGA093)	125 to 150 / 5 to 6
Stripe Coat	Interseal 670 HS, Black (EGA002)	50 to 100 / 2 to 4
Finish Coat	Interseal 670 HS, White (EGA010)	125 to 150 / 5 to 6
Total DFTR	**Note: Stripe coat applied by brush only. Back rolling of moderate and heavily pitted areas required. Contact International Paint for maximum thinning limits, recoat interval, and cure time before filling. Only colors above are approved by NSF**	**250 - 300 / 10 - 12**

Table 10.14 - Interior Surfaces of Lube Oil, Dirty/Waste Oil, Oily Water, Base Oil, Hydraulic Oil, Live Oil Tanks, Brine Tanks, and internals of water-based BOP Control System Fluid Tanks

(Steel Tanks Only – Do Not Paint If Tanks Are Stainless Steel)

PROFESSIONAL OR RIG CREW APPLICATION

Surface Preparation:	Clean in accordance with Section 8.14. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5) Use 20/40 to 40/80 mesh abrasive. Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.

Coating	Type	Thickness μm/mils
Prime Coat	Interline 850 Epoxy Phenolic Gray	100 to 150 / 4 to 6
Stripe Coat	Interline 850 Epoxy Phenolic White	50 to 100 / 2 to 4
Finish Coat:	Interline 850 Epoxy Phenolic White	100 to 150 / 4 to 6
Total DFTR	**Note: Stripe coat applied by brush only. Contact International Paint prior to application in Hydraulic Oil Tanks to verify compatibility.**	**200 to 300 / 8 to 12**

Note: Where available, Interline 850, Color TLA852 Buff can be substituted for gray to provide better light reflectance.

Table 10.15.A – Risers (Steel) PROFESSIONAL OR RIG CREW APPLICATION		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 $\mu g/cm^2$ or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Oxide Red, Buff, Contrasting Color	100 to 150 / 4 to 6
Stripe Coat	Interseal 670 HS Black or Contrasting Color	50 to 100 / 2 – 4
Second Coat	Interseal 670 HS Buff, Gray, or Contrasting Color	100 to 150/ 4 to 6
Finish Coat	Interseal 670 HS White	125 to 175 / 5 to 7
Total DFTR	**1. Auxiliary piping should be removed before blasting and painting. If this is not possible for any reason, advise Noble Drilling.** **2. Bolt holes and recessed areas must be brushed in conjunction with each full coat being sprayed in order to get paint into these tightly configured areas.** **3. For heavily pitted steel, first coat should be thinned 10% and back rolled into pits.** **4. With Owner's approval, areas that are power tool cleaned after initial blasting and painting should be cleaned to an SSPC-SP11 (bare metal with appropriate profile per SSPC specification), otherwise, spot blasting of damaged areas is required.** **5. Make sure to featheredge surrounding intact coating.**	**325 to 475 / 13 to 19**

Table 10.16 – Void Spaces (With and Without Illumination)		
PROFESSIONAL OR RIG CREW APPLICATION		
Surface Preparation	Clean in accordance with Section 8.6, then abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 50-75 μm (2-3 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interseal 670 HS Buff, Oxide Red, Contrasting Color	125 to 175 / 5 to 7
Second Coat	Interseal 670 HS Black or Contrasting Color	125 to 175/ 5 to 7
Finish Coat	Interseal 670 HS White	125 to 175 / 5 to 7
Total DFTR		**375 to 525 / 15 to 21**

Table 10.17 – Pontoon Mud Storage Tanks – Interior Walls, Floor, & Piping		
PREFERRED SYSTEM - PROFESSIONAL CREW ONLY		
Surface Preparation:	Clean in accordance with Section 8.6. Abrasive blast to Near-White Metal (NACE 2 / SSPC-SP10 / ISOSa2.5). Anchor pattern (surface profile) shall be between 75-100 μm (3-4 mils). Surface chloride content must be 5 μg/cm^2 or less immediately prior to painting.	
Coating	**Type**	**Thickness μm/mils**
Prime Coat	Interzone 505, with stripe coat applied “wet on wet”	300 to 375 / 12 to 15
Prime Coat	Interzone 505. with stripe coat applied “wet on wet:	300 to 375 / 12 to 15
Total DFTR		**600 to 750 / 24 to 30**

11.0 Inspection and commissioning

11.1 The CONTRACTOR shall conduct pre-inspections prior to final inspection by NOBLE Representative. The NOBLE Representative shall not be called for inspection until such time as the CONTRACTOR’S inspector has certified that the work meets the requirements of this specification. In addition, the CONTRACTOR shall provide staging and lighting (minimum 20-foot candles for application, 50-foot candles for inspection) to accommodate a safe and thorough inspection.

11.2 All inspections shall be carried out by NACE Certified Coating Inspectors unless approved by the NOBLE Representative before commencement of any work. The approval or rejection of surface preparation shall be based on the written standard specified for each work area. Visual standards may be used for guidance when interpreting the written standard.

11.3 Stages of the surface preparation and coating process that represent logical inspection points include, but are not limited to:

11.3a After cleaning but prior to blasting
11.3b After blasting but before final cleaning
11.3c After final cleaning, but prior to application of the first coat
11.3d During all paint mixing operations
11.3e During application of each coat
11.3f After application of each stripe coat
11.3g After application of each full coat
11.3h After adequate drying time, but prior to application of next coat
11.3i After final cure including holiday inspection of immersion areas

11.4 All newly applied coating systems in immersed areas, whether in tanks, voids, or hull, shall be holiday tested after the final coat is applied. Coatings that have already been immersed shall not be holiday detected (Absorbed water will give false readings). A low voltage detector shall be used for DFT's of 20 mils or less. A high voltage detector set at 100 volts per mil of the coating system shall be used for DFT's of more than 20 mils. All holidays shall be marked with a non-greasy marker and repaired with the same coating system at no charge to NOBLE.

11.5 NOBLE and the CONTRACTOR shall conduct an inspection of the completed painting work prior to final acceptance. The CONTRACTOR shall correct any defective work at no additional cost to NOBLE.

*APPENDIX **A** - COATINGS CROSS REFERENCE – NEW CONSTRUCTION & MAJOR REPAIRS*

TYPE OF SERVICE	GENERIC TYPE	International (Volume solids %)	Alternate Coating if Approved in Accordance With Section 7.1
Pre-blasted steel	Pre-construction Zinc Primer (1)	Interplate 937 (25)	
High Temp. over 200 Deg. F **ONLY**	Inorganic Zinc Primer (2)	Interzinc 22 (63)	
	Modified Silicone Finish Coat	Intertherm 875 (45) or Intertherm 50	
Repair Primers	Zinc Rich Epoxy (3)	Interzinc 52 (59)	
	Rapid Recoat Zinc Rich Epoxy (4)	Interzinc 315 (69)	
	Rapid Recoat Epoxy Primer (4)	Intercure 200 (67)	
Extended Recoat Epoxy Primer	Epoxy Primer (7)	Intergard 269 (47)	
Intermediate Coat Epoxy	Extended Recoat Epoxy	Intergard 475HS (80)	
Multi-Purpose, Surface Tolerant Epoxy for Tank internals, Hulls, Decks, and all other structures	Barrier Epoxy (Cure above 40^0F) (6)	Interseal 670HS (82)	
	Barrier Epoxy (Cure below 40^0F) (6)	Interseal 670HS with Low Temp. Cure (82)	
Finish Coats (8)	Epoxy High Gloss Finish	Intergard 740 (52)	
	Polysiloxane	Interfine 979 (76)	
	Epoxy Acrylic Finish	Interfine 629HS (65)	
High Build Abrasion Resistant Epoxy	High Build - High Solids Epoxy (5)	Interzone 954 (85)	
	High Build Glass Flake Epoxy (5)	Interzone 505 (90)	
Non-Skid Additives	Crushed Flint/Alum. Oxide, etc.	International Non-Slip Additive	
Mud Pits and Flow Lines (9)	Glass Flake Epoxy	Interzone 505 (90)	
Tank Lining Caulking (10)	Epoxy Filler Putty	Intergard 821 or 822 USA (100)	
Brine, Base Oil, and Mud Chemicals other than Acids	Epoxy Phenolic Tank Lining	Interline 850 (76)	
Potable Water Epoxy (11)	High Solids Epoxy	Interseal 670HS NSF colors only (82) (Where Available)	
	Solvent Free Epoxy	Interline 925 (100)	
	High Solids Epoxy Phenolic	Interline 850 (76)	
Anti-fouling Coatings (12)	Epoxy Tie Coat	Intergard 263 (57)	
	Ablative Self Polishing	Intersmooth 360/365 (40)	
Biodegradable Cleaner	Oil and Grease Remover	International 950	

Footnotes to Appendix A:

(1) This product is used strictly as a pre-construction primer used on steel plates and shapes before structural fabrication begins. It does an excellent job at resisting burn-back from hotwork, and minimizes corrosion to pre-fabricated steel modules until such time as the coating system can be applied. When used on surfaces that will be exposed to immersion service, such as jackup preload tanks, drill water, salt water ballast, hull

plating below the deep load line, or any oil tanks, the surface must be cleaned with International 950 cleaner, rinsed, and sweep-blasted after all hot work and testing is completed, and prior to the application of any coating system. Sweep-blasting prior to the application of other coatings onto the pre-fabricated modules is not required on surfaces that will not subject to immersion service. If this product cannot be used in this manner, then it should not be used. **If it is NOT used**, then blasting and painting should be done after fabrication of the module is completed. Whether this products is used or not, the module must have at least one coat of epoxy that is specified applied to full DFT, with all seams and butts taped back 4 inches to allow hot work to be done before the module is erected in its final location.

(2) To be used for high temperature (200^0F [93^0C] or above) service ONLY.

(3) NOT FOR IMMERSION SERVICE! Use only in cases where a primer is needed to hold an area for an extended amount of time. Otherwise, Interseal 670 HS should be used as the primer coat.

(4) NOT FOR IMMERSION SERVICE! Use only when a fast cure primer is required in order to allow over-coating in the shortest amount of time.

(5) Both Interzone 954 and 505 can be used for high traffic decks and other areas where abrasion resistance is needed. In this application, both the 505 and 954 should be applied in two (2) coats at the specified DFT. The 505 is superior to the 954 in abrasion resistance, as well as chemical resistance. However, 954 can and should be used in place of the 505 when environmental conditions are such that ambient temperatures never rise above the minimum of 5 degrees above the dew point as is required to apply the 505, and heating and/or dehumidification equipment is not available to achieve these conditions. 954 can also be used in place of Interseal 670 HS in situations when time is allowed for only one coat of paint to be applied. In this case, one 16 mil coat of 954 can be applied instead of two 8 mil coats of 670 HS. With either the 954 or 505, abrasion resistance can be improved by broadcasting aluminum oxide aggregate (either 16 or 24 grit size), over the first coat of paint immediately after application. To achieve a non-skid surface, or when it is undesirable to have the dark specks of aluminum oxide visible as the coating wears down, broadcast GMA 132 crushed flint instead. The 505 is only available in gray, while the 954 is available in standard colors. Both products can be, and it is strongly recommended that they be over-coated with Interfine 979 or Interfine 629, or Intergard 740 to protect them from UV deterioration.

(6) Interseal 670 HS is the primary all-purpose epoxy coating to be used in most all areas of the rig. It is surface tolerant, easy to apply, has reasonable pot life and overcoat time, is VOC compliant in all countries, and can be used for both immersion and non-immersion service. In addition, where a primer is needed on pitted surfaces or where tight corners need to be penetrated, and for applications over galvanized surfaces, 670 HS can be thinned up to 15% by volume to increase the wetting properties of the coating.

*APPENDIX **A** - COATINGS CROSS REFERENCE – NEW CONSTRUCTION & MAJOR REPAIRS*

(7) Intergard 269 is an epoxy primer that has an extended overcoat time that exceeds that of Interseal 670 HS and other epoxies specified herein for use in situations where an extended amount of time (usually months) is needed before the specified epoxy coating system can be applied. This product is not VOC compliant in the U.S.A.

(8) The finish coat of choice is Interline 979 due to its high gloss and color retention, as well as chemical resistance. However, a modified acrylic epoxy such as Interfine 629HS or Glossy Epoxy Intergard 740 may be used. **Under no circumstances shall any alkyd enamels or chlorinated rubber type finish coatings be used except for engines as per specific color of the manufacturer..**

(9) Coatings for mud pits and flow lines requires both chemical and abrasion resistance that the Interzone 505 satisfies. However, this coating requires a near white blast surface for application. If a situation presents itself whereas only a commercial blast surface can be achieved, use of Interseal 670 HS may be used, except one additional coat will be required.

(10) Epoxy filler putty is used to fill-in between skip-welds and other crevices that cannot be sealed with a coat of paint. International 821 or 822 is more commonly known as “Red Hand”, and can be troweled or injected into crevices with a caulking gun.

(11) All of these products are NSF approved for coating potable water tanks in limited colors.

(12) All of the products listed contain no tributyl tin (TBT) compounds. There is an IMO protocol being developed as of the writing of this standard that bans the application of TBT anti-fouling coatings, but the protocol has not been signed by all of the required countries to establish it as international law. The tie coat specified must be applied to existing anti-fouling coatings before the anti-fouling coating specified can be applied.

*APPENDIX **B** - COATINGS ESTIMATE SHEET*

Based on 25% Application Loss Factor

Product Name	Coat Type	Sq. Ft. Area	Sq. Ft. Coverage	Gal. Per Coat	# of Coats	# of Gallons	Cost per Gallon	Total Cost
Interplate 937	PCP Zinc Primer		375 @ 0.8 mils					
Interzinc 22	Full coat		253 @ 3 mils					
Intertherm 875	Full Coat		540 @ 1 mil					
Interzinc 52	Full Coat		236 @ 3 mils					
Interzinc 315	Full Coat		277 @ 3 mils					
Intercure 200	Full Coat		269 @ 3 mils					
Intergard 269	Full Coat		188 @ 1.5 mils					
Intergard 475HS	Full Coat		160 @ 6 mils					
Interseal 670 HS	Full Coat		165 @ 6 mils					
Intergard 740 (1)	Full Coat		156 @ 3 mils					
Interfine 979 (1)	Full Coat		183 @ 5 mils					
Interfine 629 (1)	Full coat (2)		260 @ 3 mils					
Interzone 954	Full Coat		102 @ 10 mils					
Interzone 505	Full coat		135 @ 8 mils					
Interline 925	Full Coat		240 @ 5 mils					
Interline 850	Full Coat		183 @ 6 mils					
Intergard 263	Full Coat		228 @ 3 mils					
Intersmooth 360/365	Full Coat		96 @ 5 mils					

Footnotes to Coating Estimate Calculation Sheet for Jackups:

(1) Neither Interfine 979, Intergard 740, nor Interfine 629HS may be applied to surfaces exposed to continuous immersion service.

(2) In some geographical areas of rig operation, local laws may require “candy striping” the bow leg in alternate red and white colors of each “round” of leg section for the upper one third of the jacking leg.

(3) Finish Coat colors are specified in NOBLE Color Standard as shown in Appendix E.

APPENDIX C - COATINGS APPROVAL PROCEDURE

Technical steps required for approval of new coating brands or products are as Follows:

Technical Hurdle

All paint manufacturers have to show us that their products have passed the test listed in the table below. Such tests shall be verified by independent third party agency appointed by NOBLE.

NACE TG 260 Proposed Standard for Offshore Platform Atmospheric Maintenance Coatings, as modified below:

Test Method	Test Summary	Recommended Acceptance Criteria
Rust Creepage	Prohesion/QUV, Modified ASTM D4895, 20 weeks	< 5 mm for non-zinc primed coating system
		< 3 mm for inorganic and organic zinc primed surface
Residual Salt Resistance	Prohesion/QUV, Modified ASTM D4895, 20 weeks	< 5 mm for non-zinc primed coating system
		< 3 mm for inorganic and organic zinc primed surface
Thermal Cycling Resistance	Temperature Cycling between $+60^0$C (140^0F) and – 30^0C (22^0F) for 3 weeks	No cracks
Water Immersion Resistance (Potable Water Tanks)	Wet Disbondment, 0.33 cm (1/8") holiday or	< 1 mm disbondment, no holiday, no blister
	Pull-off Adhesion	< 3.l4 MPa (500 psi), cohesive failure mode, no intercoat delamination, no blister, no holiday
Impact Strength	Impact Test , ASTM G14	< 3.4 Joules (30 in. lbs) for non-deck areas
		< 5.6 Joules (50 in. lbs) for decks, boat landing and splash zone areas
Abrasion Resistance	Abrasion Resistance, ASTM G4060	< 50 μm (2 mils) per 1000 cycles

Paint Trial

a) A paint trial shall be performed to check on the paint system and competency of the painting CONTRACTOR. The paint trial shall also ensure that the select surface preparation and coating requirements can be met under prevailing condition at actual application areas, and that any practical problems can be identified and resolved before the actual work commence. During the paint trial the following shall be checked and tested by NOBLE.

- Compliance with the requirements of NOBLE's specification and with paint manufacturer's data sheets and others instruction.
- Equipment for cleaning and for coating to be of the correct type, and in good working condition.

- Control tests are under covering environmental condition and characteristics of the steel surface and applied coating system.

- Compliance with personnel protection, other safety requirements, and MSDS.

b) A minimum one panel shall be prepared for each different paint system. Each panel shall be not less than 1 meter square area and shall be chosen so as to be representative of the average condition of the particular material which is to be coated. Each panel shall be surface-treated and cleaned to the correct standard. Immediately after the cleaning has been completed, 2 coats of clear varnish or clear polyurethane shall be applied to approximately one third of the panel. The remaining area shall then be painted with the appropriate primer as of the specification. After the necessary drying times have elapsed, succeeding coats shall be applied as of the specification. Each coat shall leave a width of 100 mm. Of the preceding coat exposed. Once the top coat of each system has dried agreement reached by all parties that the standard achieved is acceptable, the panels shall be retained in the site office allocated to the NOBLE and shall be used where necessary as a visual guide to the standards of cleaning and painting to be achieved.

c) All observations, data and test results shall be documented and shall include:

- Type of surface preparation
- Chemicals use for cleaning
- Type of paint/coating materials
- Name of Manufacturer/Supplier and brand names of products used.
- Batch Number
- Models of application
- Results of tests
- Environmental conditions e.g. temperature, humidity
- Painting CONTRACTOR

Testing & Inspection

The following tests shall be carried out during paint trials and during the work and shall be reported in a format agreed with the NOBLE.

a) Visual Inspection
Individual coat and completed coatings shall be visually inspected for appearance. Coats and coatings shall be smooth and free from dry spray, pinholes, blisters, caters and excessive sagging.

b) Profile Height
The profile height shall be spot checked by means of a surface profile gauge or pressure sensitive profile tape.

c) Film Thickness
During coating, the wet film thickness shall be checked. Specified total minimum DFT shall be spot-checked by mean of a magnetic, or other appropriate, type thickness gauge. The gauge scale shall be 0-

1000 microns (0-40 mils) range. Film thickness shall also be measured on individual coats. The specified average film thickness shall not vary by more than plus or minus 20%.

d) Temperature and Relative Humidity
Temperature and relative humidity shall be measured by means of a temperature gauge and hygrometer. Readings shall be taken at the beginning of each work shift and at regular intervals during the work shift, depending on changing in climatic condition.

e) Adhesion
During paint trials, the adhesion of the primer coat to the steel surface, and the inter-coat adhesion between subsequent coats shall be qualified by the' pull-off test ' in accordance with BS 3900: Part E 10. The glass flake polyester paints shall have a minimum ' pull-off value of 34.5 bars g. (500 psi). All other paints shall at least attain 13.8 bars (200 psi) The cross-cut techniques, and the use of pressure sensitive adhesive tapes to the cut surface, shall be used on coated galvanized surfaces and conventional paints. The cross cut test shall be carried as a'' go/no go'' test in accordance with BS 3900: Part E 6; Cross-cut Test. Test areas shall be repaired in accordance with the specification.

f) Calibration
Profile height and film thickness gauges shall be calibrated at least twice daily in accordance with the manufacturer's recommendation. Reference panels for profile height and reference foils for film thickness shall be representative of the actual work.

g) Finished Paintwork
The finished paintwork shall have the correct shade, degree of gloss and evenness and be free from ''tackiness'' after drying/curing. The painted surface shall be free from defects that may prove degrading to the coating quality.

Safety

The recommendation for personal protection equipment, as given in the publication '' Personal Protective Advice for the Use of Marine Paints and Compositions (by Paintmaker Association of Great Britain) shall be met. Any types of pressure equipment must be designed in accordance with ASME code for working pressure requirement and so labeled. Excess pressures to overcome pressure drops on long hose lines should be avoided to maintain safe working conditions. Pressure vessels should be inspected annually. Personnel should be completely familiar with their use and operation. In addition warning signs, tape or barriers and safety sheeting or an encapsulated area should be present in order to protect other site workers and or surrounding buildings or equipment. Safe maintenance painting practices should include, but not limited to SSPC-PA Guide 3 'guide to Safety in Paint Application' Note: For paints that are approved, actual sites where those paints are applied shall be recorded for long-term performance tracking.

*APPENDIX **D** - CHLORID* LUIQUID SOLUBLE SALT REMOVER*

DESCRIPTION:

CHLOR*RID is an organic bonding chemical blend which aids in the removal of chlorides, sulfates and surface reacted salts. Contains no volatile organic compounds (VOC's), and is biodegradable. CHLOR*RID is recommended for use in a maintenance wash solution to reduce corrosion and as part of surface preparation prior to application of primers or coatings on a variety of surfaces, including ferrous and non-ferrous metals, concrete, wood, plastics and others.

SURFACE PREPARATION:

Best surface preparation yields the best results. If hydrocarbons are present, they should be removed prior to salt removal. Barrier materials, such as rust or scale or delaminated coatings, should be removed prior to salt removal. Sufficient mechanical force, such as high pressure water or wet abrasive blast, may be utilized so barrier materials are removed as part of salt removal procedures.

APPLICATION:

CHLOR*RID can be introduced and applied by a variety of means. Directions are available for hand cleaning, pressure washing, UHP waterjetting and wet abrasive blasting methods. Contact CHLOR*RID International, Inc. or an Authorized Distributor for other methods or technical support. Before and after cleaning a small sample area (usually 25 Sq. Ft.), test the surface for contamination. Adjust travel speed, pressure or dilution as necessary and retest to assure desired cleanliness level is achieved. It is not necessary to use the entire contents. Partially filled containers should be closed tightly.

- Color: Blue
- Packaging: 1/5/55 U.S. Gallon
- Typical coverage: 300-1000 Sq. Ft./ Gal.
- Single Component
- No VOC's * Shelf Life: 36 months
- pH 3.3 (+/- .2) * Application Temperature: +32 o F
- Keep from freezing – if frozen, thaw before use
- Non-Flammable

See M.S.D.S. for full precautions prior to use. This product is intended for professional use only. Access to additional product and training information is available at www.chlor-rid.com.

CHLOR*RID ®
LIQUID SOLUBLE SALT REMOVER
GENERAL DIRECTIONS FOR USE

HIGH PRESSURE WASHING: CHLOR*RID is added to the water of the pressure washer, usually in a dilution ratio of 1:100. The dilution ratio is dependent on the contamination level and the water quality. (See Testing below) Add CHLOR*RID by means of a metering pump or add to a reservoir water supply. A siphon device may be used, but most such devices lack dilution

control and positive input. Use potable water or other approved source. A minimum 3000 psi. pressure washer is recommended. A zero degree-rotating nozzle is also recommended. Flush washer and lines prior to application. Hold pressure nozzle perpendicular to the surface and no more than 12 inches away to ensure all surfaces are washed with direct high pressure. In areas of deep pitting, slow the wash speed to enable CHLOR*RID to penetrate. Do not rinse. Typical application rate is 300 to 1000 Sq. Ft. per gallon of CHLOR*RID.

HAND WASHING: Use CHLOR*RID DTS TM (Direct To Surface) according to directions. CHLOR*RID DTS is ready to use direct from the container- no dilution necessary.

WET ABRASIVE BLASTING: Add CHLOR*RID to the system at 1 U.S. gallon per 300-1000 square feet of surface to be blasted using potable water or other approved source. (Dilution ratio of 1:500 typical.) Add CHLOR*RID to rinse water at 1:100 ratio. Always use appropriate safety equipment.

TESTING: After cleaning or blasting a small sample area, test the surface with a CHLOR*TEST TM kit to verify cleanliness. Adjust speed of travel, pressure or dilution as necessary and retest to verify desired cleanliness level is attained. Abrasives and water used should be tested with CHLOR*TEST kits “A” and “W”. Due to a wide variety of surface conditions, work environments, weather conditions, etc.,
these directions are general and may require alterations to better suit individual conditions. Call CHLOR*RID International Inc. for recommendations for a specific project. CHLOR*RID International Inc. assumes no liability for use or misuse of the product inconsistent with its labeling.

WARRANTY: CHLOR*RID International Inc. warrants this product to be identical in chemical and physical properties from batch to batch within the specification limits of the raw materials used in its manufacture.

3.4 CORPORATE IDENTITY

The purpose of this document is to define and standardize all images identifiable as, and identified with, Noble Corporation. These policies apply to all Noble employees.

3.4.1 GENERAL

It is the intent of Noble Corporation to maintain a consistent, unified corporate image both internally and publicly. These policies stress the disciplines in the application of visual, graphic, written, and verbal representations of the corporate identity.

3.4.2 COMPANY LOGO

There is one Noble logo for all uses. There are no variants. The Senior Vice President of Administration provides reproducible masters and guidelines as to its use. They may not be altered or modified. If the masters are mislaid, do not produce another original but request a further copy.

Except as authorized by the CEO, the Company's logo shall be consistently reproduced in all areas where the Company conducts its business.

The logo is exclusive to Noble Corporation and its subsidiaries. No other word or words should appear in, or be incorporated within, the design. The logo may be used by all Noble companies so long as the proper Company name is used in conjunction with, but exterior to, the logo unless approved by the Senior Vice President of Administration, the President or the CEO.

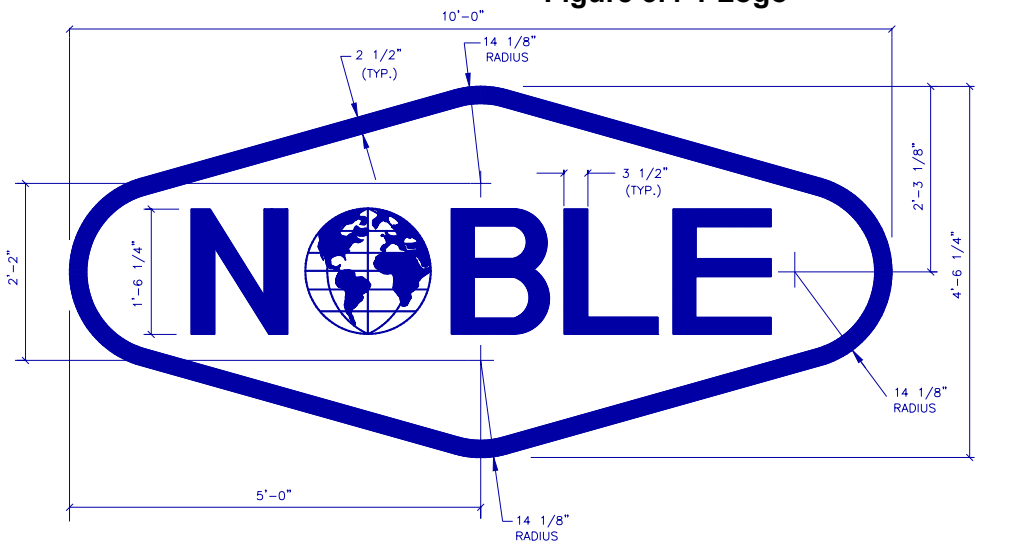
The dimensions of the logo for a drilling rig are shown on the following page.

The proportions should always be maintained irrespective of scale.

The logo should always appear superior to other wording except in advertising and other publications.

Permission to use the Noble logo by non-Noble companies for any purpose must be approved by the Senior Vice President of Administration, President or the CEO

Figure 3.4-1 Logo



1. BACKGROUND COLOR TO BE PAINTED PMS CODE 294-BLUE
2. LETTERS, GLOBE, AND BORDER COLOR TO BE PAINTED PMS CODE-109 YELLOW
3. TOTAL ESTIMATED WEIGHT IS 250 LBS

3.4.2.1 REPRODUCTION

The Senior Vice President of Administration maintains camera ready copies of the Noble logo for reproduction.

When printing the Company logo in color, printers should be directed to use the following colors as set out in the standard "Pantone Matching System":

- Blue: PMS 294
- Yellow: PMS 109

When the logo is printed through a four-color process, the following screen percentages should be used:

- Blue: 100% Process Blue 40% Process Magenta 10% Black
- Yellow: 100% Process Yellow 5 % Process Magenta

Where situations demand a single color, both the symbol and lettering are to be printed in black.

Further detail drawings are available from NDSI Vice President of Project Engineering or Senior Vice President of Administration to assure that field locations produce a consistent logo representation.

3.4.2.2 INFRINGEMENT

It is the responsibility of all employees to notify their supervisor or senior management if they recognize any third party using the Noble name or logo, or a name or logo sufficiently close to cause company recognition, whether in our industry or otherwise.

3.4.3 PUBLIC RELATIONS

At the level of press, radio, and television, the image presented by Noble is critically affected by the individual representing the Company. All verbal statements to the press will be made by the CEO or his designee. Interviews with foreign press, radio, and television may be granted by local Division Managers only after approval by the CEO or his designee.
All written releases to the press will be made by the Corporate Administration Sector.

Any and all written material including electronic media that will be used for external purposes must be reviewed and approved by the CEO, President or Senior Vice President of Administration prior to the printing, placing on the Internet or distribution of the material. This includes press releases, brochures, advertisements, magazine articles, and any other printed matter that will potentially be viewed by anyone external to the Company.

3.4.4 COMPANY VEHICLES

Whenever practical, company vehicles will be white with Company striping (½ inch wide, blue over gold), in the logo colors, applied.
The Company logo will **not** be displayed on company vehicles. Employees are instructed to refrain from placing company decals on company vehicles.

3.4.5 CORRESPONDENCE FORMS

Except as authorized by the CEO, all letterheads, envelopes, continuation sheets, and internal correspondence forms shall be standardized to match those used by Corporate, in so far as practical. Software templates may also be obtained by contacting the Corporate Information Technology department.
Paper and envelope sizes to be used are those available in your area. Corporate uses a 4-lb. white weave bond with the printing engraved. If it is not possible to exactly duplicate the paper color, use the closest available locally.
All companies incorporated in countries other than the United States or Canada should be so indicated on the letterhead. Show the country of incorporation, and if necessary, the registration number, in small type in parentheses under the name of the Company.

Note:	Where required by law to show the directors' names and nationalities on the letterhead, the print should appear on the bottom of the letterhead, in a straight line(s).

If the address of the Division is different from the address where the Company is incorporated, the local address should also be shown on the letterhead in the upper left-hand corner and should include the telephone, fax, and telex numbers, if applicable, and be headed in small type with "Reply in care of:...."

Note:	All return addresses printed on the envelopes should be printed with the local address, not the address of incorporation (unless they happen to be the same). If special airmail envelopes are used, they should conform to the same printing format.

3.4.6 DRILLING EQUIPMENT

For reasons relating to safety, regulatory compliance, and corporate identity, Noble has established a paint and marking program. The standards for offshore rig markings and paint program are shown below. The safety and regulatory compliance marking program is contained in the Noble Safety Policy Manual. These standards shall be adhered to unless directed otherwise by NDSI Engineering. Coastal State helideck marking regulations supercede the Noble marking policy, where applicable. Helidecks marked under the previous version of this policy may continue; however, when the helideck is repainted/remarked, the helideck must conform with the revised corporate marking standards.

3.4.6.1 OFFSHORE RIG MARKINGS

Rig names, hailing ports, and helideck markings will be to the standards established by Corporate Engineering based on Coastal State and IMO MODU Code Requirements. For Helideck markings, send request to Corporate Engineering. Nameplate and Hailing Port Plate standards follow.

Figure 3.4-2 Rig Name Criteria

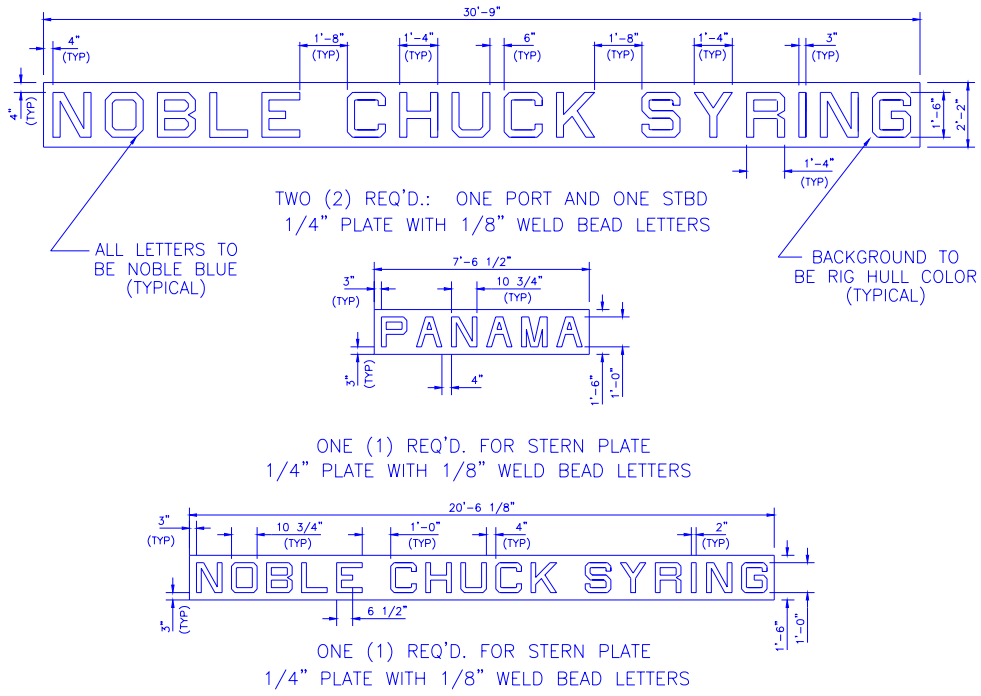
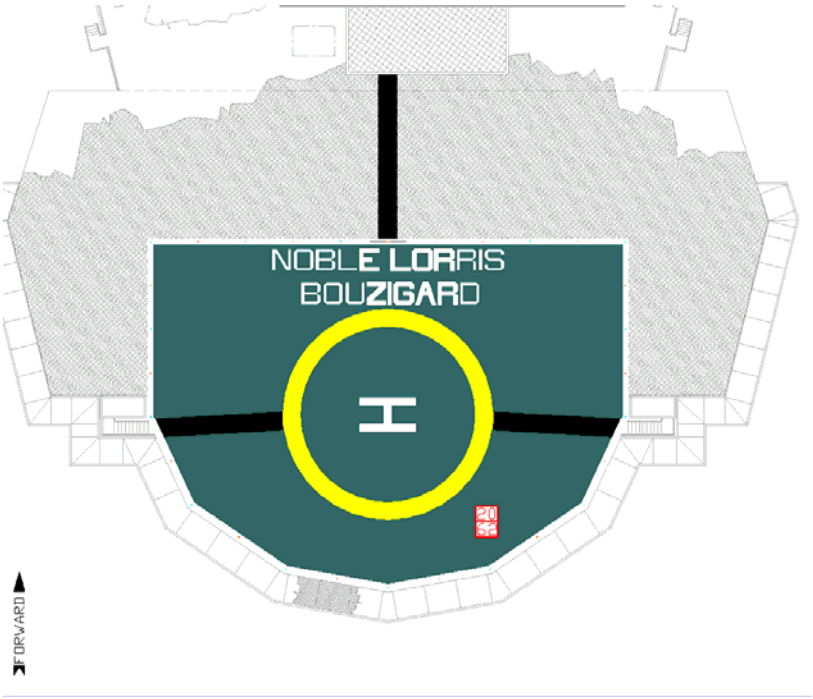


Figure 3.4-3 Helideck Markings


NOBLE LORRIS
BOUZIGARD
H
20
FORWARD

3.4.7 OFFSHORE PAINT PROGRAM

National Blue

Draw works, mud pumps, outside walls of rig floor enclosures, standpipes, small machinery and logo.

Red

Tongs, elevators, bails, standpipe manifolds, slips, collar clamps, kelly bushing, kelly bushing guard, blowout preventer (**Surface BOP**), choke manifolds, kill lines, BOP valves, any high pressure manifolds, accumulator, and chemical barrel.

Safety Yellow

Traveling blocks, hook, swivel, kelly cock, lift subs, crown assembly (including sheaves, rails & walkways), hand rails, safety rails and guard rails, air tuggers, target on helideck.

White

Mast, (unless galvanized, then they are to be left unpainted), interiors of all bulkhead compartments, crane booms, inside of rig floor wind walls, (steam lines heat resistant white), perimeter stripe, “H” on the helideck**, Low Air pressure vessels and Subsea BOP’s**

Surf Gray

Decks, inclined ladders, steps, (unless galvanized, then they are to be left unpainted), substructure, Vee-door slide, P tanks, pipe racks, vertical bulkheads, legs. Depending on paint manufacturer the paint name may be silver gray.

Black

Engine exhausts, **below water line of semi’s, footing of semi’s**

Safety Orange

Crane blocks, hooks, balls, and the boom tip extension. If crane does not have a boom tip extension the final 5 feet of boom tip.

Dark Green

Helideck

Engines, crane cabs, water makers, sewage treatment equipment**, iron roughneck, utility & man-rider hoist, mooring winches/windlasses, lifeboats, high air pressure vessels are to be manufacturer’s original color.**

“DANGER”

V-2039
7" X 10" VINYL

V-2329
7" X 10" VINYL

V-2073
7" X 10" VINYL

V-2526
7" X 10" VINYL

V-2390 / M-2390
7" X 10" VINYL / ALUMINUM

V-2388 / M-2388
7" X 10" VINYL / ALUMINUM

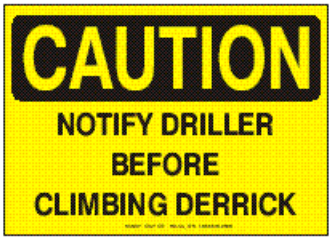
“CAUTION”

V-2394
7" X 10" VINYL

V-2393
7" X 10" VINYL

V-2129
7" X 10" VINYL

V-2395
7" X 10" VINYL



V-2113
7" X 10" VINYL

V-2521
7" X 10" VINYL

V-2116
8" X 10" VINYL

“NOTICE”

V-2224
7" x 10" VINYL

V-2226
7" x 10" VINYL

V-2323
7" x 10" VINYL

V-2324
7" x 10" VINYL

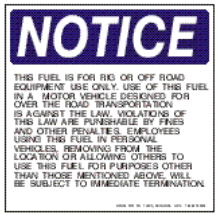
V-2522
7" x 10" VINYL

V-2525
7" x 10" VINYL

V-2531
7" x 10" VINYL

V-4003
10" x 10" VINYL

V-4004
10" x 10" VINYL



V-4005
10" x 10" VINYL

V-4006
10" x 10" VINYL

V-4226
10" x 10" VINYL

V-4007
10"x 14" VINYL

V-4209
10"x 14" VINYL

V-6001
18"x 24" VINYL

NOBLE 2000 SAFETY MARKING PROGRAM

"SAFETY FIRST"

V-2230
7" X 10" VINYL

V-2243
7" X 10" VINYL

V-2240
7" X 10" VINYL

"NFPA PLACARD"

V-2245
DIESEL

7.5" X 7.5" VINYL

V-2246
OIL

"PLACARD"

SIZES AVAILABLE
11" X 11"
OR
4" X 4"

V-4010

V-4011

V-4018

V-4016

V-4012

V-0115

V-4017

V-4013

V-4014

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"HMIS PLACARDS"

BARITE

EFFECTS OF OVEREXPOSURE

INHALATION: ACUTE EXPOSURE TO BARITE DUST MAY RESULT IN LACRIMATION, COUGHING, ETC., HOWEVER, NORMAL PRECAUTIONS FOR NUISANCE DUSTS ARE ADEQUATE TO SAFEGUARD HEALTH. REPEATED OR PROLONGED INHALATION OF DUST MAY CAUSE DELAYED RESPIRATORY ILLNESS (BARITOSIS). SOLUBLE IMPURITIES CAN LEAD TO TOXIC REACTIONS.

SKIN OR EYE CONTACT: DUST MAY CAUSE MODERATE TO SEVERE EYE IRRITATION AND MAY BE IRRITATING TO THE SKIN.

INGESTION: IS UNLIKELY TO OCCUR

FIRST AID

EYE: IMMEDIATELY FLUSH EYES WITH PLENTY OF POTABLE WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.

SKIN: PROMPTLY WASH SKIN WITH SOAP AND WATER, WASH CLOTHING BEFORE REUSE.

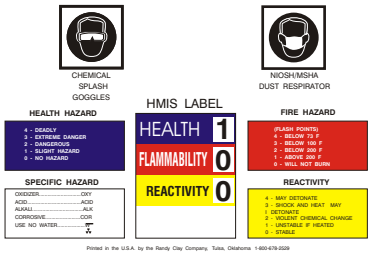
INHALATION: REMOVE TO FRESH AIR.

INGESTION: DRINK WATER TO DILUTE. INDUCE VOMITING.

OTHER INSTRUCTIONS: ORDINARY MEASURES OF PERSONAL HYGIENE SHOULD BE OBSERVED. SENSITIVE INDIVIDUALS SHOULD AVOID FURTHER CONTACT IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION. MEDICAL ADVICE SHOULD BE OBTAINED.

REQUIRED PROTECTIVE EQUIPMENT

PROTECTIVE EQUIPMENT SHOULD INCLUDE: COTTON OR RUBBER WORK GLOVES AND LONG COVERALLS, WORK BOOTS OR WORK SHOES, DUST GOGGLES, AND NIOSH/MSHA APPROVED DUST/MIST RESPIRATOR. ADEQUATE VENTILATION SHOULD BE PROVIDED, LOCAL EXHAUST VENTILATION SHOULD BE USED IN DUSTY ENVIRONMENTS.



V-4019
11" X 14" VINYL

CEMENT

EFFECTS OF OVEREXPOSURE

INHALATION: REPEATED OR PROLONGED INHALATION OF DUST MAY CAUSE DELAYED RESPIRATORY ILLNESS (SILICOSIS).

SKIN OR EYE CONTACT: DUST MAY CAUSE MODERATE TO SEVERE EYE IRRITATION WITH CORNEAL INJURY THAT MAY BE SLOW TO HEAL. DUST MAY BE IRRITATING TO THE SKIN. WET CEMENT CAN DRY THE SKIN AND CAUSE ALKALI BURNS. SENSITIVE INDIVIDUALS MAY DEVELOP ALLERGIC DERMATITUS.

INGESTION: IS NOT LIKELY TO OCCUR.

FIRST AID

EYE: IMMEDIATELY FLUSH EYES WITH PLENTY OF POTABLE WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.

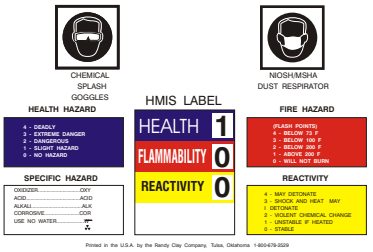
SKIN: PROMPTLY WASH SKIN WITH SOAP AND WATER. WASH CLOTHING BEFORE REUSE.

INHALATION: REMOVE TO FRESH AIR. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.

INGESTION: DO NOT INDUCE VOMITING! IN GENERAL, NO TREATMENT IS NECESSARY UNLESS LARGE QUANTITIES ARE INGESTED. HOWEVER, MEDICAL ADVICE SHOULD BE OBTAINED.

REQUIRED PROTECTIVE EQUIPMENT

PROTECTIVE EQUIPMENT SHOULD INCLUDE: NORMAL WORK GLOVES AND COVERALLS, WORK BOOTS OR WORK SHOES, DUST GOGGLES, AND NIOSH/MSHA APPROVED DUST/MIST RESPIRATOR. ADEQUATE VENTILATION SHOULD BE PROVIDED, LOCAL EXHAUST VENTILATION SHOULD BE USED IN DUSTY ENVIRONMENTS.



V-4020
11" X 14" VINYL

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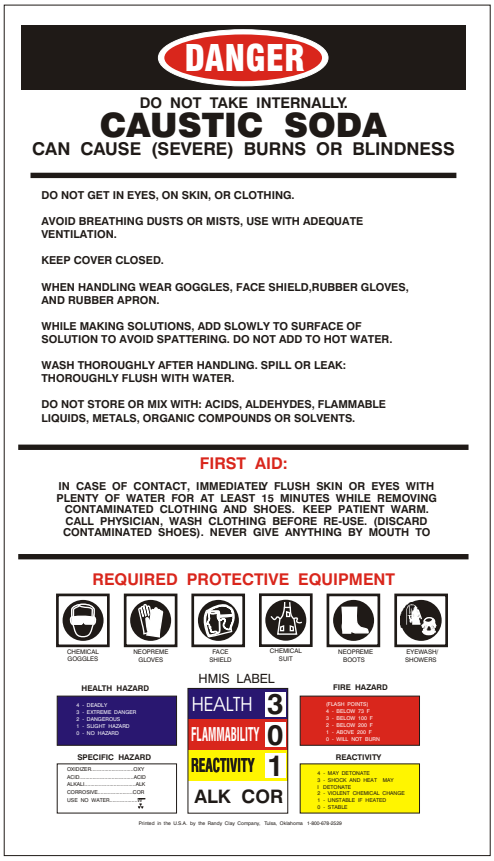
"HMIS PLACARDS"



DANGER

DO NOT TAKE INTERNALLY.

CAUSTIC SODA

CAN CAUSE (SEVERE) BURNS OR BLINDNESS

DO NOT GET IN EYES, ON SKIN, OR CLOTHING.

AVOID BREATHING DUSTS OR MISTS, USE WITH ADEQUATE VENTILATION.

KEEP COVER CLOSED.

WHEN HANDLING WEAR GOGGLES, FACE SHIELD,RUBBER GLOVES, AND RUBBER APRON.

WHILE MAKING SOLUTIONS, ADD SLOWLY TO SURFACE OF SOLUTION TO AVOID SPATTERING. DO NOT ADD TO HOT WATER.

WASH THOROUGHLY AFTER HANDLING. SPILL OR LEAK: THOROUGHLY FLUSH WITH WATER.

DO NOT STORE OR MIX WITH: ACIDS, ALDEHYDES, FLAMMABLE LIQUIDS, METALS, ORGANIC COMPOUNDS OR SOLVENTS.

FIRST AID:

IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN OR EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. KEEP PATIENT WARM. CALL PHYSICIAN, WASH CLOTHING BEFORE RE-USE. (DISCARD CONTAMINATED SHOES). NEVER GIVE ANYTHING BY MOUTH TO

REQUIRED PROTECTIVE EQUIPMENT

CHEMICAL GOGGLES · NEOPREME GLOVES · FACE SHIELD · CHEMICAL SUIT · NEOPREME BOOTS · EYEWASH SHOWERS

HMIS LABEL

HEALTH HAZARD
4 - DEADLY
3 - EXTREME DANGER
2 - DANGEROUS
1 - SLIGHT HAZARD
0 - NO HAZARD

HEALTH 3
FLAMMABILITY 0
REACTIVITY 1
ALK COR

FIRE HAZARD
(FLASH POINTS)
4 - BELOW 73 F
3 - BELOW 100 F
2 - BELOW 200 F
1 - ABOVE 200 F
0 - WILL NOT BURN

SPECIFIC HAZARD
OXIDIZER.....OXY
ACID.....ACID
ALKALI.....ALK
CORROSIVE.....COR
USE NO WATER.....W

REACTIVITY
4 - MAY DETONATE
3 - SHOCK AND HEAT MAY DETONATE
2 - VIOLENT CHEMICAL CHANGE
1 - UNSTABLE IF HEATED
0 - STABLE

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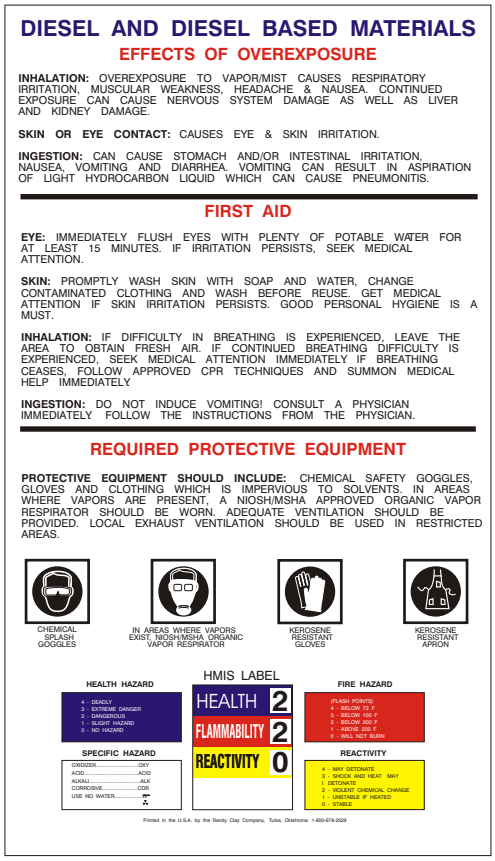
V-4021
11" X 14" VINYL



DIESEL AND DIESEL BASED MATERIALS

EFFECTS OF OVEREXPOSURE

INHALATION: OVEREXPOSURE TO VAPOR/MIST CAUSES RESPIRATORY IRRITATION, MUSCULAR WEAKNESS, HEADACHE & NAUSEA. CONTINUED EXPOSURE CAN CAUSE NERVOUS SYSTEM DAMAGE AS WELL AS LIVER AND KIDNEY DAMAGE.

SKIN OR EYE CONTACT: CAUSES EYE & SKIN IRRITATION.

INGESTION: CAN CAUSE STOMACH AND/OR INTESTINAL IRRITATION, NAUSEA, VOMITING AND DIARRHEA. VOMITING CAN RESULT IN ASPIRATION OF LIGHT HYDROCARBON LIQUID WHICH CAN CAUSE PNEUMONITIS.

FIRST AID

EYE: IMMEDIATELY FLUSH EYES WITH PLENTY OF POTABLE WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.

SKIN: PROMPTLY WASH SKIN WITH SOAP AND WATER, CHANGE CONTAMINATED CLOTHING AND WASH BEFORE REUSE. GET MEDICAL ATTENTION IF SKIN IRRITATION PERSISTS. GOOD PERSONAL HYGIENE IS A MUST.

INHALATION: IF DIFFICULTY IN BREATHING IS EXPERIENCED, LEAVE THE AREA TO OBTAIN FRESH AIR. IF CONTINUED BREATHING DIFFICULTY IS EXPERIENCED, SEEK MEDICAL ATTENTION IMMEDIATELY IF BREATHING CEASES, FOLLOW APPROVED CPR TECHNIQUES AND SUMMON MEDICAL HELP IMMEDIATELY

INGESTION: DO NOT INDUCE VOMITING! CONSULT A PHYSICIAN IMMEDIATELY FOLLOW THE INSTRUCTIONS FROM THE PHYSICIAN.

REQUIRED PROTECTIVE EQUIPMENT

PROTECTIVE EQUIPMENT SHOULD INCLUDE: CHEMICAL SAFETY GOGGLES, GLOVES AND CLOTHING WHICH IS IMPERVIOUS TO SOLVENTS. IN AREAS WHERE VAPORS ARE PRESENT, A NIOSH/MSHA APPROVED ORGANIC VAPOR RESPIRATOR SHOULD BE WORN. ADEQUATE VENTILATION SHOULD BE PROVIDED. LOCAL EXHAUST VENTILATION SHOULD BE USED IN RESTRICTED AREAS.

CHEMICAL SPLASH GOGGLES · IN AREAS WHERE VAPORS EXIST, NIOSH/MSHA ORGANIC VAPOR RESPIRATOR · KEROSENE RESISTANT GLOVES · KEROSENE RESISTANT APRON

HMIS LABEL

HEALTH HAZARD
4 - DEADLY
3 - EXTREME DANGER
2 - DANGEROUS
1 - SLIGHT HAZARD
0 - NO HAZARD

HEALTH 2
FLAMMABILITY 2
REACTIVITY 0

FIRE HAZARD
(FLASH POINTS)
4 - BELOW 73 F
3 - BELOW 100 F
2 - BELOW 200 F
1 - ABOVE 200 F
0 - WILL NOT BURN

SPECIFIC HAZARD
OXIDIZER.....OXY
ACID.....ACID
ALKALI.....ALK
CORROSIVE.....COR
USE NO WATER.....W

REACTIVITY
4 - MAY DETONATE
3 - SHOCK AND HEAT MAY DETONATE
2 - VIOLENT CHEMICAL CHANGE
1 - UNSTABLE IF HEATED
0 - STABLE

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V-4022
11" X 14" VINYL

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"HMIS PLACARDS"

OIL AND OIL RELATED MATERIALS

EFFECTS OF OVEREXPOSURE

INHALATION: INHALATION OF VAPOR (GENERATED AT HIGH TEMPERATURES ONLY) OR OIL MIST FROM THIS PRODUCT MAY RESULT IN MINOR IRRITATION OF THE UPPER RESPIRATORY TRACT.

SKIN OR EYE CONTACT: LUBRICATING OILS ARE GENERALLY CONSIDERED NO MORE THAN MINIMALLY IRRITATING TO THE EYES. SKIN CONTACT WITH WASTE OIL SHOULD BE AVOIDED.
4
INGESTION: LUBRICATING OILS ARE GENERALLY CONSIDERED NO MORE THAT SLIGHTLY TOXIC IF SWALLOWED.

FIRST AID

EYE: IMMEDIATELY FLUSH EYES WITH PLENTY OF POTABLE WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.

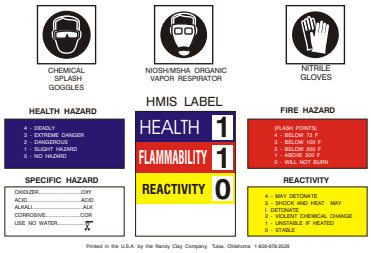
SKIN: PROMPTLY WASH SKIN WITH SOAP AND WATER, REMOVE CONTAMINATED CLOTHING AND WIPE THE EXCESS OFF. WASH CLOTHING BEFORE REUSE. GET MEDICAL ATTENTION IF SKIN IRRITATION PERSISTS. GOOD PERSONAL HYGIENE IS A MUST.

INHALATION: REMOVE THE VICTIM TO FRESH AIR. IF BREATHING IS DIFFICULT GET MEDICAL ATTENTION.

INGESTION: DO NOT INDUCE VOMITING! IN GENERAL NO TREATMENT IS NECESSARY UNLESS LARGE QUANTITIES OF PRODUCT ARE INGESTED. HOWEVER, GET MEDICAL ATTENTION.

REQUIRED PROTECTIVE EQUIPMENT

PROTECTIVE EQUIPMENT SHOULD INCLUDE: AREAS WHERE VAPORS ARE PRESENT, A NIOSH/MSHA APPROVED ORGANIC VAPOR RESPIRATOR OR A ATMOSPHERE-SUPPLYING RESPIRATOR SHOULD BE WORN. WEAR CHEMICAL RESISTANT GLOVES AND OTHER PROTECTIVE CLOTHING AS REQUIRED TO MINIMIZE SKIN CONTACT. WEAR CHEMICAL SPLASH GOGGLES TO AVOID EYE CONTACT. TEST DATA FROM PUBLISHED LITERATURE AND/OR GLOVE/CLOTHING MANUFACTURERS INDICATE THE BEST PROTECTION IS PROVIDED BY NITRILE GLOVES. ADEQUATE VENTILATION SHOULD BE PROVIDED. LOCAL EXHAUST VENTILATION SHOULD BE USED IN



V-4023
11" X 14" VINYL

PAINT AND PAINT RELATED MATERIALS

EFFECTS OF OVEREXPOSURE

INHALATION: IRRITATION OF RESPIRATORY TRACT, HEADACHE, NAUSEA, DIZZINESS, WEAKNESS & FATIGUE. EXTREME EXPOSURE CAN RESULT IN UNCONSCIOUSNESS AND EVEN RESPIRATORY ARREST. REPORTS HAVE ASSOCIATED REPEATED AND PROLONGED OVEREXPOSURE TO SOLVENTS WITH PERMANENT BRAIN AND NERVOUS SYSTEM DAMAGE. PROLONGED OR REPEATED BREATHING OF SPRAY MIST AND/OR SANDING DUST OVER A PERIOD OF YEARS MAY CAUSE DISEASE OF THE LUNGS AND SYMPTOMS OF LEAD TOXICITY.

SKIN OR EYE CONTACT: CAUSES EYE & SKIN IRRITATION. MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN.

SWALLOWIING: CAN CAUSE STOMACH AND/OR INTESTINAL IRRITATION, NAUSEA, VOMITING AND DIARRHEA.

FIRST AID

EYE: IMMEDIATELY FLUSH EYES WITH PLENTY OF POTABLE WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.

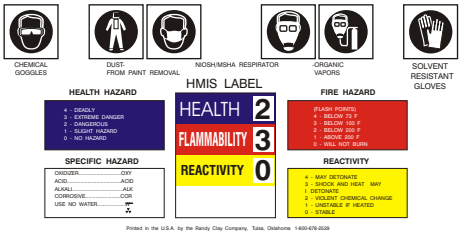
SKIN: PROMPTLY WASH SKIN WITH SOAP AND WATER, WASH CLOTHING BEFORE REUSE. GET MEDICAL ATTENTION IF IRRITATION PERSISTS.

INHALATION: IF YOU EXPERIENCE DIFFICULTY IN BREATHING, LEAVE THE AREA TO OBTAIN FRESH AIR. IF BREATHING DIFFICULTY IS EXPERIENCED, SEEK MEDICAL ATTENTION IMMEDIATELY. IF BREATHING CEASES, FOLLOW APPROVED CPR TECHNIQUES AND SUMMON MEDICAL HELP IMMEDIATELY.

INGESTION: DO NOT INDUCE VOMITING! CONSULT A PHYSICIAN IMMEDIATELY.

REQUIRED PROTECTIVE EQUIPMENT

PROTECTIVE EQUIPMENT SHOULD INCLUDE: SOLVENT IMPERMEABLE GLOVES, SOLVENT RESISTANT EYEWEAR WITH SPLASH GUARDS & SOLVENT RESISTANT LONG SHEAVE COVERALLS. WORK BOOTS OR WORK SHOES, NIOSH/MSHA APPROVED CHEMICAL/MECHANICAL RESPIRATOR TO REMOVE AIRBORNE PARTICLES AND SANDING DUST AS WELL AS SOLVENT VAPORS. IN CONFINED SPACES, WEAR NIOSH/MSHA APPROVED AIR SUPPLY RESPIRATORS OR USE HOODS. USE NIOSH/MSHA APPROVED FUME RESPIRATOR WHEN CUTTING, BRAZING OR WELDING ON THIS PRODUCT. ADEQUATE VENTILATION SHOULD BE PROVIDED. LOCAL EXHAUST VENTILATION SHOULD BE USED IN RESTRICTED AREAS.



V-4024
11" X 14" VINYL

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"SPECIALTY (ELECTRICAL DECALS)"

110/120 VAC	220/240 VAC	440/480 VAC	380 VAC	600 VAC	6,000 VAC	11,000 VAC
V-0034 2" X 4" / VINYL	V-0035 2" X 4" / VINYL	V-0036 2" X 4" / VINYL	V-0260 2" X 4" / VINYL	V-0037 2" X 4" / VINYL	V-0262 2" X 4" / VINYL	V-0261 2" X 4" / VINYL

"MARKINGS FOR ELECTRICAL LINES"

110/120 VOLTS
V-2475
.5" X 2.25" 54 COUNT
VINYL

220/240 VOLTS
V-2476
.5" X 2.25" 54 COUNT
VINYL

380 VOLTS
V-2477
.5" X 2.25" 54 COUNT
VINYL

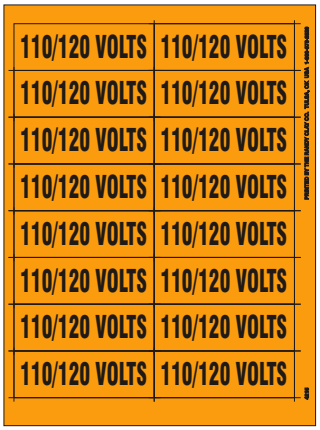
440/480 VOLTS
V-2478
.5" X 2.25" 54 COUNT
VINYL

600 VOLTS
V-2479
.5" X 2.25" 54 COUNT
VINYL

6000 VOLTS
V-2480
.5" X 2.25" 54 COUNT
VINYL

11000 VOLTS
V-2481
.5" X 2.25" 54 COUNT
VINYL

ARROW
V-2482
.5" X 2.25" 54 COUNT
VINYL



110/120 VOLTS
V-4215
1.5" X 4.5" 16 COUNT
VINYL

220/240 VOLTS
V-4216
1.5" X 4.5" 16 COUNT
VINYL

380 VOLTS
V-4217
1.5" X 4.5" 16 COUNT
VINYL

440/480 VOLTS
V-4218
1.5" X 4.5" 16 COUNT
VINYL

600 VOLTS
V-4219
1.5" X 4.5" 16 COUNT
VINYL

6000 VOLTS
V-4220
1.5" X 4.5" 16 COUNT
VINYL

11000 VOLTS
V-4221
1.5" X 4.5" 16 COUNT
VINYL

ARROW
V-4222
1.5" X 4.5" 16 COUNT
VINYL

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“SPECIALTY (RED DECALS)”

V-0098
4" X 6" / VINYL

V-0078
4" X 6" / VINYL

V-0079
4" X 6" / VINYL

V-0080
4" X 6" / VINYL

V-0081
4" X 6" / VINYL

V-0082
4" X 6" / VINYL

V-0083
4" X 6" / VINYL

V-0252
4" X 6" / VINYL

V-0253
4" X 6" / VINYL

V-0254
4" X 6" / VINYL

V-0255
4" X 6" / VINYL

V-0259
4" X 6" / VINYL

V-0257
4" X 6" / VINYL

V-0258
4" X 6" / VINYL

V-0256
4" X 6" / VINYL

V-0267
2" X 4" / VINYL

V-0268
2" X 4" / VINYL

V-0269
2" X 4" / VINYL

V-0270
2" X 4" / VINYL

V-0092
5" X 7" / VINYL

V-0093
5" X 7" / VINYL

V-0094
5" X 7" / VINYL

V-0095
5" X 7" / VINYL

V-0096
5" X 7" / VINYL

V-0097
5" X 7" / VINYL

V-2153
7" X 10" / VINYL

V-2166
8" X 10" / VINYL

V-2164
2" DIGITS / VINYL
(FIRE EXTINGUISHER)
(1 SET WILL HAVE NUMBERS 1-55)

V-0090
2" DIGITS / VINYL
(FIRE HOSE STATION)
(1 SET WILL DO 20 STATIONS)

V-2513
7" X 10" / VINYL

V-4025
12" X 12" / VINYL

V-4040
6" X 17" / VINYL

"SPECIALTY (BLACK DECALS)"

V-2191
7" x 10" / VINYL

V-2244
7" x 10" / VINYL

V-2184
7" x 10" / VINYL

V-2192
7" x 10" / VINYL

V-2182
7" x 10" / VINYL

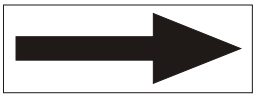
V-2183
7" x 10" / VINYL

V-2186
7" x 10" / VINYL

V-2187
7" x 10" / VINYL

V-2188
7" x 10" / VINYL

V-2189
7" x 10" / VINYL



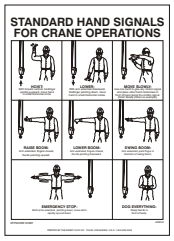
V-0102
4" x 12" / VINYL

V-4002
10" x 10" / VINYL
(ONSHORE CHART)

V-0296
1" X 4" / VINYL / V-0295 2.5" X 10" / VINYL

V-0298
1" X 4" / VINYL / V-0297 2.5" X 10" / VINYL

(TO BE PLACED JUST BELOW THE AREA VENT SIGN)



V-4009
10" x 14" / VINYL
(OFFSHORE CHART)

V-2210
7" x 10" / VINYL

V-2212
7" x 10" / VINYL

V-2195
7" x 10" / VINYL

V-2206
7" x 10" / VINYL

V-2205
7" x 10" / VINYL

V-2215
7" x 10" / VINYL

V-2203
7" x 10" / VINYL

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"VENT MARKERS (BLACK DECALS)"

V-2209
7" x 10" / VINYL

V-2214
7" x 10" / VINYL

V-2194
7" x 10" / VINYL

V-2211
7" x 10" / VINYL

V-2197
7" x 10" / VINYL

V-2202
7" x 10" / VINYL

V-2201
7" x 10" / VINYL

V-2204
7" x 10" / VINYL

V-2196
7" x 10" / VINYL

V-2199
7" x 10" / VINYL

V-2208
7" x 10" / VINYL

V-2200
7" x 10" / VINYL

V-2207
7" x 10" / VINYL

V-0050
2" x 4" / VINYL

V-0051
2" x 4" / VINYL

V-0052
2" x 4" / VINYL

V-0053
2" x 4" / VINYL

V-0054
2" x 4" / VINYL

V-0055
2" x 4" / VINYL

V-0056
2" x 4" / VINYL

V-0057
2" x 4" / VINYL

V-0058
2" x 4" / VINYL

V-0059
2" x 4" / VINYL

V-0060
2" x 4" / VINYL

V-0061
2" x 4" / VINYL

V-0062
2" x 4" / VINYL

V-0063
2" x 4" / VINYL

V-0064
2" x 4" / VINYL

V-0065
2" x 4" / VINYL

V-0066
2" x 4" / VINYL

V-0067
2" x 4" / VINYL

V-0068
2" x 4" / VINYL

V-0069
2" x 4" / VINYL

V-0070
2" x 4" / VINYL

V-0071
2" x 4" / VINYL

V-0072
2" x 4" / VINYL

V-0073
2" x 4" / VINYL

Randy Clay's
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WE'RE STUCK ON SAFETY!

The Randy Clay Company
SAFETY SIGN & DECAL SPECIALISTS
1316 East 6th Street
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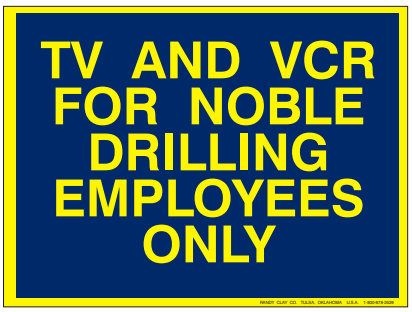
"SPECIALTY (BLUE & YELLOW DECALS)"

V-4026
12" x 12" / VINYL



V-4029
12" x 16" / VINYL

V-4001
10" x 10" / VINYL

V-0116
4" x 8" / VINYL

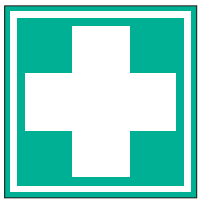
V-0117
4" x 8" / VINYL

V-0118
4" x 8" / VINYL

V-0119
4" x 8" / VINYL

"SPECIALTY REFERENCE & INFO DECALS"

V-4028
12" x 15" / VINYL



V-4000
10" x 10" / VINYL
(GRAPHIC CROSS)

V-0122
2" x 2" / VINYL
(REFLECTIVE YELLOW)

V-0120
1" x 2" / VINYL
HARD HAT DECAL (SMALL)

V-0121
2" x 4.5" / VINYL
HARD HAT DECAL (LARGE)

V-4227
5" x 12" / VINYL
NOBLE LOGO

V-6002
11" x 24" / VINYL
NOBLE LOGO

V-6011
22" x 48" / VINYL
NOBLE LOGO

Randy Clay's SAFETY SIGNS AND DECALS
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"PIPE MARKERS"

TYPE A 1" to 1-7/8" DIAMETER PIPE
TYPE B 2" to 8" DIAMETER PIPE

FIRE WATER
V-0009 TYPE "A" / VINYL / V-0126 TYPE "B" / VINYL

CO_2 GAS
V-0010 TYPE "A" / VINYL

HALON GAS
V-0011 TYPE "A" / VINYL / V-0128 TYPE "B" / VINYL

FIRE FOAM
V-0012 TYPE "A" / VINYL / V-0129 TYPE "B" / VINYL

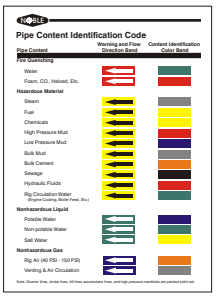
POTABLE WATER
V-0130 TYPE "B" / VINYL

HOT WATER
V-0249 TYPE "A" / VINYL

LOW PRESSURE AIR
V-0131 TYPE "B" / VINYL

BREATHING AIR
V-0015 TYPE "A" / VINYL

VACUUM
V-0248 TYPE "B" / VINYL


Pipe Content Identification Code

Pipe Content	Warning and Flow Direction Band	Content Identification Color Band
Fire Quenching		
Water		
Foam, CO_2, Halonol, Etc.		
Hazardous Material		
Steam		
Fuel		
Chemicals		
High Pressure Mud		
Low Pressure Mud		
Bulk Mud		
Bulk Cement		
Sewage		
Hydraulic Fluids		
Rig Circulation Water (Engine Cooling, Boiler Feed, Etc.)		
Nonhazardous Liquid		
Potable Water		
Non-potable Water		
Salt Water		
Nonhazardous Gas		
Rig Air (40 PSI - 150 PSI)		
Venting & Air Circulation		

Note: Diverter lines, choke lines, kill lines, accumulator lines, and high pressure manifolds are painted solid red.

V-2247
8.5" X 11" / VINYL

BARITE
V-0133 TYPE "B" / VINYL

BENTONITE
V-0134 TYPE "B" / VINYL

CEMENT
V-0135 TYPE "B" / VINYL

DIESEL FUEL
V-0136 TYPE "B" / VINYL

HIGH PRESSURE AIR
V-0020 TYPE "A" / VINYL / V-0137 TYPE "B" / VINYL

LOW PRESSURE MUD
V-0138 TYPE "B" / VINYL

HIGH PRESSURE MUD
V-0139 TYPE "B" / VINYL

ENGINE COOLING WATER
V-0140 TYPE "B" / VINYL

HYDRAULIC OIL
V-0141 TYPE "B" / VINYL

SEWAGE
V-0142 TYPE "B" / VINYL

DRILL WATER
V-0026 TYPE "A" / VINYL V-0143 TYPE "B" / VINYL

SALT WATER
V-0144 TYPE "B" / VINYL

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1-800-678-2529

2002 SAFETY MARKING PROGRAM

"SOLAS SYMBOLS (BLUE ON GLOW)"

85-4000
6" x 6" VINYL
(FASTEN SEATBELT)
$12.95

85-4001
6" x 6" VINYL
(SECURE HATCHES)
$12.95

85-4002
6" x 6" VINYL
(START ENGINE)
$12.95

85-4003
6" x 6" VINYL
(LOWER RESCUE BOAT TO WATER)
$12.95

85-4004
6" x 6" VINYL
(LOWER LIFERAFT TO WATER)
$12.95

85-4005
6" x 6" VINYL
(LOWER LIFEBOAT TO WATER)
$12.95

85-4006
6" x 6" VINYL
(RELEASE FALLS)
$12.95

85-4007
6" x 6" VINYL
(START WATER - SPRAY)
$12.95

85-4008
6" x 6" VINYL
(START AIR SUPPLY)
$12.95

85-4009
6" x 6" VINYL
(RELEASE GRIPES)
$12.95

85-6257
6" x 6" VINYL
(LOCKER ADDITIONAL BREATHING APPARATUS)
$12.95

"SOLAS SYMBOLS (GREEN ON GLOW)"

85-4031
6" x 6" VINYL
(EMERGENCY EXIT)
$12.95

85-4091
8" x 4" VINYL
(EMERGENCY EXIT ARROW)
$10.50

NC-1000
6" x 10" VINYL
(WORK VEST BOX MARKER)
$21.60

NC-1001
6" x 10" VINYL
(LIFE JACKET BOX MARKER)
$21.60

85-1781
7" x 10" VINYL
(ESCAPE LADDER)
$19.50

85-4010
6" x 6" VINYL
(LIFEBOAT)
$12.95

85-4011
6" x 6" VINYL
(RESCUE BOAT)
$12.95

85-4012
6" x 6" VINYL
(LIFERAFT)
$12.95

85-4017
6" x 6" VINYL
(LIFEBUOY WITH LINE)
$12.95

85-4081
6" x 6" VINYL
(LIFEBUOY WITH LIGHT)
$12.95

85-4020
6" x 6" VINYL
(LIFEBUOY WITH LIGHT AND SMOKE)
$12.95

85-4021
6" x 6" VINYL
(LIFE JACKET)
$12.95

85-4013
6" x 6" VINYL
(DAVIT - LAUNCHED LIFE RAFT)
$12.95

85-4014
6" x 6" VINYL
(EMBARKATION LADDER)
$12.95

85-4016
6" x 6" VINYL
(LIFEBUOY)
$12.95

2002 SAFETY MARKING PROGRAM

"SOLAS SYMBOLS (GREEN ON GLOW)" CONTINUED

85-4023
6" x 6" VINYL
(IMMERSION SUIT)
$12.95

85-4024
6" x 6" VINYL
(SURVIVAL CRAFT PORTABLE RADIO)
$12.95

85-4025
6" x 6" VINYL
(EPIRB)
$12.95

85-4026
6" x 6" VINYL
(RADAR TRANSPONDER)
$12.95

85-4027
6" x 6" VINYL
(SURVIVAL CRAFT PYROTECHNIC DISTRESS SIGNAL)
$12.95

85-4028
6" x 6" VINYL
(ROCKET PARACHUTE FLARES)
$12.95

85-4029
6" x 6" VINYL
(LINE - THROWING APPLIANCE)
$12.95

85-4030
6" x 6" VINYL
(MUSTER STATION)
$12.95

85-4090
6" x 4" VINYL
(DIRECTION INDICATOR)
$12.95

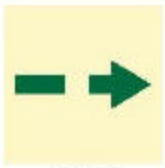
85-4000
6" x 4" VINYL
$10.50

85-4001
6" x 4" VINYL
$10.50

85-4002
6" x 4" VINYL
$10.50

85-4003
6" x 4" VINYL
$10.50

85-4260
6" x 6" VINYL
(ESCAPE ROUTING INDICATOR)
$12.95



85-4260
6" x 6" VINYL
(GREEN ARROW TAPE)
$12.95

85-1001
2" x 9.25" VINYL
(INDICATOR ARROW)
$10.50

85-1312
6" x 6" VINYL
(STAIRWAY)
$12.95

85-1402
6" x 6" VINYL
(FIRE EXTINGUISHER)
$12.95

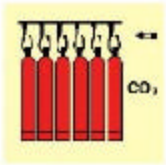
85-1403
6" x 6" VINYL
(FIRE HOSE)
$12.95

85-1300
6" x 6" VINYL
( )
$12.95

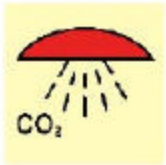
85-1301
6" x 6" VINYL
( )
$12.95

85-1302
6" x 6" VINYL
(DIRECTION INDICATOR)
$12.95

85-1303
6" x 6" VINYL
(DIRECTION INDICATOR)
$12.95

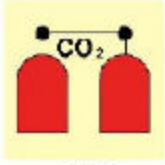


85-4212
6" x 6" VINYL
(CO2 BATTERY)
$12.95



85-4213
6" x 6" VINYL
(SPACE PROTECTED BY CO2)
$12.95

85-4214
6" x 6" VINYL
(EMBARKATION)
$12.95



85-4215
6" x 6" VINYL
(CO2 RELEASE STATION)
$12.95

85-1500
6" x 12" VINYL
( )
$19.50

85-1501
6" x 12" VINYL
( )
$19.50

85-1502
6" x 12" VINYL
( )
$19.50

2002 SAFETY MARKING PROGRAM

"SOLAS SYMBOLS (RED ON GLOW)"

85-6242
6" x 6" VINYL
(WATER MONITOR - GUN)
$12.95

85-6244
6" x 6" VINYL
(PORTABLE FIRE EXTINGUISHER)
$12.95

85-6245
6" x 6" VINYL
(PORTABLE FIRE EXTINGUISHER)
$12.95

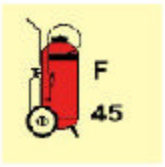
85-6246
6" x 6" VINYL
(PORTABLE FIRE EXTINGUISHER)
$12.95

85-6247
6" x 6" VINYL
(PORTABLE FIRE EXTINGUISHER)
$12.95

85-6248
6" x 6" VINYL
(PORTABLE FIRE EXTINGUISHER)
$12.95

85-6249
6" x 6" VINYL
(PORTABLE FIRE EXTINGUISHER)
$12.95

85-6250
6" x 6" VINYL
(WHEELED FIRE EXTINGUISHER)
$12.95



85-6251
6" x 6" VINYL
(WHEELED FIRE EXTINGUISHER)
$12.95

85-6252
6" x 6" VINYL
(WHEELED FIRE EXTINGUISHER)
$12.95

85-6253
6" x 6" VINYL
(PORTABLE FIRE EXTINGUISHER)
$12.95

NOBLE 2002 PICTOGRAM PROGRAM

WARNING

W8000

CORROSIVE / CHEMICALS

W8001

HIGH VOLTAGE

W8002

HIGH NOISE AREA

W8003

FLAMMABLE

W8004

RADIOACTIVE

W8005

WELDING

W8006

HIGH PRESSURE HOSE

W8009


TOXIC GAS

W8011

WIRE ROPE IN TENSION

W8019

HIGH WINDS

W8024

WET PAINT

W8025

HELICOPTER BLADE

W8026

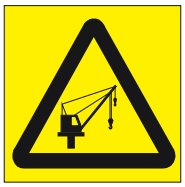

TOXIC H2S GAS

W8028

FALL OVERBOARD

W8031


AREA PROTECTED BY HALON

W8033

OFFSHORE CRANE

W8015

SLIPPERY FLOOR

W8022

HOT SURFACES

W8037

STEPPING HAZARDS

W8038

FLYING OBJECTS

W8039

HIGH PRESSURE

W8040

HEAVY DUTY FORKLIFT

W8042

CAREFUL OPEN DOOR SLOWLY

W8043

ROTATING DRILL

W8044

FALLING MAN

W8045

FORK LIFT

W8046

DECK OPENINGS

W8047

EXPLOSIVE

W8048

LOADS OVERHEAD

W8049

MOVING LOAD/ROTATING LOAD

W8050

FALLING BOXES AND PALLETS

W8051


AREA PROTECTED BY CO2

W8053

GENERAL RISK

W8054

MACHINERY/PINCH POINTS

W8093

CONFINED AREA

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MANDATORY

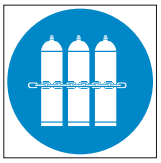
M8008

HARD HAT & EYE PROTECTION REQUIRED

M8010

HARD HAT, EYE PROTECTION & HEARING PROTECTION REQUIRED

M8012



GAS CYLINDER STORAGE

M8013

HAND PROTECTION OR RUBBER GLOVES REQUIRED

M8014

EYE PROTECTION REQUIRED

M8016

STEEL TOE BOOTS REQUIRED

M8017

FULL BODY HARNESS OR FALL PROTECTION REQUIRED

M8018

FOLLOW LOCK OUT TAG OUT PROCEDURES

M8034

HARD HAT, SAFETY GLASSES & STEEL TOE BOOTS REQUIRED

M8035

RESPIRATOR REQUIRED

M8055

MAINTAIN GOOD HOUSEKEEPING

M8056

CLEAN SPILLS

M8057

USE STOP/START

M8058

CLOSE DOOR

M8059

REPORT INJURIES

M8061

WORK PERMIT REQUIRED

M8062

WASH HANDS

M8063

USE TIE TOOLS

M8065

WEAR APRON

M8066

WEAR OVERALLS AND STEEL TOE SHOES

M8067

USE ISOLATION MAT

M8068

BLEED DOWN PRESSURE

M8069

USE TAG LINES

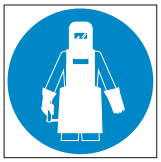
M8070

WEAR OVERALLS

M8071

WEAR HAIR CAP

M8095



USE WELDING EQUIPMENT

M8097

USE SCBA

M8099

TEST ATMOSPHERE

M8100

FASTEN SEATBELTS

M8102

USE HANDRAILS

M8103

USE CRANE SIGNALS

M8104

USE HORN

M8105

CHECK WIND DIRECTION H2S GAS

M8108

CARRY FIRE EXTINGUISHER

M8109

TOOL BOX MEETING

M8110

PLACE WATCHMAN

M8111

USE LIFEVEST

M8128

FACE SHIELD REQUIRED

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NOBLE 2002 PICTOGRAM PROGRAM

PROHIBITED

P8021

KEEP WATER AWAY

P8023

NO SMOKING

P8052

DO NOT RUN

P8072

RESTRICTED ACCESS

P8074

DO NOT WORK WITH INJURED HAND

P8075

NO WELDING

P8077

NO DRUGS

P8078

NO DIRTY BOOTS

P8079

NO DIRTY OVERALLS

P8081

NO MATCHES OR LIGHTERS

P8082

DO NOT STAND UNDER LOAD

P8083

DO NOT LIFT HEAVY LOAD

P8084

DO NOT MAKE NOISE

P8086

DO NOT LOOK AT WELDING ARC

P8087

DO NOT ROLL GAS CYLINDERS

P8088

DO NOT CLIMB ON FORKLIFT

P8089

NO DIRTY BOOTS OR COVERALLS

P8090

DO NOT STAND UNDER FORKLIFT

P8112

NO JEWELLERY

P8113

NO HARD HAT

P8114

DO NOT USE TOP STEP

P8115

NO SHARP OBJECTS

P8116

DO NOT DUMP OIL IN THE SEA

P8117

NO MOBILES

P8118

NO HAMMERS

P8120

NO CAMERAS

P8121

NO SWIMMING

P8122

NO RADIOS

P8123

DO NOT GO NEAR HELICOPTER TAIL

P8125

NO GUNS

P8124

NO FISHING

P8126

DO NOT DRINK

P8131

NO FOOD OR DRINK PERMITTED

P8132

DO NOT ENTER

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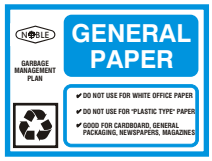
NOBLE GARBAGE MANAGEMENT PLAN

$4.00
V2967

$4.00
V2968



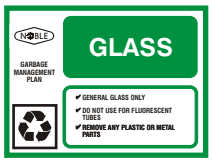
$4.00
V2969

$4.00
V2970

$4.00
V2971

$4.00
V2972

$4.00
V2973



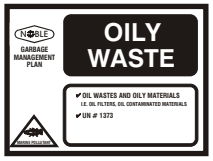
$4.00
V2974

$4.00
V2975

$4.00
V2976

$4.00
V2977

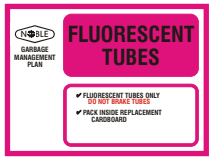
$4.00
V2978



$4.00
V2979

$4.00
V2980

$4.00
V2981



$4.00
V2982

$4.00
V2983

$4.00
V2984

$4.00
V2985

$4.00
V2986

$4.00
V2987

$4.00
V2988

$4.00
V2989

$4.00
V2990

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NOBLE ENVIRONMENTALLY SENSITIVE

$4.00
V3006

$4.00
V3007

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COMMUNICATIONS

RIG COMMUNICATION AND SAFETY SIGN STANDARD

1.0 POLICY

All personnel on board a Noble installation or facilities are expected to observe and comply with all Health, Safety & Environment signs. **Wherever possible, pictograms are to be used to eliminate the need for text-based signs**. Text-based signs are only to be replaced by the pictograms system on an as needed basis.

2.0 SCOPE

This policy specifies the minimum requirements for safety signs. It describes the signboard system, which is designed to communicate and identify hazards within specific areas, and also indicates the regulatory and prohibited actions in order to mitigate the risks associated with hazards - including signs to be used for hazardous areas, prohibited access, actions and regulatory requirements. Also covered are:

- Emergency escapes
- Crane signals
- Pipe labeling
- Minimum safety standards of the International Maritime Organization (IMO)

This policy applies to all company personnel, installations, facilities, as well as covers all subcontractors on board a Noble installation or facility.

3.0 PURPOSE

To set an international safety sign and communication standard, along with insuring the signs are posted in selected areas to create awareness, and to inform all personnel of conditions on the installation.

4.0 METHOD

All installations and facilities shall use internationally recognized pictogram type signs to convey critical information such as PPE requirements, hazards, escape routes, emergency equipment, etc.

Where text is required to ensure understanding of the hazard and/or situation, it will be in both English and the predominant local language.

Temporary barriers for specific hazards will be erected, clearly identified, and removed after the area is made safe.

5.0 TRAINING

Training should cover identifying and understanding the pictograms and locations. **(References - SPM Section 205, HR-NC-MOD-100 Module Training, COM-NC-SLR-100 Safety Sign Location Reference.)**

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6.0 ACCIDENT PREVENTION - SIGN SPECIFICATIONS

6.1 Sign Formats -

- There are six pictogram prevention sign formats**.**
- The following are the symbols and colors for safety communication and their definitions:

Yellow triangles indicate hazards

Blue circles indicate mandatory requirements

Red circles indicate prohibited actions or accesses

White rectangles indicate information

Green rectangles indicate first aid, safety equipments & evacuation means

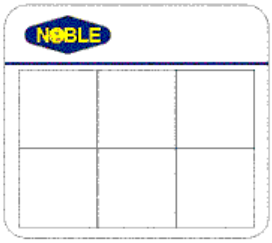
Red rectangles indicate fire fighting equipment

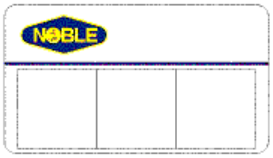
6.2 Grid Signboard

6.2.1 Standard IMO grid signboards are to be installed at the access points to areas requiring 3 or more pictograms and should highlight the potential risks within that area. This includes escape routes requiring 3 or more pictograms.

.6.2.2 The grid signboards are designed to:

- Indicate likely risks/hazards within the area
- Indicate mandatory requirements to be observed in the area
- Indicate prohibited actions in the area





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6.2.3 A Risk Analysis must be conducted for each rig area in order to prepare a recommended location for the signboard (if applicable).

6.3 Hierarchy With Pictogram Placement

6.3.1 Signboards containing only hazard, mandatory, prohibited and/or IMO pictograms will be used to mark an area.

6.3.2 The top grid section **Hazard signs**

6.3.3 The mid section **Mandatory signs**

6.3.4 The bottom section **Prohibited signs**

6.3.5 Safety signs should not be mixed between relevant sections unless there are 3 or less pictograms

6.3.6 If necessary, a forth level may be used for the **IMO** pictograms

Note: The safety information signboard may be customized by the rig depending on what is identified as being important for any one operating area.

6.4 SOLAS Signs

6.4.1 The safety grid pattern signboard shall also be used to display mandatory IMO signs for the following locations: lifeboat area, life raft area, davit-launched raft area, outside escape route marking.

- Arrows indicates the direction
- Lifeboat sign indicates that there are liferafts in that direction
- Numbers indicate the life boat/raft in that direction
- Lifejacket sign indicates there are lifejackets available at the lifeboat station

6.5 Accident Prevention Sign Recommendations

6.5.1 Marine and Offshore Drilling Units

- **See SOP 602 Appendix 1, Rig Communication and Safety Standard for the guidance.**

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7.0 PIPE IDENTIFICATION COLOR CODES

7.1 Description Of Markings

The markings will consist of 2 two-inch (five centimeters) bands of vinyl adhesive tape. The first bans positioned closest to the primary source of flow will have black arrows on a colored background. The arrows will be positioned to display the primary direction of flow and the background color will identify the system that the pipe belongs.

The second band will be a solid color (see Figure 1) that will identify the content.

There may be local regulatory requirements which mandate the use of printed descriptions of the pipe contents. In these cases, the vinyl description label will have a background color that is the same as the background color of the arrow band (see Figure 2).

7.2 Marking Location

Each pipe will be marked as it enters and leaves a space.

Segments longer than 40' (12 meters) will also be marked in the middle.

Significant portions of pipe in restricted viewing arrangements are to have additional markings to make for ready identification of the pipe contents.

7.3 Arrow Band Colors

7.3.1 The four colors used for background on the arrow band with descriptions.

RED	fire quenching
YELLOW	materials hazardous to life and property
GREEN	liquids that pose little or no threat to life or property
BLUE	gases of low pressure and temperature that offer little or no threat to life or property.

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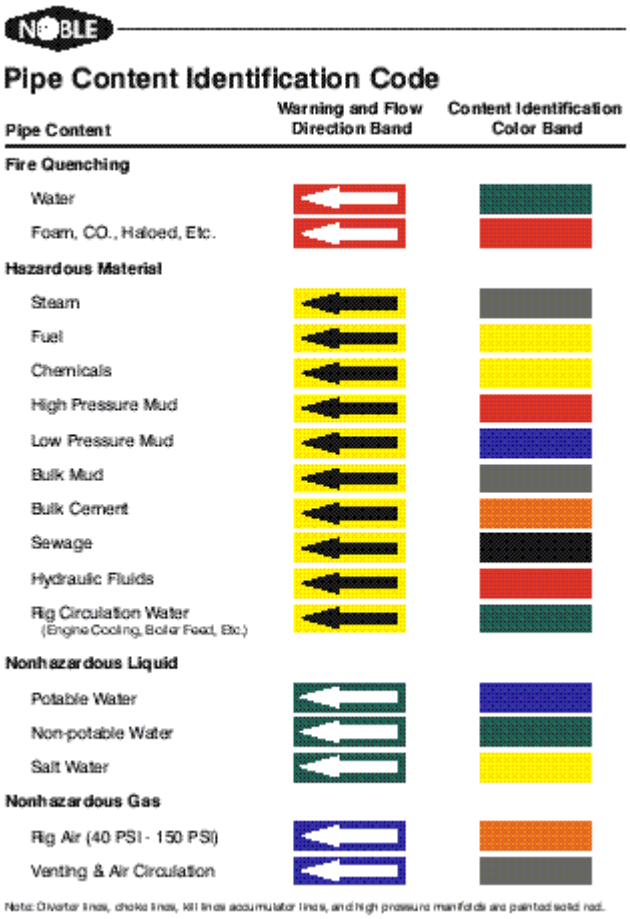
7.4 Pipe Content Identification Code



Pipe Content Identification Code

Pipe Content	Warning and Flow Direction Band	Content Identification Color Band
Fire Quenching		
Water		
Foam, CO., Haloed, Etc.		
Hazardous Material		
Steam		
Fuel		
Chemicals		
High Pressure Mud		
Low Pressure Mud		
Bulk Mud		
Bulk Cement		
Sewage		
Hydraulic Fluids		
Rig Circulation Water (Engine Cooling, Boiler Feed, Etc.)		
Nonhazardous Liquid		
Potable Water		
Non-potable Water		
Salt Water		
Nonhazardous Gas		
Rig Air (40 PSI - 150 PSI)		
Venting & Air Circulation		

Note: Diverter lines, choke lines, kill lines accumulator lines, and high pressure manifolds are painted solid red.

7.5 Warning And Flow Direction Band

Red band with black arrows (Fire Warning)	Fire quenching materials (Water, Halon, CO_2, etc.)
Yellow Band with black arrows (Hazardous Material)	Steam, fuel, chemicals, H.P. mud, L.P. mud, bulk mud/cement, sewage, hydraulic lines, hot water (rig engine cooling, boiler feed / return)
Green Band with black arrows (Non Hazardous Liquid)	Potable and non-potable Water
Blue Band with black arrows (Non Hazardous gas)	Rig air, venting & air circulation

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7.6 Pipe Content

	Arrow Band Background Color	Identification Band Color
Fire Quenching		
Water	Red	Green
Foam, CO_2, Halon, etc.		

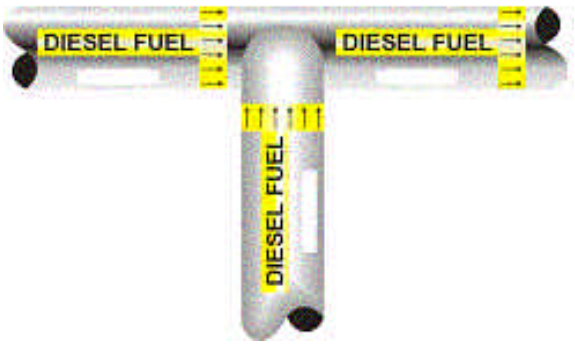
Typical Fire Quenching

Figure 1

Hazardous Material		
Steam	Yellow	Gray
Fuel	Yellow	Yellow
Chemicals	Yellow	Yellow
High Pressure Mud	Yellow	Red
Low Pressure Mud	Yellow	Blue
Bulk Mud/Cement	Yellow	Gray
Sewage	Yellow	Black
Hydraulic Fluids	Yellow	Red
Rig Circulation Water (engine cooling, boiler feed, etc.)	Yellow	Green

Typical Hazard Marking

Figure 2



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Non-Hazardous Liquid		
Potable water	Green	Blue
Non-Potable water	Green	Green
Non-Hazardous Gas		
Rig Air (40 psi-150 PSI)	Blue	Orange
High Pressure Air >150 PSI	Blue	Red
Venting & Air Circulation	Blue	Gray

NOTE: Diverter lines, choke lines, kill lines, accumulator lines and high pressure manifolds are painted solid red.

If you have any piping that does not fit the above list, contact NDSI Compliance Department.

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Location	Sign Type	National SAP#	Sign #	Description	Comments
RIG FLOOR	Pictogram		W8039	HIGH PRESSURE	
RIG FLOOR	Pictogram			SHOWER EYEWASH	
RIG FLOOR	Pictogram		W8006	HIGH PRESSURE HOSE	
RIG FLOOR	Pictogram		W8054	MACHINERY/PINCH POINTS	
RIG FLOOR	Pictogram		W8048	LOADS OVERHEAD	
RIG FLOOR	Pictogram		W8002	HIGH NOISE AREA	PLACE AT ALL ENRANCES OF HIGH NOISE AREA.
RIG FLOOR	Pictogram			ARROW	DIRECTION OF EXIT
RIG FLOOR	Pictogram		W8001	HIGH VOLTAGE	ON DRILLERS CONSOLE IF CONTROLS ARE ELECTRIC AND ON HIGH WOLTAGE BOXES
RIG FLOOR	Pictogram		W8043	ROTATING DRILL	
RIG FLOOR	Pictogram		W8034	SLIPPERY FLOOR	
RIG FLOOR	Pictogram		P8021	KEEP WATER AWAY	AS REQUIRED
RIG FLOOR	Pictogram		P8126	NON-POTABLE NO/DRINKING	
RIG FLOOR	Pictogram		M8068	BLEED DOWN PRESSURE	
RIG FLOOR	Pictogram		M8017	HARNESS/ BODY PROTECT	AT BASE OF EACH LADDER
RIG FLOOR	Pictogram		M8013	HAND PROTECTION	
RIG FLOOR	Pictogram		M8102	USE HANDRAILS	
RIG FLOOR	Pictogram		NC-1001	LIFE JACKETS	
RIG FLOOR	Pictogram		85-1506	EXIT SIGNS	AT EACH EXIT
RIG FLOOR	Pictogram			CAUTION EYE PROTECTION	WHEN CHIPPING GRINDING, CUTTING OR DRIVING WITH HAMMER
RIG FLOOR	Text			SAFETY BOARD	INSIDE OF DOG HOUSE
RIG FLOOR	Text			CAUTION TOXIC/HAZARDOUS CHEMICALS	RIGHT TO KNOW STATION LOCATION
RIG FLOOR	Text			CAUTION GUARD V-DOOR	V-DOOR MUST BE GAURDED (EA SIDE)
RIG FLOOR	Text			NOBLE PIPE MARKING CODE	2 PLACES
SHAKER AREA	Pictogram		M8013	HAND/GLOVE PROTECTION	
SHAKER AREA	Pictogram		M8018	FOLLOW LOCKOUT/TAGOUT	
SHAKER AREA	Pictogram		M8102	USE HANDRAILS	
SHAKER AREA	Pictogram		P8116	NO DUMPING OIL INTO SEA	
SHAKER AREA	Pictogram		W8054	MACHINERY/PINCH POINTS	
SHAKER AREA	Pictogram		M8055	HOUSKEEPING	AS REQUIRED
SHAKER AREA	Pictogram		W8034	SLIPPERY FLOOR	
SHAKER AREA	Text		V-2247	PIPE CONTENT CODE	
SHAKER AREA	Text		V-4023	OIL RELATED MATERIALS	
SHAKER AREA	Text		V-4021	DIESEL/RELATED MATERIALS	
SHAKER AREA	Pictogram			EYE WASH SHOWER	
SHAKER AREA	Pictogram			PPE INSIDE	
BENCH GRINDER	Pictogram		M8034	AFETY GLASSES AND STEELED TOED BOOTS REQUIRED	
BENCH GRINDER	Pictogram		W8054	MACHINERY/PINCH POINTS	
BENCH GRINDER	Pictogram		M8128	FACE SHIELD REQUIRED	
CHANGE ROOM	Pictogram		P8078	NO DIRTY BOOTS	
CHANGE ROOM	Pictogram		M8058	CLOSE DOOR	
CHANGE ROOM	Pictogram		M8055	GOOD HOUSEKEEPING	
CHANGE ROOM	Pictogram		M8034	AFETY GLASSES AND STEELED TOED BOOTS REQUIRED	
CHANGE ROOM	Pictogram		M8062	WASH HANDS	
CHANGE ROOM	Text			NOTICE	INSTRUCTION AT EACH ALARM DEVICE ADVISING ACTION TO BE TAKEN WHEN ALARM SOUNDS
CHANGE ROOM	Text			CAUTION TOXIC/HAZARDOUS CHEMICALS	RIGHT TO KNOW STATION LOCATION
CHANGE ROOM	Text			GENERAL ALARM	POSTED AT EACH ALARM DEVICE
COMPRESSED AIR TANKS AND VESSELS	Text		V-4018	NON-FLAMMABLE PLACARD	
ELECTRICAL PANELS	Pictogram		W8001	HIGH VOLTAGE	
ELECTRICAL PANELS	Pictogram		P8021	KEEP WATER AWAY	
ELECTRICAL PANELS	Pictogram		M8018	LOCKOUT/TAGOUT	
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8051	AREA PROTECTED BY CO2	
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8051	AREA PROTECTED BY CO2	
ENGINE ROOM / GENERATOR ROOM	Pictogram		M8058	CLOSE DOOR	
ENGINE ROOM / GENERATOR ROOM	Pictogram		M8058	CLOSE DOOR	
ENGINE ROOM / GENERATOR ROOM	Text			DANGER EQUIPMENT START/STOP	POSTED NEAR ALL AUTOMATICALLY OR REMOTE EQUIPMENT THAT STARTS OR STOPS
ENGINE ROOM / GENERATOR ROOM	Text			DANGER EQUIPMENT START/STOP	POSTED NEAR ALL AUTOMATICALLY OR REMOTE EQUIPMENT THAT STARTS OR STOPS
ENGINE ROOM / GENERATOR ROOM	Text			DIESEL	PLACARD
ENGINE ROOM / GENERATOR ROOM	Pictogram		P8083	DO NOT LIFT HEAVY LOAD	
ENGINE ROOM / GENERATOR ROOM	Pictogram		M8018	FOLLOW LOCKOUT/TAGOUT	
ENGINE ROOM / GENERATOR ROOM	Pictogram		M8018	FOLLOW LOCKOUT/TAGOUT	
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8002	HIGH NOISE AREA	PLACE AT ALL ENRANCES OF HIGH NOISE AREA.
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8039	HIGH PRESSURE	
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8001	HIGH VOLTAGE	
FIRE EXTINGUISHER	Pictogram		85-1402	FIRE EXTINGUISHER	
FIRE HOSE	Pictogram		85-1403	FIRE HOSE	
FUELTANKS, FUEL BULKHEADS AND DAYTANKS AREAS/ TANKS.	Pictogram		M8075	NO WELDING	
FUELTANKS, FUEL BULKHEADS AND DAYTANKS AREAS/ TANKS.	Pictogram		W8003	FLAMMABLE	

Location	Sign Type	National SAP#	Sign #	Description	Comments
FUELTANKS, FUEL BULKHEADS AND DAYTANKS AREAS/ TANKS.	Pictogram		W8047	EXPLOSIVE	
FUELTANKS, FUEL BULKHEADS AND DAYTANKS AREAS/ TANKS.	Text			1993 PLACARD	
FUELTANKS, FUEL BULKHEADS AND DAYTANKS AREAS/ TANKS.	Text			DIESEL AND DIESEL BASED MATERIALS-PLACARD	
FUELTANKS, FUEL BULKHEADS AND DAYTANKS AREAS/ TANKS.	Text			FUEL VENT	
GALLEY	Pictogram		W8035	HOT SURFACES	
GALLEY	Pictogram		W8036	HOT LIQUIDS	
GALLEY	Pictogram		P8113	NO HARD HATS	
GALLEY	Pictogram		P8079	NO DIRTY OVERALLS	
GALLEY	Pictogram		M8071	WEAR HAIR CAP	
GALLEY	Pictogram		M8062	WASH HANDS	
GALLEY	Pictogram		M8056	CLEAN SPILLS	
GALLEY	Pictogram		P8078	NO DIRTY BOOTS	
GALLEY	Pictogram		W8034	SLIPPERY FLOOR	
GALLEY	Text			FIRE BLANKET	
GALLEY	Text			NO CAPS OR WORK CLOTHES	
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8035	HOT SURFACES	EXHAUST
ENGINE ROOM / GENERATOR ROOM	Pictogram		M8067	ISOLATION MATS	
ENGINE ROOM / GENERATOR ROOM	Pictogram		P8021	KEEP WATER AWAY	
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8054	MACHINERY/PINCH POINTS	
ENGINE ROOM / GENERATOR ROOM	Text		V-4018	NON-FLAMMABLE PLACARD	PLACARD AT POSTED ON EACH AIR RECEIVER TANK.
ENGINE ROOM / GENERATOR ROOM	Pictogram		W8039	PRESSURIZED TANKS	
ENGINE ROOM / GENERATOR ROOM	Pictogram		P8072	RESTRICTED ACCESS	
HELIPORT AREA	Pictogram		W8025	Beware of Tail Rotor	
HELIPORT AREA	Pictogram		V-4209	NOTICE	NO JOGGING
HELIPORT AREA	Pictogram		V-6001	WELCOME ABOARD	
INFIRMARY	**Text**		V-4000	FIRST AID OR MEDIC	
MAIN DECK	Pictogram		M8055	GOOD HOUSEKEEPING	
MAIN DECK	Pictogram		W8048	LOADS OVERHEAD	
MAIN DECK	Pictogram		M8017	HARNESS/ BODY PROTECT	
MAIN DECK	Pictogram		M8111	USE LIFEVEST	
MAIN DECK	Pictogram		M8069	USE TAG LINES	
MAIN DECK	Pictogram		M8103	USE CRANE SIGNALS	VARIOUS CONSPICUOUS AREAS
MAIN DECK	Pictogram		W8038	FLYING OBJECTS	VARIOUS CONSPICUOUS AREAS
MAIN DECK	Pictogram		P8082	DON'T STAND UNDER LOAD	VARIOUS CONSPICUOUS AREAS
MAIN DECK	Pictogram		W8033	OFFSHORE CRANE	VARIOUS CONSPICUOUS AREAS
MAIN DECK	Text			SAFE WELDING AREA	
MAIN DECK	Text		V-0086	EMER FUEL SHUTDOWN	
MECHANIC SHOP	Pictogram		W8001	HIGH VOLTAGE	AS REQUIRED
MECHANIC SHOP	Pictogram		M8067	ISOLATION MATS	AS REQUIRED
MECHANIC SHOP	Pictogram		M8013	HAND PROTECTION	AS REQUIRED
MECHANIC SHOP	Pictogram		P8083	DO NOT LIFT HEAVY LOAD	AS REQUIRED
MECHANIC SHOP	Pictogram		M8058	CLOSE DOOR	AS REQUIRED
MUD PUMP ROOM	Pictogram		M8018	FOLLOW LOCKOUT/TAGOUT	
MUD PUMP ROOM	Pictogram		M8068	BLEED DOWN PRESSURE	
MUD PUMP ROOM	Pictogram		P8087	DON'T ROLL GAS CYLINDERS	
MUD PUMP ROOM	Pictogram		W8001	HIGH VOLTAGE	
MUD PUMP ROOM	Pictogram		W8054	MACHINERY/PINCH POINTS	
MUD PUMP ROOM	Pictogram		W8002	HIGH NOISE AREA	PLACE AT ALL ENRANCES OF HIGH NOISE AREA.
MUD PUMP ROOM	Pictogram		W8039	HIGH PRESSURE	
MUD PUMP ROOM	Text			PIPE CONTENT	
MUD PUMP ROOM	Text			KEEP DOOR CLOSED/AFLOAT	
MUD PUMP ROOM	Text			EQUIPMENT STARTS/REMOTE	
MUD PUMP ROOM	Text			LOW PRESSURE MUD	
MUD PUMP ROOM	Text			HIGH PRESSURE MUD	
MUD PUMP ROOM	Text			GAS (NO-INFLAMMABLE)	PLACARD
MUD TANKS / PITS	Pictogram		M8099	TEST ATMOSPHERE	POST AT EACH CONFINED SPACE
MUD TANKS / PITS	Pictogram		W8093	CONFINED SPACE	POST AT EACH CONFINED SPACE
MUD TANKS / PITS	Pictogram		M8013	HAND/GLOVE PROTECTION	
MUD TANKS / PITS	Pictogram		M8018	FOLLOW LOCKOUT/TAGOUT	
MUD TANKS / PITS	Pictogram		M8102	USE HANDRAILS	
MUD TANKS / PITS	Pictogram		W8054	MACHINERY/PINCH POINTS	
MUD TANKS / PITS	Pictogram		W8034	SLIPPERY FLOOR	
MUD TANKS / PITS	Pictogram		M8058	KEEP DOOR CLOSED	POST ON BOTH SIDES OF DOORS
MUD TANKS / PITS	Pictogram			EYE WASH SHOWER	
MUD TANKS / PITS	Pictogram		W8000	DANGER CAUSTIC SODA	
NUMBER EACH STATION	Pictogram		85-4080	NUMBERS	LIFEBOAT NUMBER 1
NUMBER EACH STATION	Pictogram		85-4081	NUMBERS	LIFEBOAT NUMBER 2
NUMBER EACH STATION	Pictogram		85-4082	NUMBERS	LIFEBOAT NUMBER 3
NUMBER EACH STATION	Pictogram		85-4083	NUMBERS	LIFEBOAT NUMBER 4
OIL TANKS AND OIL STORAGE AREAS	Pictogram		M8075	NO WELDING	
OIL TANKS AND OIL STORAGE AREAS	Pictogram		W8003	FLAMMABLE	
OIL TANKS AND OIL STORAGE AREAS	Pictogram		W8047	EXPLOSIVE	
OIL TANKS AND OIL STORAGE AREAS	Text			COMBUSTIBLE PLACARD	
OIL TANKS AND OIL STORAGE AREAS	Text			HMIS OIL AND OIL RELATED PLACARD	
OIL TANKS AND OIL STORAGE AREAS	Text			LABELING	LABEL EA ITEM AS PER CONTENT (i>e>, motor oil, gear oil, hydraulic oil).

Location	Sign Type	National SAP#	Sign #	Description	Comments
OUTSIDE AND INSIDE STAIRWAYS	Pictogram		85-1506	EXIT SIGNS	BASE AND TOP OF STAIRWAYS WHERE APPLICABLE
OUTSIDE AND INSIDE STAIRWAYS	Pictogram			ESCAPE ARROWS	TOWARDS ESCAPE ROUTE
OUTSIDE AND INSIDE STAIRWAYS	Pictogram		M8101	USE HANDRAILS	BASE AND TOP
OXYGEN AND ACETLYNE STORAGE AREA	Text		V-4017	OXYGEN PLACARD	
OXYGEN AND ACETLYNE STORAGE AREA	Text		V-4014	FLAMMABLE GAS 3 PLACARD	
OXYGEN AND ACETLYNE STORAGE AREA	Text			BOTTLES	MUST HAVE APPROPRIATE DOT OR UN PLACARD
PAINT LOCKER	Pictogram		M8075	NO WELDING	
PAINT LOCKER	Pictogram		W8003	FLAMMABLE	
PAINT LOCKER	Pictogram		W8047	EXPLOSIVE	
PAINT LOCKER	Pictogram		W8051	AREA PROTECTED BY CO2	
PAINT LOCKER	Pictogram		P8081	NO MATCHES/LIGHTERS	
PAINT LOCKER	Text			PAINT/RELATED MATERIALS	HMIS PLACARD
PROPANE BOTTLES/TANKS	Text			FLAMMABLE GAS 3 PLACARD	
P-TANKS	Pictogram		P8118	NO HAMMERS	
P-TANKS	Text		V-4020	CEMENT HMIS PLACARD	
P-TANKS	Text		V-4019	BARITE HMIS	
SACK ROOM / MUD MIXING AREA	Text			DANGER CAUSTIC SODA	HMIS PLACARD
SACK ROOM / MUD MIXING AREA	Text			MSDS SHEETS	
SACK ROOM / MUD MIXING AREA	Text			PLASTIC PACKAGING	
SACK ROOM / MUD MIXING AREA	Text			BARITE	
SACK ROOM / MUD MIXING AREA	Text			PIPE CONTENT	
SACK ROOM / MUD MIXING AREA	Text			CAUSTIC SODA	
SACK ROOM / MUD MIXING AREA	Text			RESPIRATOR/SPLASH	
SACK ROOM / MUD MIXING AREA	Text			CAUTION TOXIC/HAZARDOUS CHEMICALS	RIGHT TO KNOW STATION LOCATION
SACK ROOM / MUD MIXING AREA	Text			DANGER CORROSIVE SODA	HMIS PLACARD
SACK ROOM / MUD MIXING AREA	Pictogram		M8035	RESPIRATOR REQUIRED	AT MIXING AREA
SACK ROOM / MUD MIXING AREA	Pictogram			GOGGLES	AT MIXING AREA
SACK ROOM / MUD MIXING AREA	Pictogram		M8128	FACE SHIELD REQUIRED	AT MIXING AREA
SACK ROOM / MUD MIXING AREA	Pictogram		M8065	WEAR APRON	AT MIXING AREA
SACK ROOM / MUD MIXING AREA	Pictogram		M8013	HAND/GLOVE PROTECTION	AT MIXING AREA
SACK ROOM / MUD MIXING AREA	Pictogram		W8000	CORROSIVE CHEMICALS	AT MIXING AREA
SACK ROOM / MUD MIXING AREA	Pictogram		M8061	PERMIT REQUIRED	IF APPLICABLE
SACK ROOM / MUD MIXING AREA	Pictogram		W8031	AREA PROTECTED BY HALON	IF INSTALLED
SACK ROOM / MUD MIXING AREA	Pictogram		M8008	HARD/EYE PROTECTION	
SACK ROOM / MUD MIXING AREA	Pictogram		M8055	GOOD HOUSEKEEPING	
SACK ROOM / MUD MIXING AREA	Pictogram		M8068	BLEED DOWN PRESSURE	
SACK ROOM / MUD MIXING AREA	Pictogram		M8102	USE HANDRAILS	
SACK ROOM / MUD MIXING AREA	Pictogram		P8083	DO NOT HEAVY LOAD	
SACK ROOM / MUD MIXING AREA	Pictogram		P8088	DO NOT CLIMB ON FORKLIFT	
SACK ROOM / MUD MIXING AREA	Pictogram		P8118	NO HAMMERS	
SACK ROOM / MUD MIXING AREA	Pictogram		W8034	SLIPPERY FLOOR	
SACK ROOM / MUD MIXING AREA	Pictogram		W8039	HIGH PRESSURE	
SACK ROOM / MUD MIXING AREA	Pictogram		W8039	PRESSURIZED TANKS	
SACK ROOM / MUD MIXING AREA	Pictogram		W8045	FORKLIFT	
SACK ROOM / MUD MIXING AREA	Text			CONFINED SPACE	
STORE ROOM	Pictogram		M8055	GOOD HOUSEKEEPING	
STORE ROOM	Pictogram		W8050	FALLING BOXES/ PALLETS	
STRETCHER LOCATIONS	**Pictogram**			STRETCHER	OVER EACH LOCATION
WELDING AREA	Pictogram		M8012	GAS CYLENDER STORAGE	
WELDING AREA	Pictogram		M8055	GOOD HOUSEKEEPING	
WELDING AREA	Pictogram		M8095	USE WELDIND EQUIP.	
WELDING AREA	Pictogram		M8128	FACE SHIELD REQUIRED	
WELDING AREA	Pictogram		M8061	PERMIT REQUIRED	
WELDING AREA	Pictogram		P8087	DO NOT ROLL GAS CYLINDER	
WELDING AREA	Pictogram		P8083	DO NOT LIFT HEAVY LOAD	
WELDING AREA	Pictogram		P8086	DO NOT LOOK AT ARC	
WELDING AREA	Pictogram		W8038	FLYING OBJECTS	
WELDING AREA	Pictogram		W8005	WELDING	

SSPC: The Society for Protective Coatings

SURFACE PREPARATION SPECIFICATION NO. 1

Solvent Cleaning

1. Scope

1.1 This specification covers the requirements for the solvent cleaning of steel surfaces.

2. Definition

2.1 Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces.

2.2 It is intended that solvent cleaning be used prior to the application of paint and in conjunction with surface preparation methods specified for the removal of rust, mill scale, or paint.

3. Surface Preparation Before and After Solvent Cleaning

3.1 Prior to solvent cleaning, remove foreign matter (other than grease and oil) by one or a combination of the following: brush with stiff fiber or wire brushes, abrade, scrape, or clean with solutions of appropriate cleaners, provided such cleaners are followed by a fresh water rinse.

3.2 After solvent cleaning, remove dirt, dust, and other contaminants from the surface prior to paint application. Acceptable methods include brushing, blow off with clean, dry air, or vacuum cleaning.

4. Methods of Solvent Cleaning

4.1 Remove heavy oil or grease first by scraper. Then remove the remaining oil or grease by any of the following methods:

4.1.1 Wipe or scrub the surface with rags or brushes wetted with solvent. Use clean solvent and clean rags or brushes for the final wiping.

4.1.2 Spray the surface with solvent. Use clean solvent for the final spraying.

4.1.3 Vapor degrease using stabilized chlorinated hydrocarbon solvents.

4.1.4 Immerse completely in a tank or tanks of solvent. For the last immersion, use solvent which does not contain detrimental amounts of contaminant.

4.1.5 Emulsion or alkaline cleaners may be used in place of the methods described. After treatment, wash the surface with fresh water or steam to remove detrimental residues.

4.1.6 Steam clean, using detergents or cleaners and follow by steam or fresh water wash to remove detrimental residues.

5. Inspection

5.1 All work and materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found defective under this specification. In case of dispute the arbitration or settlement procedure established in the procurement documents, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

5.2 The procurement documents covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

6. Safety

6.1 All safety requirements stated in this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

7. Notes*

7.1 While every precaution is taken to ensure that all information furnished in SSPC standards and specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials, coatings, or methods specified herein, or of the standard itself.

7.2 A Commentary Section is available and contains additional information and data relative to this specification. The Surface Preparation Commentary, SSPC-SP COM, is not part of this specification. The table below lists the subjects discussed relevant to solvent cleaning and appropriate Commentary Section.

Subject	SSPC-SP COM Section
Solvents and Cleaners	5.1.1 through 5.1.3
Steam Cleaning	5.1.4
Threshold Limit Values	5.1.5
Film Thickness	10

*Notes are not requirements of this specification.

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SURFACE PREPARATION SPECIFICATION NO. 2

Hand Tool Cleaning

1. Scope

1.1 This specification covers the requirements for the hand tool cleaning of steel surfaces.

2. Definitions

2.1 Hand tool cleaning is a method of preparing steel surfaces by the use of non-power hand tools.

2.2 Hand tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.

2.3 ISO 8501-1:1988 or other visual standards of surface preparation agreed upon by the contracting parties may be used to further define the surface.

3. Reference Standards

3.1 The standards referenced in this specification listed in Section 3.4 and form a part of the specification.

3.2 The latest issue, revision, or amendment of the reference standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and the specification, the requirements of the specification shall prevail.

3.4 SSPC SPECIFICATIONS:

SSPC-SP 1	Solvent Cleaning

3.5 International Organization for Standardization (ISO):

850-1:1988	Preparation of steel substrates before application of paints and related products: visual assessment of surface cleanliness, Part I.

4. Surface Preparation Before and After Hand Tool Cleaning

4.1 Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP 1.

4.2 After hand tool cleaning and prior to painting, reclean the surface if it does not conform to this specification.

4.3 After hand tool cleaning and prior to painting, remove dirt, dust, or similar contaminants from the surface. Acceptable methods include brushing, blow off with clean, dry air, or vacuum cleaning.

5. Methods of Hand Tool Cleaning

5.1 Use impact hand tools to remove stratified rust (rust scale).

5.2 Use impact hand tools to remove all weld slag.

5.3 Use hand wire brushing, hand abrading, hand scraping, or other similar non-impact methods to remove all loose mill scale, all loose or non-adherent rust, and all loose paint.

5.4 Regardless of the method used for cleaning, if specified in the procurement documents, feather edges of remaining old paint so that the repainted surface can have a reasonably smooth appearance.

5.5 If approved by the owner, use power tools or blast cleaning as a substitute cleaning method for this specification.

6. Inspection

6.1 All work and materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found defective under this specification. In case of dispute the arbitration or settlement procedure established in the procurement documents, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure speci-

fied by the American Arbitration Association shall be used.

6.2 The procurement documents covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

7. Safety

7.1 All safety requirements stated in this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

8. Notes*

8.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility or incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

8.2 A Commentary Section is available and contains additional information and data relevant to this specification. The Surface Preparation Commentary, SSPC-SP COM, is not part of this specification. The table below lists the subjects discussed relevant to hand tool cleaning and appropriate Commentary Section.

	SSPC-SP COM Section
Film Thickness	10
Maintenance Painting	4.2
Rust Back	4.5
Visual Standards	11
Weld Spatter	4.4.1

8.3 Note that the use of visual standards in conjunction with this specification is required only when they are specified in the procurement documents (project specification) covering the work. It is recommended, however, that the use of visual standards be made mandatory in the procurement documents.

SSPC-VIS 3, “Visual Standard for Power- and Hand-Tool Cleaned Steel,” provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. For more information about visual standards see SSPC-SP COM, Section 11.

*Notes are not requirements of this specification.

SSPC: The Society for Protective Coatings

SURFACE PREPARATION SPECIFICATION NO. 3

Power Tool Cleaning

1. Scope

1.1 This specification covers the requirements for power tool cleaning of steel surfaces.

2. Definition

2.1 Power tool cleaning is a method of preparing steel surfaces by the use of power assisted hand tools.

2.2 Power tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.

2.3 SSPC-VIS 3, ISO 8501-1:1988 or other visual standards of surface preparation agreed upon by the contracting parties may be used to further define the surface.

3. Reference Standards

3.1 The standards referenced in this specification are listed in Section 3.4 and form a part of the specification.

3.2 The latest issue, revision or amendment of the reference standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and the specification, the requirements of the specification shall prevail.

3.4 SSPC SPECIFICATIONS:

SP 1	Solvent Cleaning
VIS 3	Visual Standard for Power- and Hand Tool Cleaned Steel

3.5 International Organization for Standardization (ISO):

8501-1:1988	Preparation of Steel Substrates Before Application of Paints and Related Products: Visual Assessment of Surface Cleanliness, Part I

4. Surface Preparation Before and After Power Tool Cleaning

4.1 Before power tool cleaning, remove visible oil, grease, soluble welding residue, and salts by the methods outlined in SSPC-SP 1.

4.2 After power tool cleaning and prior to painting, reclean the surface if it does not conform to this specification.

4.3 After power tool cleaning and prior to painting, remove dirt, dust, or similar contaminants from the surface. Acceptable methods include brushing, blow off with clean, dry air, or vacuum cleaning.

5. Methods of Power Tool Cleaning

5.1 Use rotary or impact power tools to remove stratified rust (rust scale).

5.2 Use rotary or impact power tools to remove all weld slag.

5.3 Use power wire brushing, power abrading, power impact or other power rotary tools to remove all loose mill scale, all loose or non-adherent rust, and all loose paint. Do not burnish the surface.

5.4 Operate power tools in a manner that prevents the formation of burrs, sharp ridges, and sharp cuts.

5.5 Regardless of the method used for cleaning, if specified in the procurement documents, feather edges of remaining old paint so that the repainted surface can have a reasonably smooth appearance.

5.6 if approved by the owner, use blast cleaning as substitute cleaning method for this specification.

6. Inspection

6.1 All work and materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found defective under this specification. In case of dispute the arbitration or settlement procedure established in the procure-

ment documents, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

6.2 The procurement documents covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

7. Safety

7.1 All safety requirements stated in this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

8. Notes*

8.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility or incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

8.2 A Commentary Section is available and contains additional information and data relevant to this specification.

The Surface Preparation Commentary, SSPC-SP COM, is not part of this specification. The table below lists the subjects discussed relevant to power tool cleaning and appropriate Commentary Section.

SSPC-SP COM	Section
Film Thickness	10
Rust Back	4.5
Visual Standards	11
Weld Spatter	4.4.1

8.3 Note that the use of visual standards in conjunction with this specification is required only when they are specified in the procurement documents (project specification) covering the work. It is recommended, however, that the use of visual standards be made mandatory in the procurement documents.

SSPC-VIS 3, “Visual Standard for Power- and Hand-Tool Cleaned Steel,” provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. For more information about visual standards, see SSPC-SP COM, Section 11.

*Notes are not requirements of this specification.

Joint Surface Preparation Standard

SSPC-SP 5/NACE NO. 1

White Metal Blast Cleaning

This SSPC: The Society for Protective Coatings and NACE International standard represents a consensus of those individual members who have reviewed this document, its scope and provisions. Its acceptance does not in any respect preclude anyone, having adopted the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in conformance with this standard. Nothing contained in this standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by Letters Patent, or as indemnifying or protecting anyone against liability for infringement of Letters Patent. This standard represents minimum requirements and should in no way be interpreted as a restriction on the use of better procedures or materials. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. SSPC and NACE assume no responsibility for the interpretation or use of this standard by other parties and accept responsibility for only those official interpretations issued by SSPC or NACE in accordance with their respective governing procedures and policies, which preclude the issuance of interpretations by individual volunteers.

Users of this standard are responsible for reviewing appropriate health, safety, and regulatory documents and for determining their applicability in relation to this standard prior to its use. This SSPC/NACE standard may not necessarily address all potential health and safety problems or environmental hazards associated with the use of materials, equipment and/or operations detailed or referred to within this standard. Users of this standard are also responsible for establishing appropriate health, safety, and environmental protection practices, in consultation with appropriate regulatory authorities, if necessary, to achieve compliance with any existing applicable regulatory requirements prior to the use of this standard.

CAUTIONARY NOTICE: SSPC/NACE standards are subject to periodic review and may be revised or withdrawn at any time without prior notice. SSPC and NACE require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication. The user is cautioned to obtain the latest edition. Purchasers may receive current information on all standards and other publications by contacting the organizations at the addresses below:

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Foreword

This joint standard covers the use of blast cleaning abrasives to achieve a defined degree of cleaning of steel surfaces prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others whose responsibility it may be to define a standard degree of surface cleanliness.

The focus of this standard is white metal blast cleaning. Near-white metal blast cleaning, commercial blast cleaning, industrial blast cleaning and brush-off blast cleaning are addressed in separate standards.

White metal blast cleaning provides a greater degree of cleaning than near-white blast cleaning (SSPC-SP 10/NACE No. 2).

The difference between a white metal blast and a near-white blast is that a white metal blast removes all of the coating, mill scale, rust, oxides, corrosion products, and other foreign matter from the surface. Near-white blasting allows light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating to remain on no more than 5 percent of each unit area of surface.

This joint standard was prepared by the SSPC/NACE Task Group A on Surface Preparation by Abrasive Blast Cleaning. This joint Task Group includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation.

1. General

1.1 This joint standard covers the requirements for white metal blast cleaning of unpainted or painted steel surfaces by the use of abrasives. These requirements include the end condition of the surface and materials and procedures necessary to achieve and verify the end condition.

1.2 The mandatory requirements are described in Sections 1 to 9 as follows:

Section 1	General
Section 2	Definition
Section 3	References
Section 4	Procedures Before Blast Cleaning
Section 5	Blast Cleaning Methods and Operation
Section 6	Blast Cleaning Abrasives
Section 7	Procedures Following Blast Cleaning and Immediately Prior to Coating
Section 8	Inspection
Section 9	Safety and Environmental Requirements

NOTE: Section 10, "Comments" and Appendix A, "Explanatory Notes" are not mandatory requirements of this standard.

2. Definition

2.1 A white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter.

2.2 Acceptable variations in appearance that do not affect surface cleanliness as defined in Section 2.1 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat affected zones, blasting abrasives, and differences due to blasting technique.

2.3 When a coating is specified, the surface shall be roughened to a degree suitable for the specified coating system.

2.4 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning specified herein.

2.5 SSPC-VIS 1-89 may be specified to supplement the written definition. In any dispute, the written standards shall take precedence over visual standards and comparators. Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

3. References

3.1 The documents referenced in this standard are listed in Section 3.4.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this standard, the requirements of this standard shall prevail.

3.4 SSPC: The Society For Protective Coatings Standards:

AB 1	Mineral and Slag Abrasives
AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
AB 3	Newly Manufactured or Re-Manufactured Steel Abrasives
PA Guide 3	A Guide to Safety in Paint Application
SP 1	Solvent Cleaning
VIS 1	Visual Standard for Abrasive Blast Cleaned Steel

4. Procedures Before Blast Cleaning

4.1 Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1 or other agreed upon methods.

4.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification). Additional information on surface imperfections is available in Section A.5 of Appendix A.

4.3 If a visual standard or comparator is specified to supplement the written standard, the condition of the steel prior to blast cleaning should be determined before the blasting commences. Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

5. Blast Cleaning Methods and Operation

5.1 Clean, dry compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve this requirement.

5.2 Any of the following methods of surface preparation may be used to achieve a white metal abrasive blast cleaned surface:

5.2.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

5.2.2 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

5.2.3 Dry abrasive blasting using a closed cycle, recirculating abrasive system with centrifugal wheels and abrasive.

5.3 Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve a white metal blast cleaned surface by mutual agreement between those responsible for performing the work and those responsible for establishing the requirements. NOTE: Information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Section A.9 of Appendix A.

6. Blast Cleaning Abrasives

6.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

6.2 The cleanliness and size of recycled abrasives shall be maintained to ensure compliance with this specification.

6.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1, AB 2 and AB 3.

6.4 Any limitations on the use of specific abrasives, the quantity of contaminants, or the degree of allowable embedment shall be included in the procurement documents (project specification) covering the work, because abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements. NOTE: Additional information on abrasive selection is given in Section A.2 of Appendix A.

7. Procedures Following Blast Cleaning and Immediately Prior to Coating

7.1 Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP 1 or another method agreed upon by those parties responsible for establishing the requirements and those responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning, or other methods agreed upon by those responsible for establishing the requirements and those responsible for performing the work. NOTE: The presence of toxic metals in the abrasives or paint being removed may place restrictions on the methods of cleaning permitted. Comply with all applicable regulations. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

7.3 After blast cleaning, surface imperfections that remain (e.g., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers, etc.) shall be removed to the extent required in the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Section 2.4. NOTE: Additional information on surface imperfections is contained in Section A.5 of Appendix A.

7.4 Any visible rust that forms on the surface of the steel after blast cleaning shall be removed by recleaning the rusted areas to meet the requirements of this standard before coating. NOTE: Information on rust-back (re-rusting) and surface condensation is contained in Sections A.6, A.7 and A.8 of Appendix A.

8. Inspection

8.1 Work and materials supplied under this standard are subject to inspection by a representative of those responsible for establishing the requirements. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and supplier shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

9. Safety and Environmental Requirements

9.1 Because abrasive blast cleaning is a hazardous operation, all work shall be conducted in compliance with applicable occupational and environmental health and safety rules and regulations. NOTE: SSPC-PA Guide 3, “A Guide to Safety in Paint Application,” addresses safety concerns for coating work.

10. Comments

10.1 Additional information and data relative to this standard are contained in Appendix A. Detailed information and data are presented in a separate document, SSPC-SP COM, “Surface Preparation Commentary.” The recommendations contained in Appendix A and SSPC-SP COM are believed to represent good practice, but are not to be

considered requirements of the standard. The sections of SSPC-SP COM that discuss subjects related to industrial blast cleaning are listed below.

Subject	Commentary Section
Abrasive Selection	6
Film Thickness	10
Wet Abrasive Blast Cleaning	8.2
Maintenance Repainting	4.2
Rust-back (Re-rusting)	8.3
Surface Profile	6.2
Visual Standards	11
Weld Spatter	4.4.1

Appendix A. Explanatory Notes

A.1 FUNCTION: White metal blast cleaning (SSPC-SP 5/NACE No. 1) provides the greatest degree of cleaning. It should be used when the highest degree of blast cleaning is required. The primary functions of blast cleaning before coating are: (a) to remove material from the surface that can cause early failure of the coating system and (b) to obtain a suitable surface roughness and to enhance the adhesion of the new coating system**.** The hierarchy of blasting standards is as follows: white metal blast cleaning, near-white blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning.

A.2 ABRASIVE SELECTION: Types of metallic and non-metallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). It is important to recognize that blasting abrasives may become embedded in or leave residues on the surface of the steel during preparation. While normally such embedment or residues are not detrimental, care should be taken to ensure that the abrasive is free from detrimental amounts of water-soluble, solvent-soluble, acid-soluble, or other soluble contaminants (particularly if the prepared steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are given in SSPC-AB 1, "Mineral and Slag Abrasives," SSPC-AB 2, "Cleanliness of Recycled Ferrous Metallic Abrasives," and SSPC-AB 3, "Newly Manufactured or Re-Manufactured Steel Abrasives."

A.3 SURFACE PROFILE: Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth (or height) is dependent upon the size, shape, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent upon the thickness of the coating to be applied. Large particle sized abrasives (particularly metallic) can produce a profile that may be too deep to be adequately covered by a single thin film coat. Accordingly, it is recommended that the use of larger abrasives be avoided in these cases. However, larger abrasives may be needed for thick film coatings or to facilitate removal of thick coatings, heavy mill scale, or rust. If control of profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical profile heights achieved with commercial abrasive media are shown in Table 5 of the Surface Preparation Commentary (SSPC-SP COM). Surface profile should be measured in accordance with NACE Standard RP0287 (latest edition), "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape, " or ASTM[1] D 4417 (latest edition), "Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel."

A.4 VISUAL STANDARDS: Note that the use of visual standards or comparators in conjunction with this standard is required only when specified in the procurement document (project specification) covering the work. However, it is strongly recommended that the procurement document require the use of visual standards or comparators. SSPC-VIS 1-89 (Visual Standard for Abrasive Blast Cleaned Steel) provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The series A-SP 5, B-SP 5, C-SP 5 and D-SP 5 depict surfaces cleaned to white metal grade. In addition, the series A-SP 5 M and N depict surfaces cleaned by various metallic and non-metallic abrasives to SP 5 condition. The NACE Visual Comparator for Surface Finishing of Welds Prior to Coating is a plastic weld replica that complements NACE Standard RP 0178. Other available visual standards are described in Section 11 of SSPC-SP COM.

A.5 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the service is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features that are difficult to properly cover and protect include crevices, weld porosities, laminations, etc. The high cost of the methods to remedy surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper plan-

[1] ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ning for such surface repair work is essential because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4.4 of SSPC-SP COM and NACE Standard RP0178 (latest edition), "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service" contain additional information on surface imperfections.

A.6 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (e.g., chlorides and sulfates) develops rust-back rapidly at intermediate and high humidities. These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during blast cleaning if the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in SSPC-SP 12/NACE No. 5. Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-TU 4, "Technology Update on Field Methods for Retrieval and Analysis of Soluble Salts on Substrates."

A.7 RUST-BACK: Rust-back (re-rusting) occurs when freshly cleaned steel is exposed to moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, if chemical contamination is not present (see Section A.6), it is best to blast clean and coat a surface the same day. Severe conditions may require more expedient coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating (see Section A.6).

A.8 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of the steel surface be at least 3 °C (5 °F) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations and to avoid the application of coating over a damp surface.

A.9 WET ABRASIVE BLAST CLEANING: Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing. It may be necessary that inhibitors be added to the water or applied to the surface immediately after blast cleaning to temporarily prevent rust formation. The use of inhibitors or the application of coating over slight discoloration should be in accordance with the requirements of the coating manufacturer. CAUTION: Some inhibitive treatments may interfere with the performance of certain coating systems.

A.10 FILM THICKNESS: It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry film thickness of the coating above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured the procedures in SSPC-PA 2 (latest edition), "Measurement of Dry Coating Thickness with Magnetic Gauges" should be used.

A.11 MAINTENANCE AND REPAIR PAINTING: When this standard is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness**.** In these cases, the cleaning shall be performed across the entire area specified. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning shall be applied 100% to all weld seams. If the entire structure is to be prepared, this degree of cleaning shall be applied to 100% of the entire structure. SSPC-PA Guide 4 (latest edition), "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

Joint Surface Preparation Standard

SSPC-SP 6/NACE NO. 3

Commercial Blast Cleaning

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Users of this standard are responsible for reviewing appropriate health, safety, and regulatory documents and for determining their applicability in relation to this standard prior to its use. This SSPC/NACE standard may not necessarily address all potential health and safety problems or environmental hazards associated with the use of materials, equipment and/or operations detailed or referred to within this standard. Users of this standard are also responsible for establishing appropriate health, safety, and environmental protection practices, in consultation with appropriate regulatory authorities, if necessary, to achieve compliance with any existing applicable regulatory requirements prior to the use of this standard.

CAUTIONARY NOTICE: SSPC/NACE standards are subject to periodic review and may be revised or withdrawn at any time without prior notice. SSPC and NACE require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication. The user is cautioned to obtain the latest edition. Purchasers may receive current information on all standards and other publications by contacting the organizations at the addresses below:

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Foreword

This joint standard covers the use of blast cleaning abrasives to achieve a defined degree of cleaning of steel surfaces prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others whose responsibility it may be to define a standard degree of surface cleanliness.

The focus of this standard is commercial blast cleaning. White metal blast cleaning, near-white blast cleaning, industrial blast cleaning, and brush-off blast cleaning are addressed in separate standards.

Commercial blast cleaning provides a greater degree of cleaning than industrial blast cleaning (SSPC-SP 14/NACE No. 8), but less than near-white blast cleaning (SSPC-SP 10/NACE No. 2).

Commercial blast cleaning is used when the objective is to remove all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter, leaving staining or shadows on no more than 33 percent of each unit area of surface as described in Section 2.2.

The difference between a commercial blast and a near-white blast is in the amount of staining permitted to remain on the surface. Commercial blast allows stains or shadows on 33 percent of each unit area of surface. Near-white blast allows staining or shadows on only 5 percent of each unit area.

The difference between a commercial blast and an industrial blast is that a commercial blast removes all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter from all surfaces and allows stains to remain on 33 percent of each unit area of surface, while industrial blast allows defined mill scale, coating, and rust to remain on less than 10 percent of the surface and allows defined stains to remain on all surfaces.

This joint standard was prepared by the SSPC/NACE Task Group A on Surface Preparation by Abrasive Blast Cleaning. This joint Task Group includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation.

1. General

1.1 This joint standard covers the requirements for commercial blast cleaning of unpainted or painted steel surfaces by the use of abrasives. These requirements include the end condition of the surface and materials and procedures necessary to achieve and verify the end condition.

1.2 The mandatory requirements are described in Sections 1 to 9 as follows:

Section 1	General
Section 2	Definition
Section 3	References
Section 4	Procedures Before Blast Cleaning
Section 5	Blast Cleaning Methods and Operation
Section 6	Blast Cleaning Abrasives
Section 7	Procedures Following Blast Cleaning and Immediately Prior to Coating
Section 8	Inspection
Section 9	Safety and Environmental Requirements

NOTE: Section 10, "Comments" and Appendix A, "Explanatory Notes" are not mandatory requirements of this standard.

2. Definition

2.1 A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, except for staining as noted in Section 2.2.

2.2 Random staining shall be limited to no more than 33 percent of each unit area of surface as defined in Section 2.6, and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.

2.3 Acceptable variations in appearance that do not affect surface cleanliness as defined in Section 2.1 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat affected zones, blasting abrasives, and differences due to blasting technique.

2.4 When a coating is specified, the surface shall be roughened to a degree suitable for the specified coating system.

2.5 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning specified herein.

2.6 Unit area for determinations shall be approximately 5776 mm^2 (9 in^2) (i.e., a square 76 x 76 mm [3 in x 3 in]).

2.7 SSPC-VIS 1-89 may be specified to supplement the written definition. In any dispute, the written standards shall take precedence over visual standards and comparators. Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

3. References

3.1 The documents referenced in this standard are listed in Section 3.4.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this standard, the requirements of this standard shall prevail.

3.4 SSPC: THE SOCIETY FOR PROTECTIVE COATINGS STANDARDS:

AB 1	Mineral and Slag Abrasives
AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
AB 3	Newly Manufactured or Re-Manufactured Steel Abrasives
PA Guide 3	A Guide to Safety in Paint Application
SP 1	Solvent Cleaning
VIS 1-89	Visual Standard for Abrasive Blast Cleaned Steel

4. Procedures Before Blast Cleaning

4.1 Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1 or other agreed upon methods.

4.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification). Additional information on surface imperfections is available in Section A.5 of Appendix A.

4.3 If a visual standard or comparator is specified to supplement the written standard, the condition of the steel prior to blast cleaning should be determined before the blasting commences. Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

5. Blast Cleaning Methods and Operation

5.1 Clean, dry compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve this requirement.

5.2 Any of the following methods of surface preparation may be used to achieve a commercial blast cleaned surface:

5.2.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

5.2.2 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

5.2.3 Dry abrasive blasting using a closed cycle, recirculating abrasive system with centrifugal wheels and abrasive.

5.3 Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve a commercial blast cleaned surface by mutual agreement between those responsible for performing the work and those responsible for establishing the requirements. NOTE: Information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Section A.9 of Appendix A.

6. Blast Cleaning Abrasives

6.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

6.2 The cleanliness and size of recycled abrasives shall be maintained to ensure compliance with this specification.

6.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1, AB 2 and AB 3.

6.4 Any limitations on the use of specific abrasives, the quantity of contaminants, or the degree of allowable embedment shall be included in the procurement documents (project specification) covering the work, because abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements. NOTE: Additional information on abrasive selection is given in Section A.2 of Appendix A.

7. Procedures Following Blast Cleaning and Immediately Prior to Coating

7.1 Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP 1 or another method agreed upon by those parties responsible for establishing the requirements and those responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning, or other methods agreed upon by those responsible for establishing the requirements and those responsible for performing the work. NOTE: The presence of toxic metals in the abrasives or paint being removed may place restrictions on the methods of cleaning permitted. Comply with all applicable regulations. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

7.3 After blast cleaning, surface imperfections that remain (e.g., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers, etc.) shall be removed to the extent required in the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Section 2.4. NOTE: Additional information on surface imperfections is contained in Section A.5 of Appendix A.

7.4 Any visible rust that forms on the surface of the steel after blast cleaning shall be removed by recleaning the rusted areas to meet the requirements of this standard before coating. NOTE: Information on rust-back (re-rusting) and surface condensation is contained in Sections A.6, A.7 and A.8 of Appendix A.

8. Inspection

8.1 Work and materials supplied under this standard are subject to inspection by a representative of those responsible for establishing the requirements. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and supplier shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

9. Safety and Environmental Requirements

9.1 Because abrasive blast cleaning is a hazardous operation, all work shall be conducted in compliance with applicable occupational and environmental health and safety rules and regulations. NOTE: SSPC-PA Guide 3, "A Guide to Safety in Paint Application," addresses safety concerns for coating work.

10. Comments

10.1 Additional information and data relative to this standard are contained in Appendix A. Detailed information and data are presented in a separate document, SSPC-SP COM, "Surface Preparation Commentary." The recommendations contained in Appendix A and SSPC-SP COM are believed to represent good practice, but are not to be considered requirements of the standard. The sections of SSPC-SP COM that discuss subjects related to industrial blast cleaning are listed below.

Subject	Commentary Section
Abrasive Selection	6
Film Thickness	10
Wet Abrasive Blast Cleaning	8.2
Maintenance Repainting	4.2
Rust-back (Re-rusting)	8.3
Surface Profile	6.2
Visual Standards	11
Weld Spatter	4.4.1

Appendix A. Explanatory Notes

A.1 FUNCTION: Commercial blast cleaning (SSPC-SP 6/NACE No. 3) provides a greater degree of cleaning than brush-off blast cleaning (SSPC-SP 7/NACE No. 4), but less than near-white blast cleaning (SSPC-SP 10/NACE No. 2). It should be specified only when a compatible coating will be applied. The primary functions of blast cleaning before coating are: (a) to remove material from the surface that can cause early failure of the coating system and (b) to obtain a suitable surface roughness and to enhance the adhesion of the new coating system. The hierarchy of blasting standards is as follows: white metal blast cleaning, near-white blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning.

A.2 ABRASIVE SELECTION: Types of metallic and non-metallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). It is important to recognize that blasting abrasives may become embedded in or leave residues on the surface of the steel during preparation. While normally such embedment or residues are not detrimental, care should be taken to ensure that the abrasive is free from detrimental amounts of water-soluble, solvent-soluble, acid-soluble, or other soluble contaminants (particularly if the prepared steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are given in SSPC-AB 1, "Mineral and Slag Abrasives," SSPC-AB 2, "Cleanliness of Recycled Ferrous Metallic Abrasives," and SSPC-AB 3, "Newly Manufactured or Re-Manufactured Steel Abrasives."

A.3 SURFACE PROFILE: Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth (or height) is dependent upon the size, shape, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent upon the thickness of the coating to be applied. Large particle sized abrasives (particularly metallic) can produce a profile that may be too deep to be adequately covered by a single thin film coat. Accordingly, it is recommended that the use of larger abrasives be avoided in these cases. However, larger abrasives may be needed for thick film coatings or to facilitate removal of thick coatings, heavy mill scale, or rust. If control of profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical profile heights achieved with commercial abrasive media are shown in Table 5 of the Surface Preparation Commentary (SSPC-SP COM). Surface profile should be measured in accordance with NACE Standard RP0287 (latest edition), "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape,"or ASTM[1] D 4417 (latest edition), "Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel."

A.4 VISUAL STANDARDS: SSPC-VIS 1-89 (Visual Standard for Abrasive Blast Cleaned Steel) provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The A-SP 6, B-SP 6, C-SP 6 and D-SP 6 series of photographs depict surfaces cleaned to a commercial blast. Other available visual standards are described in Section 11 of SSPC-SP COM.

A.5 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the service is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features that are difficult to properly cover and protect include crevices, weld porosities, laminations,

[1] ASTM, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959.

etc. The high cost of the methods to remedy surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such surface repair work is essential because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4.4 of SSPC-SP COM and NACE Standard RP0178 (latest edition), "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service" contain additional information on surface imperfections.

A.6 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (e.g., chlorides and sulfates) develops rust-back rapidly at intermediate and high humidities. These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during blast cleaning if the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in SSPC-SP 12/NACE No. 5. Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-TU 4, "Technology Update on Field Methods for Retrieval and Analysis of Soluble Salts on Substrates."

A.7 RUST-BACK: Rust-back (re-rusting) occurs when freshly cleaned steel is exposed to moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, if chemical contamination is not present (see Section A.6), it is best to blast clean and coat a surface the same day. Severe conditions may require more expedient coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating (see Section A.6).

A.8 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of the steel surface be at least 3 °C (5 °F) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations and to avoid the application of coating over a damp surface.

A.9 WET ABRASIVE BLAST CLEANING: Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing. It may be necessary that inhibitors be added to the water or applied to the surface immediately after blast cleaning to temporarily prevent rust formation. The use of inhibitors or the application of coating over slight discoloration should be in accordance with the requirements of the coating manufacturer. CAUTION: Some inhibitive treatments may interfere with the performance of certain coating systems.

A.10 FILM THICKNESS: It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry film thickness of the coating above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured the procedures in SSPC-PA 2 (latest edition), "Measurement of Dry Coating Thickness with Magnetic Gauges" should be used.

A.11 MAINTENANCE AND REPAIR PAINTING: When this standard is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, the cleaning shall be performed across the entire area specified. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning shall be applied 100% to all weld seams. If the entire structure is to be prepared, this degree of cleaning shall be applied to 100% of the entire structure. SSPC-PA Guide 4 (latest edition), "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

Joint Surface Preparation Standard

SSPC-SP 7/NACE NO. 4

Brush-Off Blast Cleaning

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Foreword

This joint standard covers the use of blast cleaning abrasives to achieve a defined degree of cleaning of steel surfaces prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others whose responsibility it may be to define a standard degree of surface cleanliness.

The focus of this standard is brush-off blast cleaning. White metal blast cleaning, near-white blast cleaning, commercial blast cleaning, and industrial blast cleaning are addressed in separate standards.

Brush-off blast cleaning provides a lesser degree of cleaning than industrial blast cleaning (SSPC-SP 14/NACE No. 8). The difference between an industrial blast and a brush-off blast is that the objective of a brush-off blast is to allow as much of an existing coating to remain as possible, and to roughen the surface prior to coating application while the purpose of the industrial blast is to remove most of the coating, mill scale and rust, when the extra effort required to remove every trace of these is determined to be unwarranted.

This joint standard was prepared by the SSPC/NACE Task Group A on Surface Preparation by Abrasive Blast Cleaning. This joint Task Group includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation.

1. General

1.1 This joint standard covers the requirements for brush-off blast cleaning of unpainted or painted steel surfaces by the use of abrasives. These requirements include the end condition of the surface and materials and procedures necessary to achieve and verify the end condition.

1.2 This joint standard allows tightly adherent rust, mill scale and/or old coating to remain on the surface.

1.3 The mandatory requirements are described in Sections 1 to 9 as follows:

Section 1	General
Section 2	Definitions
Section 3	References
Section 4	Procedures Before Blast Cleaning
Section 5	Blast Cleaning Methods and Operation
Section 6	Blast Cleaning Abrasives
Section 7	Procedures Following Blast Cleaning and Immediately Prior to Coating
Section 8	Inspection
Section 9	Safety and Environmental Requirements

NOTE: Section 10, "Comments" and Appendix A, "Explanatory Notes" are not mandatory requirements of this standard.

2. Definition

2.1 A brush-off blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Tightly adherent mill scale, rust, and coating may remain on the surface. Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife after abrasive blast cleaning has been performed.

2.2 The entire surface shall be subjected to the abrasive blast. The remaining mill scale, rust, or coating shall be tight. Flecks of the underlying steel need not be exposed whenever the original substrate consists of intact coating.

2.3 When a coating is specified, the surface shall be roughened to a degree suitable for the specified coating system.

2.4 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning as specified herein.

2.5 Visual standards or comparators may be specified to supplement the written definition. In any dispute, the written standards shall take precedence over visual standards and comparators. Additional information on visual standards is available in Section A.4 of Appendix A.

3. References

3.1 The documents referenced in this standard are listed in Section 3.4.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this standard, the requirements of this standard shall prevail.

3.4 SSPC: THE SOCIETY FOR PROTECTIVE COATINGS STANDARDS:

AB 1	Mineral and Slag Abrasives
AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
AB 3	Newly Manufactured or Re-Manufactured Steel Abrasives
PA Guide 3	A Guide to Safety in Paint Application
SP 1	Solvent Cleaning
VIS 1-89	Visual Standard for Abrasive Blast Cleaned Steel

4. Procedures Before Blast Cleaning

4.1 Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1 or other agreed upon methods.

4.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification). Additional information on surface imperfections is available in Section A.5 of Appendix A.

4.3 If a visual standard or comparator is specified to supplement the written standard, the condition of the steel prior to blast cleaning should be determined before the blasting commences. Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

5. Blast Cleaning Methods and Operation

5.1 Clean, dry compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve this requirement.

5.2 Any of the following methods of surface preparation may be used to achieve a brush-off blast cleaned surface:

5.2.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

5.2.2 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with compressed air, blast nozzle,

and abrasive, with or without vacuum for dust and abrasive recovery.

5.2.3 Dry abrasive blasting using a closed cycle, recirculating abrasive system with centrifugal wheels and abrasive.

5.3 Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve a brush-off blast cleaned surface by mutual agreement between those responsible for performing the work and those responsible for establishing the requirements. NOTE: Information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Section A.9 of Appendix A.

6. Blast Cleaning Abrasives

6.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

6.2 The cleanliness and size of recycled abrasives shall be maintained to ensure compliance with this specification.

6.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1, AB 2 and AB 3.

6.4 Any limitations on the use of specific abrasives, the quantity of contaminants, or the degree of allowable embedment shall be included in the procurement documents (project specification) covering the work, because abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements. NOTE: Additional information on abrasive selection is given in Section A.2 of Appendix A.

7. Procedures Following Blast Cleaning and Immediately Prior to Coating

7.1 Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP 1 or another method agreed upon by those parties responsible for establishing the requirements and those responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning, or other methods agreed upon by those responsible for establishing the requirements and those responsible for performing the work. NOTE: The presence of toxic metals in the abrasives or paint being removed may place restrictions on the methods of cleaning permitted. The method chosen shall comply with all applicable regulations. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

7.3 After blast cleaning, surface imperfections that remain (e.g., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers, etc.) shall be removed to the extent required in the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Section 2.4. NOTE: Additional information on surface imperfections is contained in Section A.5 of Appendix A.

8. Inspection

8.1 Work and materials supplied under this standard are subject to inspection by a representative of those responsible for establishing the requirements. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and supplier shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

9. Safety and Environmental Requirements

9.1 Because abrasive blast cleaning is a hazardous operation, all work shall be conducted in compliance with applicable occupational and environmental health and safety rules and regulations. NOTE: SSPC-PA Guide 3, “A Guide to Safety in Paint Application,” addresses safety concerns for coating work.

10. Comments

10.1 Additional information and data relative to this standard are contained in Appendix A. Detailed information and data are presented in a separate document, SSPC-SP COM, “Surface Preparation Commentary.” The recommendations contained in Appendix A and SSPC-SP COM are believed to represent good practice, but are not to be considered requirements of the standard. The sections of SSPC-SP COM that discuss subjects related to brush-off

blast cleaning are listed below.

Subject	Commentary Section
Abrasive Selection	6
Film Thickness	10
Wet Abrasive Blast Cleaning	8.2
Maintenance Repainting	4.2
Rust-back (Re-rusting)	8.3
Surface Profile	6.2
Visual Standards	11
Weld Spatter	4.4.1

Appendix A. Explanatory Notes

A.1 FUNCTION: Brush-off blast cleaning (SSPC-SP 7/NACE No. 4), provides a lesser degree of cleaning than industrial blast cleaning (SSPC-SP 14/NACE No. 8). It should be used when the service environment is mild enough to permit tight mill scale, coating, rust, and other foreign matter to remain on the surface. The primary functions of blast cleaning before coating are (a) to remove material from the surface that can cause early failure of the coating and (b) to obtain a suitable surface roughness and to enhance the adhesion of the new coating system. The hierarchy of blasting standards is as follows: white metal blast cleaning, near-white blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning.

A.2 ABRASIVE SELECTION: Types of metallic and non-metallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). It is important to recognize that blasting abrasives may become embedded in or leave residues on the surface of the steel during preparation. While normally such embedment or residues are not detrimental, care should be taken to ensure that the abrasive is free from detrimental amounts of water-soluble, solvent-soluble, acid-soluble, or other soluble contaminants (particularly if the prepared steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are given in SSPC-AB 1, "Mineral and Slag Abrasives," SSPC-AB 2, "Cleanliness of Recycled Ferrous Metallic Abrasives," and SSPC-AB 3, "Newly Manufactured or Re-Manufactured Steel Abrasives."

A.3 SURFACE PROFILE: Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth (or height) is dependent upon the size, shape, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent upon the thickness of the coating to be applied. Large particle sized abrasives (particularly metallic) can produce a profile that may be too deep to be adequately covered by a single thin film coat. Accordingly, it is recommended that the use of larger abrasives be avoided in these cases. However, larger abrasives may be needed for thick film coatings or to facilitate removal of thick coatings, heavy mill scale, or rust. If control of profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical profile heights achieved with commercial abrasive media are shown in Table 5 of the Surface Preparation Commentary (SSPC-SP COM). Surface profile should be measured in accordance with NACE Standard RP0287 (latest edition), "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape, " or ASTM[1] D 4417 (latest edition), "Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel."

A.4 VISUAL STANDARDS: SSPC-VIS 1-89 (Visual Standard for Abrasive Blast Cleaned Steel) provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The series A-SP 7, B-SP 7, C-SP 7 and D-SP 7 depict surfaces cleaned to brush-off blast grade. Other available visual standards are described in Section 11 of SSPC-SP COM.

A.5 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the service is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features that are difficult to properly cover and protect include crevices, weld porosities, laminations, etc. The high cost of the methods to remedy surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such surface repair work is essential because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4.4 of SSPC-SP COM and NACE Standard RP0178 (latest edition), "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service" contain additional information on surface imperfections.

A.6 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (e.g., chlorides and sulfates) develops rust-back rapidly at intermediate and high humidities.

[1] ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during blast cleaning if the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface, preferably before blast cleaning, and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in SSPC-SP 12/NACE No. 5. Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-TU 4, "Technology Update on Field Methods for Retrieval and Analysis of Soluble Salts on Substrates."

A.7 RUST-BACK: Rust-back (re-rusting) occurs when freshly cleaned steel is exposed to moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, if chemical contamination is not present (see Section A.6), it is best to blast clean and coat a surface the same day. Severe conditions may require more expedient coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating (see Section A.6).

A.8 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of the steel surface be at least 3 °C (5 °F) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations and to avoid the application of coating over a damp surface.

A.9 WET ABRASIVE BLAST CLEANING: Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing. It may be necessary that inhibitors be added to the water or applied to the surface immediately after blast cleaning to temporarily prevent rust formation. The coating should then be applied before any rusting is visible. The use of inhibitors or the application of coating over slight discoloration should be in accordance with the requirements of the coating manufacturer. CAUTION: Some inhibitive treatments may interfere with the performance of certain coating systems.

A.10 FILM THICKNESS: It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry film thickness of the coating above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured the procedures in SSPC-PA 2 (latest edition), "Measurement of Dry Coating Thickness with Magnetic Gauges" should be used.

A.11 MAINTENANCE AND REPAIR COATING: When this standard is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, the cleaning shall be performed across the entire area specified. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning shall be applied 100% to all weld seams. If the entire structure is to be prepared, this degree of cleaning shall be applied to 100% of the entire structure. SSPC-PA Guide 4 (latest edition), "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

Joint Surface Preparation Standard

SSPC-SP NO. 10/NACE NO. 2

Near-White Blast Cleaning

This SSPC: The Society for Protective Coatings and NACE International standard represents a consensus of those individual members who have reviewed this document, its scope and provisions. Its acceptance does not in any respect preclude anyone, having adopted the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in conformance with this standard. Nothing contained in this standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by Letters Patent, or as indemnifying or protecting anyone against liability for infringement of Letters Patent. This standard represents minimum requirements and should in no way be interpreted as a restriction on the use of better procedures or materials. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. SSPC and NACE assume no responsibility for the interpretation or use of this standard by other parties and accept responsibility for only those official interpretations issued by SSPC or NACE in accordance with their respective governing procedures and policies, which preclude the issuance of interpretations by individual volunteers.

Users of this standard are responsible for reviewing appropriate health, safety, and regulatory documents and for determining their applicability in relation to this standard prior to its use. This SSPC/NACE standard may not necessarily address all potential health and safety problems or environmental hazards associated with the use of materials, equipment and/or operations detailed or referred to within this standard. Users of this standard are also responsible for establishing appropriate health, safety, and environmental protection practices, in consultation with appropriate regulatory authorities, if necessary, to achieve compliance with any existing applicable regulatory requirements prior to the use of this standard.

CAUTIONARY NOTICE: SSPC/NACE standards are subject to periodic review and may be revised or withdrawn at any time without prior notice. SSPC and NACE require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication. The user is cautioned to obtain the latest edition. Purchasers may receive current information on all standards and other publications by contacting the organizations at the addresses below:

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Foreword

This joint standard covers the use of blast cleaning abrasives to achieve a defined degree of cleaning of steel surfaces prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others whose responsibility it may be to define a standard degree of surface cleanliness.

The focus of this standard is near-white metal blast cleaning. White metal blast cleaning, commercial blast cleaning, industrial blast cleaning and brush-off blast cleaning are addressed in separate standards.

Near-white blast cleaning provides a greater degree of cleaning than commercial blast cleaning (SSPC-SP 6/NACE No. 3), but less than white metal blast cleaning (SSPC-SP 5/NACE No. 1).

Near-white blast cleaning is used when the objective is to remove all rust, coating, and mill scale, but when the extra effort required to remove all stains of these materials is determined to be unwarranted. Staining shall be limited to no more than 5 percent of each unit area of surface.

Near-white blast cleaning allows staining on only 5 percent of each unit area of surface, while commercial blast cleaning allows staining on 33 percent of each unit area of surface. White metal blast cleaning does not permit any staining to remain on the surface.

This joint standard was prepared by the SSPC/NACE Task Group A on Surface Preparation by Abrasive Blast Cleaning. This joint Task Group includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation.

1. General

1.1 This joint standard covers the requirements for near-white blast cleaning of unpainted or painted steel surfaces by the use of abrasives. These requirements include the end condition of the surface and materials and procedures necessary to achieve and verify the end condition.

1.2 This joint standard allows random staining to remain on no more than 5 percent of each unit area of surface as defined in Section 2.6.

1.3 The mandatory requirements are described in Sections 1 to 9 as follows:

Section 1	General
Section 2	Definition
Section 3	References
Section 4	Procedures Before Blast Cleaning
Section 5	Blast Cleaning Methods and Operation
Section 6	Blast Cleaning Abrasives
Section 7	Procedures Following Blast Cleaning and Immediately Prior to Coating
Section 8	Inspection
Section 9	Safety and Environmental Requirements

NOTE: Section 10, "Comments" and Appendix A, "Explanatory Notes" are not mandatory requirements of this standard.

2. Definition

2.1 A near-white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, except for staining as noted in Section 2.2.

2.2 Random staining shall be limited to no more than 5 percent of each unit area of surface as defined in Section 2.6, and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.

2.3 Acceptable variations in appearance that do not affect surface cleanliness as defined in Section 2.1 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat affected zones, blasting abrasives, and differences in the blast pattern.

2.4 When a coating is specified, the surface shall be roughened to a degree suitable for the specified coating system.

2.5 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning specified herein.

2.6 Unit area for determinations shall be approximately 5776 mm^2 (9 in^2) (i.e., a square 76 mm x 76 mm [3 in x 3 in]).

2.7 SSPC-VIS 1-89, photographs A SP-10, B SP-10, C SP-10 or D SP-10 may be specified to supplement the written definition. In any dispute, the written standards shall take precedence over visual standards and comparators. Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

3. References

3.1 The documents referenced in this standard are listed in Section 3.4.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this standard, the requirements of this standard shall prevail.

3.4 SSPC: THE SOCIETY FOR PROTECTIVE COATINGS STANDARDS:

AB 1	Mineral and Slag Abrasives
AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
AB 3	Newly Manufactured or Re-Manufactured Steel Abrasive
PA Guide 3	A Guide to Safety in Paint Application
SP 1	Solvent Cleaning
VIS 1	Visual Standard for Abrasive Blast Cleaned Steel

4. Procedures Before Blast Cleaning

4.1 Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1 or other agreed upon methods.

4.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification). Additional information on surface imperfections is available in Section A.5 of Appendix A.

4.3 If a visual standard or comparator is specified to supplement the written standard, the condition of the steel prior to blast cleaning should be determined before the blasting commences. Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

5. Blast Cleaning Methods and Operation

5.1 Clean, dry compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve this requirement.

5.2 Any of the following methods of surface preparation may be used to achieve a near-white blast cleaned surface:

5.2.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

5.2.2 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

5.2.3 Dry abrasive blasting using a closed cycle, recirculating abrasive system with centrifugal wheels and abrasive.

5.3 Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve a near-white blast cleaned surface by mutual agreement between those parties responsible for establishing the requirements and those responsible for performing the work. NOTE: Information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Section A.9 of Appendix A.

6. Blast Cleaning Abrasives

6.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

6.2 The cleanliness and size of recycled abrasives shall be maintained to ensure compliance with this specification.

6.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1, AB 2 and AB 3.

6.4 Any limitations on the use of specific abrasives, the quantity of contaminants, or the degree of allowable embedment shall be included in the procurement documents (project specification) covering the work, because abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements. NOTE: Additional information on abrasive selection is given in Section A.2 of Appendix A.

7. Procedures Following Blast Cleaning and Immediately Prior to Coating

7.1 Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP 1 or another method agreed upon by those parties responsible for establishing the requirements and those responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning, or other methods agreed upon by those responsible for establishing the requirements and those responsible for performing the work. NOTE: The presence of toxic metals in the abrasives or paint being removed may place restrictions on the methods of cleaning permitted. Comply with all applicable regulations. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

7.3 After blast cleaning, surface imperfections that remain (e.g., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers, etc.) shall be removed to the extent required in the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Section 2.4. NOTE: Additional information on surface imperfections is contained in Section A.5 of Appendix A.

7.4 Any visible rust that forms on the surface of the steel after blast cleaning shall be removed by recleaning the rusted areas to meet the requirements of this standard before coating. NOTE: Information on rust-back (re-rusting) and surface condensation is contained in Sections A.6, A.7 and A.8 of Appendix A.

8. Inspection

8.1 Work and materials supplied under this standard are subject to inspection by a representative of those responsible for establishing the requirements. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and supplier shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

9. Safety and Environmental Requirements

9.1 Because abrasive blast cleaning is a hazardous operation, all work shall be conducted in compliance with applicable occupational and environmental health and safety rules and regulations. NOTE: SSPC-PA Guide 3, "A Guide to Safety in Paint Application," addresses safety concerns for coating work.

10. Comments

10.1 Additional information and data relative to this standard are contained in Appendix A. Detailed information and data are presented in a separate document, SSPC-SP COM, "Surface Preparation Commentary." The recommendations contained in Appendix A and SSPC-SP COM are believed to represent good practice, but are not to be considered requirements of the standard. The sections of SSPC-SP COM that discuss subjects related to near-white blast cleaning are listed below.

Subject	Commentary Section
Abrasive Selection	6
Film Thickness	10
Wet Abrasive Blast Cleaning	8.2
Maintenance Repainting	4.2
Rust-back (Re-rusting)	8.3
Surface Profile	6.2
Visual Standards	11
Weld Spatter	4.4.1

Appendix A. Explanatory Notes

A.1 FUNCTION: Near-white blast cleaning (SSPC-SP 10/NACE No. 2) provides a greater degree of cleaning than commercial blast cleaning (SSPC-SP 6/NACE No. 3) but less than white metal blast cleaning (SSPC-SP 5/NACE No. 1). It should be used when a high degree of blast cleaning is required. The primary functions of blast cleaning before coating are: (a) to remove material from the surface that can cause early failure of the coating system and (b) to obtain a suitable surface roughness and to enhance the adhesion of the new coating system. The hierarchy of blasting standards is as follows: white metal blast cleaning, near-white blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning.

A.2 ABRASIVE SELECTION: Types of metallic and non-metallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). It is important to recognize that blasting abrasives may become embedded in or leave residues on the surface of the steel during preparation. While normally such embedment or residues are not detrimental, care should be taken to ensure that the abrasive is free from detrimental amounts of water-soluble, solvent-soluble, acid-soluble, or other soluble contaminants (particularly if the prepared steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are given in SSPC-AB 1, "Mineral and Slag Abrasives," SSPC-AB 2, "Cleanliness of Recycled Ferrous Metallic Abrasives," and SSPC-AB 3, "Newly Manufactured or Re-Manufactured Steel Abrasives."

A.3 SURFACE PROFILE: Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth (or height) is dependent upon the size, shape, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent upon the thickness of the coating to be applied. Large particle sized abrasives (particularly metallic) can produce a profile that may be too deep to be adequately covered by a single thin film coat. Accordingly, it is recommended that the use of larger abrasives be avoided in these cases. However, larger abrasives may be needed for thick film coatings or to facilitate removal of thick coatings, heavy mill scale, or rust. If control of profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical profile heights achieved with commercial abrasive media are shown in Table 5 of the Surface Preparation Commentary (SSPC-SP COM). Surface profile should be measured in accordance with NACE Standard RP0287 (latest edition), "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape," or ASTM[1] D 4417 (latest edition), "Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel."

A.4 VISUAL STANDARDS: SSPC-VIS 1-89 (Visual Standard for Abrasive Blast Cleaned Steel) provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The series A-SP 10, B-SP 10, C-SP 10 and D-SP 10 photographs depict surfaces cleaned to a near-white blast grade. Other available visual standards are described in Section 11 of SSPC-SP COM.

A.5 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the service is severe. Coatings tend to pull away from sharp edges and

[1] ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

projections, leaving little or no coating to protect the underlying steel. Other features that are difficult to properly cover and protect include crevices, weld porosities, laminations, etc. The high cost of the methods to remedy surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such surface repair work is essential because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4.4 of SSPC-SP COM and NACE Standard RP0178 (latest edition), "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service" contain additional information on surface imperfections.

A.6 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (e.g., chlorides and sulfates) develops rust-back rapidly at intermediate and high humidities. These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during blast cleaning if the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface,, and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in SSPC-SP 12/NACE No. 5. Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-TU 4, "Technology Update on Field Methods for Retrieval and Analysis of Soluble Salts on Substrates."

A.7 RUST-BACK: Rust-back (re-rusting) occurs when freshly cleaned steel is exposed to moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, if chemical contamination is not present (see Section A.6), it is best to blast clean and coat a surface the same day. Severe conditions may require more expedient coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating (see Section A.6).

A.8 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of the steel surface be at least 3 °C (5 °F) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations and to avoid the application of coating over a damp surface.

A.9 WET ABRASIVE BLAST CLEANING: Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing. It may be necessary that inhibitors be added to the water or applied to the surface immediately after blast cleaning to temporarily prevent rust formation. The use of inhibitors or the application of coating over slight discoloration should be in accordance with the requirements of the coating manufacturer. CAUTION: Some inhibitive treatments may interfere with the performance of certain coating systems.

A.10 FILM THICKNESS: It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry film thickness of the coating above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured the procedures in SSPC-PA 2 (latest edition), "Measurement of Dry Coating Thickness with Magnetic Gauges" should be used.

A.11 MAINTENANCE AND REPAIR PAINTING: When this standard is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, the cleaning shall be performed across the entire area specified. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning shall be applied 100% to all weld seams. If the entire structure is to be prepared, this degree of cleaning shall be applied to 100% of the entire structure. SSPC-PA Guide 4 (latest edition), "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

SSPC: The Society for Protective Coatings

SURFACE PREPARATION SPECIFICATION NO. 11

Power Tool Cleaning to Bare Metal

1. Scope

1.1 This specification covers the requirements for power tool cleaning to produce a bare metal surface and to retain or produce a surface profile.

1.2 This specification is suitable where a roughened, clean, bare metal surface is required, but where abrasive blasting is not feasible or permissible.

1.3 This specification differs from SSPC-SP 3, Power Tool Cleaning, in that SSPC-SP 3 requires only the removal of loosely adherent materials and does not require producing or retaining a surface profile.

2. Definition

2.1 Metallic surfaces which are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted.

2.2 When painting is specified, the surface shall be roughened to a degree suitable for the specified paint system. The surface profile shall not be less than 1 mil (25 micrometers). NOTE: Additional information on profile is contained in Sections A.5 and A.6 of the Appendix.

2.3 Photographs or other visual standards may be used to supplement the written definition. NOTE: Additional information on visual standards is available in Section A.7 of the Appendix.

3. Power Surface Preparation Tools and Media

3.1 SURFACE CLEANING POWER TOOLS: Any tool capable of appropriately driving the media of Section 3.3 is acceptable; the surface profile may or may not be destroyed.

3.2 IMPACT AND OTHER PROFILE PRODUCING POWER TOOLS: Any tool on which the media of Section 3.4 can be properly mounted and used to produce the required uniform profile is acceptable. NOTE: Information on suitable tools is found in Sections A.3.a and A.3.b of the Appendix.

3.3 SURFACE CLEANING MEDIA:

3.3.1 Non-woven abrasive wheels and discs constructed of a non-woven synthetic fiber web material of continuous undulated filaments impregnated with an abrasive grit. NOTE: Information on suitable discs and wheels is found in Section A.3.c of the Appendix.

3.3.2 Coated abrasive discs (sanding pads), coated abrasive flap wheels, coated abrasive bands or other coated abrasive devices capable of running on power tools. NOTE: Information on suitable wheels is found in Section A.3.d of the Appendix.

3.3.3 Other materials that produce the requirements of Section 2.1.

3.4 SURFACE PROFILE PRODUCING MEDIA:

3.4.1 Rotary impact flap assembly consisting of a flexible loop construction with carbide spheres bonded to the peening surfaces of each of the metal supports fastened to the loop. NOTE: Information on suitable flap assemblies is found in Section A.3.e of the Appendix.

3.4.2 Needle guns consisting of a bundle of wire “needles” which can impact a surface, producing a peened effect. NOTE: Information on suitable needles is found in Section A.3.f of the Appendix.

3.4.3 Other materials which, when mounted on power hand tools, can produce the profile required in Section 2.2.

4. Reference Standards

4.1 The standards referenced in this specification are listed in Section 4.4 and form a part of this specification.

4.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

4.3 If there is a conflict between the requirements of any of the cited reference standards and this specification, the requirements of this specification shall prevail.

4.4 SSPC SPECIFICATIONS:

SP 1	Solvent Cleaning
SP 3	Power Tool Cleaning
VIS 3	Visual Standard for Power- and Hand-Tool Cleaned Steel

5. Procedures Prior to Power Tool Surface Preparation

5.1 Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP 1, "Solvent Cleaning," or other agreed-upon methods.

5.2 Prior to power tool surface preparation, remove surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag to the extent required by the procurement documents (project specification). NOTE: Additional information on surface imperfections is available in Appendix A.9.

6. Power Tool Surface Preparation Methods and Operations

6.1 Depending on profile conditions, use either or both of the following methods to remove tightly adhering materials and to retain or produce the required surface profile with power tools:

6.1.1 Profile Condition A, Acceptable Profile Exists: Achieve the cleanliness required in Section 2.1 by using power tools described in Section 3.1.

6.1.2 Profile Condition B. Unacceptable Profile Exists: Achieve the cleanliness required in Section 2.1 and the profile required in Section 2.2 by using power tools described in Section 3. NOTE: Information on the selection of tools and cleaning media is found in Section A.2 of the Appendix.

7. Procedures Following Power Tool Surface Preparation

7.1 After power tool surface preparation and prior to the application of coatings, reclean the surface if it does not conform to this specification.

7.2 Remove visible deposits of oil, grease, or other contaminants by any of the methods specified in SSPC-SP 1 or other methods agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work. NOTE: Information on oil contamination is found in Section A.4.d of the Appendix.

7.3 Remove dirt, dust, or similar contaminants from the surface. Acceptable methods include brushing, blow off with oil-free, clean, dry air; vacuum cleaning; or wiping with a clean, dry cloth.

7.4 Power tool prepared surfaces must be coated prior to the reformation of rust or visible contamination.

8. Inspection

8.1 Surfaces prepared under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work as is found defective under this specification. In case of dispute, the arbitration or settlement procedure as established in the procurement documents (project specification), shall be followed. If no arbitration procedure is established, the procedure specified by the American Arbitration Association shall be used.

8.2 The procurement documents (project specification) covering work or purchase shall establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

9. Safety

9.1 All safety requirements stated in the procurement document as well as this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

10. Comments

10.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

10.2 Additional information and data relative to this specification are contained in the following Appendix. Additional detailed information and data are presented in a separate document, SSPC-SP COM, "Surface Preparation Commentary." The recommendations contained in the Notes, Appendix, and SSPC-SP COM are believed to represent good practice, but are not to be considered as requirements of the specification. The table below lists the appropriate section of SSPC-SP COM.

Subject	Commentary Section
Film Thickness	10
Maintenance Painting	4.2
Rust-Back (Rerusting)	4.5
Visual Standards	11

A. Appendix

A.1 FUNCTION: Power tool surface preparation to remove tightly adherent material produces a surface which is visibly free from all rust, mill scale, and old coatings and which has a surface profile. It produces a greater degree of cleaning than SSPC-SP 3, "Power Tool Cleaning," (which does not remove tightly adherent material) and may be considered for coatings requiring a bare metal substrate.

The surfaces prepared according to this specification are not to be compared to surfaces cleaned by abrasive blasting. Although this method produces surfaces that "look" like "near-white" or "commercial blast," they are not necessarily equivalent to those surfaces produced by abrasive blast cleaning as called for in SSPC-SP 10 or SP 6.

A.2 SELECTION OF TOOLS AND CLEANING MEDIA: Selection of power tools and cleaning media shall be based on (1) the condition of the surface prior to surface preparation, (2) the extent of cleaning that is required to remove rust, scale and other matter from the surface and (3) the type of surface profile required.

A.2.1 Selection of Media: If an acceptable surface profile existed prior to preparing the surface, cleaning media, such as found in Section 3.3, shall be selected that will remove surface contaminants without severely reducing or removing the profile, if possible. If the surface profile is removed or severely reduced when preparing the surface, or if there was no profile prior to surface preparation, surface profiling media, such as found in Section 3.4, shall be selected that will produce an acceptable surface profile as required by this specification. When power tool cleaning rusted surfaces it is important to avoid embedding or peening rust into the substrate. This may require removal of rust prior to use of surface profiling media. These factors may require employing more than one type of medium in order to obtain the desired end result. NOTE: Power wire brushes when used alone will not produce the required surface profile and may remove or degrade an existing profile to an unacceptable level.

A.2.2 Selection of Tools: Power tools shall be selected on the basis of the size and speed rating of the media. These requirements may differ from one type of media to another and shall be taken into consideration when more than one type of medium will be used in the surface preparation process. Power tools shall be selected that will produce enough power to perform the cleaning operation efficiently. Operator fatigue shall be considered in the selection of power tools.

Further information on the selection of power tools and media is contained in Chapter 2.6, "Hand and Power Tool Cleaning," of SSPC Painting Manual, Volume 1, "Good Painting Practice."

A.3 SUITABLE TOOLS AND MEDIA: The text of this specification makes reference to the following footnotes. Inclusion of these items in this appendix is intended solely to guide the user to typical types of equipment and media which are available to meet the specification. The items mentioned are not all of the tools or products available, nor does their mention constitute an endorsement by SSPC.

a. The "Mini-Flushplate" from Desco Manufacturing Company, Inc., Long Beach, California, has been found suitable as a tool system which meets the requirements of this section.

b. The Aro Corporation, Bryan, Ohio, and VON ARX Air Tools Company, Englewood, New Jersey, are suppliers of needle gun equipment.

c. 3M Scotch-Brite Clean 'n Strip discs and wheels are able to satisfy the requirements.

d. Grind-O-Flex wheels from Merit Corporation, Compton, California and Nu-Matic air inflated wheels from NuMatic, Euclid, Ohio, have been found suitable.

e. 3M Heavy-Duty Roto-Peen flap assembly has been found suitable.

f. Needles having a diameter of 2 mm have been found to produce a surface profile suitable for many painting systems.

A.4 OPERATION OF TOOLS: The tools shall be operated in accordance with the manufacturers' instructions. In particular, note the following:

a. Observe the recommended operating speed (ROS). The maximum operating speed (MOS) does not necessarily give the most efficient cleaning.

b. The "rpm" (rotational speed) rating of some power tools and the cleaning media may not be compatible and could result in physical injury to the operator.

c. Exercise caution when power tools are used at critical structures (e.g., pressure vessel boundaries) so that excessive base metal is not removed.

d. When air driven tools are used, the exhaust could contain oil or moisture that could easily contaminate the recently prepared surface.

e. The media used on power tools have a finite life. When they do not produce the specified profile they shall be replaced.

Additional information on the operation of tools can be found in Chapter 2.6 of Volume 1, "Good Painting Practice" of SSPC Painting Manual.

A.5 PROFILE: The type of power tools to be used depends upon whether or not an acceptable profile exists on the surface to be cleaned.

Some limitations of the various types of media to produce a specific profile or to preserve an existing profile are as follows:

- Media of Section 3.3 produce a profile of approximately one-half mil (10-15 micrometers), whereas the media of Section 3.4 may produce a profile of 1 mil (25 micrometers) or more. The profile depends on the abrasive embedded in the rotary flaps or the diameter of the needles.
- Impact tools may produce sharp edges or cut into the base metal if not used properly.
- It is important to determine whether the profile requirements for the specified coating system can be met by this power tool cleaning method of surface preparation.

A.6 MEASUREMENT OF SURFACE PROFILE: Surface profile comparators and other visual or tactile gages used for abrasive blast cleaning are not suitable for measuring profile produced by power tools because of the differences in appearance. One acceptable procedure is use of coarse or extra coarse replica tape, as described in Method C of ASTM D 4417, "Field Measurement of Surface Profile of Blast Cleaned Steel." Replica tapes are valid for profiles in the ranges of 0.8 to 1.5 mils (20 to 38 micrometers) (coarse) to 1.5-4.5 mils (38-114 micrometers) (extra-coarse). (Note: Because of the limitations in compressibility of the mylar film, however, even very smooth surfaces will give readings of 0.5 mils [13 micrometers] or greater using the replica tape.)

A.7 VISUAL STANDARDS: Note that the use of visual standards in conjunction with this specification is required only when they are specified in the procurement documents (project specification) covering the work. It is recommended, however, that the use of visual standards be made mandatory in the procurement documents.

SSPC-VIS 3, "Visual Standard for Power- and Hand-Tool Cleaned Steel," provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. For more information about visual standards, see SSPC-SP COM, Section 11.

A.8 INACCESSIBLE AREAS: Because of the shape and configuration of the power tools themselves, some areas of a structure may be inaccessible for cleaning. These areas include surfaces close to bolt heads, inside corners, and areas with limited clearance. Areas which are inaccessible by this method of surface preparation shall be cleaned using an alternate method of surface preparation which may result in a different degree of surface cleanliness and surface profile. The alternate method shall be mutually agreed upon before commencing work.

A.9 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the environment is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features which are difficult to properly cover and protect include crevices, weld porosity, laminations, etc. The high cost of methods to remedy the surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adherent contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations, must be removed during the power tool cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such repair work is essential, since the timing of the repairs may occur before, during, or after the cleaning operation. Section 4.4 of the "Surface Preparation Commentary" (SSPC-SP COM) contains additional information on surface imperfections.

A.10 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (i.e., chlorides and sulfates) develops rustback rapidly at intermediate and high humidities. These soluble salts can be present on the steel surface prior to cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during cleaning whenever the media is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface, preferably before power tool cleaning, and eliminating sources of recontamination during and after power tool cleaning. Identification of the contaminants along with their concentrations may be obtained from laboratory or field tests.

A.11 RUST-BACK: Rust-back (rerusting) occurs when freshly cleaned steel is exposed to conditions of high humidity, moisture, contamination, or a corrosive atmosphere. The time interval between power tool cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, it is best to clean and coat a surface the same day. Severe conditions may require coating more quickly, while for exposure under controlled conditions the coating time may be extended. Under no circumstances shall the steel be permitted to rust-back before painting regardless of time elapsed (see Section A. 10).

A.12 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is,

therefore, recommended that the temperature of the steel surface be at least 5 ˚F (3 ˚C) above the dew point during power tool cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during cleaning operations. It is important that the application of a coating over a damp surface be avoided.

A.13 FILM THICKNESS: It is essential that ample coating be applied after power tool cleaning to adequately cover the peaks of the surface profile. The dry film thickness above the peaks of the profile shall equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured, refer to SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages."

A.14 MAINTENANCE AND REPAIR PAINTING: When this specification is used in maintenance painting, specific instructions shall be given on the extent of surface to be power tool cleaned or spot cleaned. SSPC-PA Guide 4, "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound paint, removing unsound paint, feathering, and spot cleaning.

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Joint Surface Preparation Standard

SSPC-SP 12/NACE No. 5
Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

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Foreword

This joint standard describes the surface preparation technique known as waterjetting. This technique provides an alternative method of removing coating systems or other materials from metal surfaces, including lead-based paint systems, prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others whose responsibility it may be to define a standard degree of surface cleanliness. Since publication of NACE Standard RP0172,[1] surface preparation using waterjetting equipment has found acceptance as a viable method.

Waterjetting can be effective in removing water-soluble surface contaminants that may not be removed by dry abrasive blasting alone, specifically, those contaminants found at the bottom of pits of severely corroded metallic substrates. Waterjetting also helps to remove surface grease and oil, rust, shot-creting spatter, and existing coatings and linings. Waterjetting is also used in areas where abrasive blasting is not a feasible method of surface preparation.

The use of a high-pressure water stream to strip existing coatings and clean the surface has advantages over open dry abrasive blasting with respect to worker respiratory exposure and work area air quality. Respiratory requirements for waterjetting may be less stringent than for other methods of surface preparation.

Waterjetting does not provide the primary anchor pattern on steel known to the coatings industry as “profile.” The coatings industry uses waterjetting primarily for recoating or relining projects in which there is an adequate preexisting profile. Waterjetting has application in a broad spectrum of industries. It is used when high-performance coatings require extensive surface preparation and/or surface decontamination.

This standard was originally prepared by SSPC/NACE Joint Task Group TGD. It was technically revised in 2002 by Task Group 001 on Surface Preparation by High-Pressure Waterjetting. This Task Group is administered by Specific Technology Group (STG) 04 on Protective Coatings and Linings—Surface Preparation, and is sponsored by STG 02 on Protective Coatings and Linings—Atmospheric, and STG 03 on Protective Coatings and Linings—Immersion/Buried. This standard is issued by SSPC Group Committee C.2 on Surface Preparation, and by NACE International under the auspices of STG 04.

Joint Surface Preparation Standard

SSPC-SP 12/NACE No. 5
Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

Contents

Section 1: General

1.1 This standard describes the use of waterjetting to achieve a defined degree of cleaning of surfaces prior to the application of a protective coating or lining system. These requirements include the end condition of the surface plus materials and procedures necessary to verify the end condition. This standard is limited in scope to the use of water only.

1.2 This standard is written primarily for applications in which the substrate is carbon steel. However, waterjetting can be used on nonferrous substrates such as bronze, aluminum, and other metals such as stainless steel. This standard does not address the cleaning of concrete. Cleaning of concrete is discussed in SSPC SP-13/NACE No. 6.[2]

1.3 Appendices A, B, and C give additional information on waterjetting equipment, production rates, procedures, and principles.

1.4 Visual Reference Photographs: SSPC-VIS 4/NACE VIS 7, "Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting,"[3] provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The latest issue of the reference photographs should be used.

Section 2: Definitions

2.1 This section provides basic waterjetting definitions. Additional definitions relevant to waterjetting are contained in the WaterJet Technology Association's[(1)] "Recommended Practices for the Use of Manually Operated High-Pressure Waterjetting Equipment."[4]

2.1.1 **Waterjetting (WJ):** Use of standard jetting water discharged from a nozzle at pressures of 70 MPa (10,000 psig) or greater to prepare a surface for coating or inspection. Waterjetting uses a pressurized stream of water with a velocity that is greater than 340 m/s (1,100 ft/s) when exiting the orifice. Waterjetting does not produce an etch or profile of the magnitude currently recognized by the coatings industry. Rather, it exposes the original abrasive-blasted surface profile if one exists.

2.1.2 **Water Cleaning (WC):** Use of pressurized water discharged from a nozzle to remove unwanted matter from a surface.

2.1.3 **Standard Jetting Water:** Water of sufficient purity and quality that it does not impose additional contaminants on the surface being cleaned and does not contain sediments or other impurities that are destructive to the proper functioning of waterjetting equipment.

2.1.4 **Low-Pressure Water Cleaning (LP WC)**: Water cleaning performed at pressures less than 34 MPa (5,000 psig). This is also called "power washing" or "pressure washing."

2.1.5 **High-Pressure Water Cleaning (HP WC):** Water cleaning performed at pressures from 34 to 70 MPa (5,000 to 10,000 psig).

2.1.6 **High-Pressure Waterjetting (HP WJ):** Waterjetting performed at pressures from 70 to 210 MPa (10,000 to 30,000 psig).

2.1.7 **Ultrahigh-Pressure Waterjetting (UHP WJ):** Waterjetting performed at pressures above 210 MPa (30,000 psig).

2.1.8 **Nonvisible Contamination (NV):** Nonvisible contamination is the presence of organic matter, such as very thin films of oil and grease, and/or soluble ionic materials such as chlorides, ferrous salts, and sulfates that remain on the substrate after cleaning.

2.1.9 **Visible Surface Cleanliness (VC):** Visible surface cleanliness is the visible condition of the substrate, when viewed without magnification, after cleaning.

Section 3: Surface Cleanliness Requirements

3.1 Table 1 lists four definitions of surface cleanliness in terms of visible contaminants. A surface shall be prepared to one of these four visual conditions prior to recoating.

3.1.1 As part of the surface preparation, deposits of oil, grease, and foreign matter must be removed by waterjetting, by water cleaning, by steam cleaning, by methods in accordance with SSPC-SP 1,[5] or by

[(1)] WaterJet Technology Association, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1419.

another method agreed upon by the contracting parties.

3.1.2 NOTE: Direct correlation to existing dry media blasting standards is inaccurate or inappropriate when describing the capabilities of water cleaning and the visible results achieved by water cleaning.

3.1.3 The entire surface to be prepared for coating shall be subjected to the cleaning method.

3.1.4 For WJ-4 (see Table 1) any remaining mill scale, rust, coating, or foreign materials shall be tightly adherent. All of the underlying metal need not be exposed.

3.1.5 Photographs may be specified to supplement the written definition. In any dispute, the written standards shall take precedence over visual reference photographs or visual standards such as SSPC-VIS 4/NACE VIS 7.[3]

3.2 Table 2 lists definitions of flash rusted surfaces (See Section 4). When deemed necessary, a surface should be prepared to one of these flash rusted surface conditions prior to recoating.

3.3 The specifier shall use one of the visual surface preparation definitions (WJ-1 to WJ-4 in Table 1) and, when deemed necessary, one of the flash rust definitions.

3.3.1 The following is an example of a specification statement:

"All surfaces to be recoated shall be cleaned to SSPC-SP 12/NACE No. 5, WJ-2/L, Very Thorough or Substantial Cleaning, Light Flash Rusting."

3.4 Appendix A contains information on nonvisible surface contaminants. In addition to the requirements given in Paragraph 3.1, the specifier should consider whether a surface should be prepared not to exceed the maximum level of nonvisible surface contamination prior to recoating. A suggested specification statement for nonvisible contaminants is given in Appendix A.

Table 1: Visual Surface Preparation Definitions

Term	Description of Surface
WJ-1	**Clean to Bare Substrate:** A WJ-1 surface shall be cleaned to a finish which, when viewed without magnification, is free of all visible rust, dirt, previous coatings, mill scale, and foreign matter. Discoloration of the surface may be present.[(A, B, C)]
WJ-2	**Very Thorough or Substantial Cleaning:** A WJ-2 surface shall be cleaned to a matte (dull, mottled) finish which, when viewed without magnification, is free of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter. The staining or tightly adherent matter is limited to a maximum of 5% of the surface.[(A, B, C)]
WJ-3	**Thorough Cleaning:** A WJ-3 surface shall be cleaned to a matte (dull, mottled) finish which, when viewed without magnification, is free of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter. The staining or tightly adherent matter is limited to a maximum of 33% of the surface.[(A, B, C)]
WJ-4	**Light Cleaning:** A WJ-4 surface shall be cleaned to a finish which, when viewed without magnification, is free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Any residual material shall be tightly adherent.[(C)]

[(A)] Surfaces cleaned by LP WC, HP WC, HP WJ, or UHP WJ do not exhibit the hue of a dry abrasive blasted steel surface. After waterjetting, the matte finish color of clean steel surface immediately turns to a golden hue unless an inhibitor is used or environmental controls are employed.[6] On older steel surfaces that have areas of coating and areas that are coating-free, the matte finish color varies even though all visible surface material has been removed. Color variations in steel can range from light gray to dark brown/black.

Steel surfaces show variations in texture, shade, color, tone, pitting, flaking, and mill scale that should be considered during the cleaning process. Acceptable variations in appearance that do not affect surface cleanliness include variations caused by type of steel or other metals, original surface condition, thickness of the steel, weld metal, mill fabrication marks, heat treating, heat-affected zones, and differences in the initial abrasive blast cleaning or in the waterjet cleaning pattern.

The gray or brown-to-black discoloration seen on corroded and pitted steel after waterjetting cannot be removed by further waterjetting. A brown-black discoloration of ferric oxide may remain as a tightly adherent thin film on corroded and pitted steel and is not considered part of the percentage staining.

[(B)] Waterjetting at pressures in excess of 240 MPa (35,000 psig) is capable of removing tightly adherent mill scale, but production rates are not always cost effective.

[(C)] Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife. (See SSPC-SP 7/NACE No. 4[7]).

Section 4: Flash Rusted Surface Requirements

4.1 Table 2 lists four definitions of flash rusted surface requirements. *Flash rust* or *water bloom* is a light oxidation of the steel that occurs as waterjetted carbon steel dries. With the exception of stainless steel surfaces, any steel surface may show flash rust within 0.5 to 2 hours, or longer depending on environmental conditions, after cleaning by water. Flash rust quickly changes the appearance. Flash rust may be reduced or eliminated by physical or chemical methods. The color of the flash rust may vary depending on the age and composition of the steel and the time-of-wetness of the substrate prior to drying. With time, the flash rust changes from a yellow-brown, well adherent, light rust to a red-brown, loosely adherent, heavy rust.

4.2 It is a common practice to remove heavy flash rust by low-pressure water cleaning. The visual appearance of steel that has heavily flash rusted after initial cleaning and is then recleaned by low-pressure water cleaning (up to 34 MPa [5,000 psig]) has a different appearance than the original light flash rusted steel depicted in SSPC-VIS 4/NACE VIS 7.

4.3 The coating manufacturer should be consulted to ascertain the tolerance of the candidate coatings to visual cleanliness, nonvisible contaminants, and the amount of flash rust commensurate with the in-service application. These conditions should be present at the time of recoating.

4.4 The following is an example of a specification statement concerning flash rust:

"At the time of the recoating, the amount of flash rust shall be no greater than moderate (M) as defined in SSPC-SP 12/NACE No. 5."

Table 2: Flash Rusted Surface Definitions

Term	Description of Surface
No Flash Rust	A steel surface which, when viewed without magnification, exhibits no visible flash rust.
Light (L)	A surface which, when viewed without magnification, exhibits small quantities of a yellow-brown rust layer through which the steel substrate may be observed. The rust or discoloration may be evenly distributed or present in patches, but it is tightly adherent and not easily removed by lightly wiping with a cloth.
Moderate (M)	A surface which, when viewed without magnification, exhibits a layer of yellow-brown rust that obscures the original steel surface. The rust layer may be evenly distributed or present in patches, but it is reasonably well adherent and leaves light marks on a cloth that is lightly wiped over the surface.
Heavy (H)	A surface which, when viewed without magnification, exhibits a layer of heavy red-brown rust that hides the initial surface condition completely. The rust may be evenly distributed or present in patches, but the rust is loosely adherent, easily comes off, and leaves significant marks on a cloth that is lightly wiped over the surface.

Section 5: Occupational and Environmental Requirements

5.1 Because waterjet cleaning is a hazardous operation, all work shall be conducted in compliance with all applicable occupational health and safety rules and environmental regulations.

Section 6: Cautionary Notes

6.1 Waterjetting can be destructive to nonmetallic surfaces. Soft wood, insulation, electric installations, and instrumentation must be protected from direct and indirect water streams.

6.2 Water used in waterjetting units must be clean and free of erosive silts or other contaminants that damage pump valves and/or leave deposits on the surface being cleaned. The cleaner the water, the longer the service life of the waterjetting equipment.

6.3 Any detergents or other types of cleaners used in conjunction with waterjetting shall be removed from surfaces prior to applying a coating.

6.4 Compatibility of the detergents with the special seals and high-alloy metals of the waterjetting equipment must be carefully investigated to ensure that WJ machines are not damaged.

6.5 If inhibitors are to be used with the standard jetting water, the manufacturer of the waterjetting equipment shall be consulted to ensure compatibility of inhibitors with the equipment.

6.6 The coatings manufacturer shall be consulted to ensure the compatibility of inhibitors with the coatings.

6.7 If effluent jetting water is captured for reuse in the jetting method, caution should be used to avoid introducing any removed contaminants back to the cleaned substrate. The effluent water should be treated to remove suspended particulate, hydrocarbons, chlorides, hazardous materials, or other by-products of the surface preparation procedures. The water should be placed in a clean water holding tank and tested to determine the content of possible contamination prior to reintroduction into the jetting stream. If detergents or degreasers are used prior to surface preparation, these waste streams should be segregated from the effluent jetting water to avoid contamination and possible equipment damage.

References

1. NACE Standard RP0172 (withdrawn), "Surface Preparation of Steel and Other Hard Materials by Water Blasting Prior to Coating or Recoating" (Houston, TX: NACE). (Available from NACE as an historical document only.)

2 SSPC-SP 13/NACE No. 6 (latest revision), "Surface Preparation of Concrete" (Houston, TX: NACE, and Pittsburgh, PA: SSPC).

3. SSPC-VIS 4/NACE VIS 7/ (latest revision), "Guide and Visual Reference Photographs for Steel Cleaned by Waterjetting" (Pittsburgh, PA: SSPC, and Houston, TX: NACE).

4. "Recommended Practices for the Use of Manually Operated High-Pressure Waterjetting Equipment," (St. Louis, MO: WaterJet Technology Association, 1987).

5. SSPC-SP 1 (latest revision), "Solvent Cleaning" (Pittsburgh, PA: SSPC).

6. NACE Publication 6A192/SSPC-TR 3 (latest revision), "Dehumidification and Temperature Control During Surface Preparation, Application, and Curing for Coatings/Linings of Steel Tanks, Vessels, and Other Enclosed Spaces" (Pittsburgh, PA: SSPC, and Houston, TX: NACE).

7. SSPC-SP 7/NACE No. 4 (latest revision), "Brush-Off Blast Cleaning" (Pittsburgh, PA: SSPC, and Houston, TX: NACE).

8. NACE Publication 6G186 (withdrawn), "Surface Preparation of Contaminated Steel Structures" (Houston, TX: NACE). (Available from NACE as an historical document only.)

9. SSPC-TU 4 (latest revision), "Field Methods for Retrieval and Analysis of Soluble Salts on Substrates" (Pittsburgh, PA: SSPC).

10. ISO[(2)] 8502-5 (latest revision), "Preparation of Steel Substrates Before Application of Paints and Related Products—Test for the Assessment of Surface Cleanliness—Part 5: Measurement of Chloride on Steel Surfaces Prepared for Painting (Ion Detection Tube Method)" (Geneva, Switzerland: ISO).

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NOTE: Appendices A, B, and C provide explanatory notes. They provide additional information on waterjetting.

Appendix A: Surface Cleanliness Conditions of Nonvisible Contaminants and Procedures for Extracting and Analyzing Soluble Salts

A1.1 For the purpose of this appendix, the list of non-visible contaminants is limited to water-soluble chlorides, iron-soluble salts, and sulfates. The contracting parties should be aware that other nonvisible contaminants may have an effect on the coating performance.[8] The specifier should determine whether, and to what condition, nonvisible chemical contaminants should be specified. Section 3 contains additional information on surface cleanliness conditions.

A1.2 The level of nonvisible contaminants that may remain on the surface is usually expressed as mass per unit area, for example, µg/cm^2 (grains/in.^{2}) or mg/m^2 (grains/yd^2) (1 µg/cm^2 = 10 mg/m^2 = 0.0001 grains/in.^{2} = 0.13 grains/yd^2).

A1.3 Coatings manufacturers should be consulted for recommendations of maximum surface contamination allowed. The specification should read as follows:

"Immediately prior to the application of the coating, the surface shall not contain more than xx µg/cm^2 (grains/in.^{2}) of the specific contaminant (e.g., chloride) when tested with a specified method as agreed upon by contracting parties."

A1.4 The contracting parties shall agree on the test method or procedure to be used for determining the level of nonvisible contaminants.

Note: NACE and ISO committees are currently (2002) developing recommendations for the level of nonvisible contaminants that may be tolerated by different types of coatings in various services.

Table A1: Description of Nonvisible Surface Cleanliness Definitions[(A)] (NV)

Term	Description of Surface
NV-1	An NV-1 surface shall be free of detectable levels of soluble contaminants, as verified by field or laboratory analysis using reliable, reproducible test methods.
NV-2	An NV-2 surface shall have less than 7 µg/cm^2 (0.0007 grains/in.^{2}) of chloride contaminants, less than 10 µg/cm^2 (0.001 grains/in.^{2}) of soluble ferrous ion levels, or less than 17 µg/cm^2 (0.0017 grains/in.^{2}) of sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test methods.
NV-3	An NV-3 surface shall have less than 50 µg/cm^2 (0.005 grains/in.^{2}) of chloride or sulfate contaminants as verified by field or laboratory analysis using reliable, reproducible test methods.

[(A)] Additional information on suitable procedures for extracting and analyzing soluble salts is available in SSPC-TU 4 (latest revision) and NACE Publication 6G186.[8,9]

A2.1 Procedure for Extracting Soluble Salts by Swabbing

The following procedures may be used to extract the soluble salts from the surface:

(a) SSPC Swabbing Method[9]
(b) Procedure described in ISO 8502-5, Section 5.1, "Washing of the Test Area"[10]
(c) Any suitable controlled washing procedures available and agreed to by the contracting parties. During the washing procedure, clean plastic or rubber gloves should be worn to ensure that the wash water is not accidentally contaminated.

A2.2 Procedure for Extracting Soluble Salts by Surface Cells

(a) Limpet Cell Method[11]
(b) Surface Conductivity Cell Method[9,11]
(c) Nonrigid Extraction Cell Method[9,11,12]

A2.3 Procedure for Field Analysis of Chloride Ions

The extract retrieved using the procedures in Paragraphs A2.1 and A2.2 may be analyzed using one of the following methods:

(a) Chloride Chemical Test Strips[9]
(b) Chloride Chemical Titration Kit[9]
(c) Ion Detection Tube Method[9,10]

The following laboratory method is available as a referee method:

(a) Specific Chloride Ion Electrode[9,11,13]

A2.4 Procedure for Field Analysis of Sulfate Ions

The extract retrieved using the procedures in Paragraphs A2.1 and A2.2 may be analyzed using one of the following methods:

(a) Turbidity Field Comparator Methods[9, 11]
(b) Turbidity Method[9,11]
(c) Standard Test Method for Sulfate Ion in Water[14]

A2.5 Procedure for Field Analysis of Soluble Iron Salts

The extract retrieved using the procedures in Paragraph A2.1 or A2.2 may be analyzed using one of the following methods:

(a) Ferrous Chemical Test Strips[9,11]
(b) Semiquantitative Test for Ferrous Ions[8]
(c) Field Colorimetric Comparator Methods

A2.5.1 Papers treated with potassium ferricyanide may be used for the qualitative field detection of ferrous ions.[8,9]

Appendix B: Waterjetting Equipment

B1.1 The commercial waterjet unit can be mounted on a skid, trailer, or truck; can be equipped with various prime movers (diesel, electric motor, etc.); and usually consists of a pump, hoses, and various tools. The tools can be hand-held or mounted on a robot (or traversing mechanism). Water is propelled through a single jet, a fan jet, or multiple rotating jets. Rotation is provided by small electric, air, or hydraulic motors, or by slightly inclined orifices in a multiple-orifice nozzle.

B1.2 The units operate at pressures up to 240 to 290 MPa (35,000 to 42,000 psig), using a hydraulic hose with a minimum bursting strength of 2.5 times the capability of its maximum-rated operating strength.

B1.3 A water flow rate of 4 to 53 L/min (1 to 14 gal/min) is typical.

B1.4 Pressure loss is a function of the flow rate of the water through the hose and the inside diameter of the hose. The manufacturer should be consulted for specific information on potential pressure loss for each type of equipment.

B1.5 Waterjets are produced by orifices, or tips, that can have different forms. The higher the pressure, the more limited is the choice of forms. Round jets are most commonly used, but orifices of other shapes are available. Tips can be designed to produce multiple jets of water that are normally rotated to achieve higher material removal rates. Interchangeable nozzle tips should be used to produce the desired streams. The manufacturer shall be consulted for specific recommendations.

B1.6 The distance from the nozzle to the work piece substrate (standoff distance) is critical for effective cleaning with any of the water methods. Excessive standoff does not produce the desired cleaning.

Appendix C: Principles of Waterjetting

SSPC-SP 12/NACE No. 5 is a performance specification, not a process specification. Appendix C is not intended to be used as an equipment specification.

C1 Commentary on Production Rates

C1.1 Operator skill and the condition of the steel surface affect waterjetting production rates.[15,16,17] Regardless of the surface conditions, production rates usually improve when:

(a) The operator gains additional experience with high- and ultrahigh-pressure waterjetting; or

(b) Mechanized, automated waterjetting equipment is used.

C1.1.1 New metal with tightly adhering mill scale requires the highest level of operator skill and concentration to produce a clean surface by waterjetting. Older, more corroded, or previously coated surfaces require an average level of skill and concentration to achieve desired results. This is the opposite of abrasive blasting, when poor surface conditions require the highest levels of operator skill and concentration.

C1.2 As a general rule, production and ease of removal increase as the waterjetting pressure increases.

C1.3 Cleanup time to remove waste material should be considered when determining the overall production rate.

C2 Commentary on Waterjetting Parameters

C2.1 The specifier should describe the final condition of the substrate. Depending on the initial condition of the area and materials to be cleaned, the method to achieve Visible Conditions WJ-1, WJ-2, WJ-3, or WJ-4 may be LP WC, HP WC, HP WJ, or UHP WJ. The method of water cleaning or waterjetting ultimately is based on the capabilities of the equipment and its components. Dwell time, transverse rate, pressure, flow, stand-off distances, the number of nozzles, and rotation speed all interact in determining what material will remain and what will be removed.

C2.2 There are two thoughts on increasing production rates during the removal of materials by pressurized water. First, determine the threshold pressure at which the material will just be removed. The user can then either increase the flow to achieve adequate production rates or increase the pressure by a factor no greater than three over the threshold pressure. These two methods do not necessarily yield the same result.[18]

C2.3 Details of the calculations in Table C1 are standard to the waterjetting industry and are beyond the scope of this standard.[19]

C2.4 Removal of degraded coating is coupled to thorough stressing of the remaining coating. The jet energy is the work done when the jet stream vertically impacts the coating surface. Energy is normally measured in kilojoules. The shear stress is developed against the vertical pit walls and larger fractures created on the eroded coating surface. This can, in gross terms, be thought of as a hydraulic load.

C2.5 Flexure stressing is induced by repetitive loading and unloading of the coatings systems by the jet streams as they pass over the surface. The rapid loading and unloading is vital to finding areas of low adherence and nonvisible adherence defects in the coating system.[19]

C2.6 Characteristics of typical pressurized water systems are included in Table C1.

Table C1: Typical Pressurized Water Systems

Pressure at Nozzle	70 MPa (10,000 psig)	140 MPa (20,000 psig)	280 MPa (40,000 psig)
Number of Tips	2	2	5
Diameter	1.0 mm (0.040 in.)	0.69 mm (0.027 in.)	0.28 mm (0.011 in.)
Flow	12.9 L/min (3.42 gpm)	8.3 L/min (2.2 gpm)	2.0 L/min (0.52 gpm)
Cross-Sectional Area	0.81 mm^2 (0.0013 $in.^2$)	0.37 mm^2 (0.00060 $in.^2$)	0.065 mm^2 (0.00010 $in.^2$)
Jet Velocity	360 m/s (1,180 ft/s)	520 m/s (1,700 ft/s)	730 m/s (2,400 ft/s)
Impact Force (per tip)	8.1 kg (18 lb)	7.7 kg (17 lb)	2.4 kg (5.3 lb)
Jet Energy	141 kJ (134 BTU)	189 kJ (179 BTU)	89 kJ (81 BTU)
Energy Intensity (energy/ cross-sectional area)	175 kJ/mm^2 (107,000 $BTU/in.^2$)	513 kJ/mm^2 (314,000 $BTU/in.^2$)	1,401 kJ/mm^2 (857,000 $BTU/in.^2$)

C2.7 In field terms, the 70-MPa (10,000-psig) jets may not significantly erode the coatings. Therefore, they are typically used for partial removal or for cleaning loose detrital material. The 140-MPa (20,000-psig) jets erode the coatings fairly rapidly and are typically used for partial removal. The 280-MPa (40,000-psig) jets erode and destroy coatings very fast and are typically used when most or all of the coating is to be removed (WJ-1 or WJ-2).

C2.8 Application judgment is employed by operators or users who make the decisions concerning which type of jetting water to use:

(a) HP WC (the water's flow rate is the predominant energy characteristic);

(b) HP WJ (pressure [i.e., the velocity of the water] and flow rate are equally important); or

(c) UHP WJ (the pressure [i.e., the velocity of the water] is the dominant energy characteristic).

C2.9 As water passes through the orifice, potential energy (pressure) is converted to kinetic energy. The energy increases linearly with the mass flow, but increases with the square of the velocity, as shown in Equation (C1).

$$\text{Kinetic Energy} = \frac{1}{2}mv^2 \qquad \text{(C1)}$$

where

m = mass (derived from water volume)
v = velocity (derived from pressure)

In order to calculate the kinetic energy from flow rates and velocity, a time period must be selected. A time period of 10 milliseconds is used for Equation (C1).

C2.10 The threshold pressure[5] of a coating must also be determined. In general, the tougher or harder the coating (i.e., the more resistant to testing by a pocket knife), the higher the threshold pressure; the softer and more jelly-like the coating, the lower the threshold pressure.

C2.10.1 Once the threshold pressure is achieved or exceeded, the production rate increases dramatically. Therefore, waterjetting production rates are affected by two conditions:

(a) Erosion at pressures lower than the threshold pressure, and

(b) Waterjet cutting and erosion at pressures greater than the threshold pressure.

[5] *Threshold pressure* is defined as the minimum pressure required to penetrate the material.[20]

Joint Surface Preparation Standard
SSPC-SP 14/NACE No. 8
Industrial Blast Cleaning

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Foreword

This joint standard covers the use of blast cleaning abrasives to achieve a defined degree of cleaning of steel surfaces prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others whose responsibility it may be to define a standard degree of surface cleanliness.

The focus of this standard is industrial blast cleaning. White metal blast cleaning, near-white blast cleaning, commercial blast cleaning, and brush-off blast cleaning are addressed in separate standards.

Industrial blast cleaning provides a greater degree of cleaning than brush-off blast cleaning (SSPC-SP 7/NACE No. 4), but less than commercial blast cleaning (SSPC-SP 6/NACE No. 3).

Industrial blast cleaning is used when the objective is to remove most of the coating, mill scale, and rust, but when the extra effort required to remove every trace of these is determined to be unwarranted.

The difference between an industrial blast and a brush-off blast is that the objective of a brush-off blast is to allow as much of an existing coating to remain as possible, while the purpose of the industrial blast is to remove most of the coating.

A commercial blast is free of mill scale, rust, and coatings, and allows only random staining on less than 33% of the surface. The industrial blast allows defined mill scale, coating, and rust to remain on less than 10% of the surface and allows defined stains to remain on all surfaces.

This joint standard was prepared by the SSPC/NACE Task Group A on Surface Preparation by Abrasive Blast Cleaning. This joint Task Group includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation.

1. General

1.1 This joint standard covers the requirements for industrial blast cleaning of unpainted or painted steel surfaces by the use of abrasives. These requirements include the end condition of the surface and materials and procedures necessary to achieve and verify the end condition.

1.2 This joint standard allows defined quantities of mill scale and/or old coating to remain on the surface.

1.3 The mandatory requirements are described in Sections 1 to 9 as follows:

Section 1 General

Section 2 Definition

Section 3 References

Section 4 Procedure Before Blast Cleaning

Section 5 Blast Cleaning Methods and Operation

Section 6 Blast Cleaning Abrasives

Section 7 Procedures Following Blast Cleaning and Immediately Prior to Coating

Section 8 Inspection

Section 9 Safety and Environmental Requirements

NOTE: Section 10, “Comments” and Appendix A, “Explanatory Notes” are not mandatory requirements of this standard.

2. Definition

2.1 An industrial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, and dirt. Traces of tightly adherent mill scale, rust, and coating residues are permitted to remain on 10% of each unit area of the surface (see Section 2.6) if they are evenly distributed. The traces of mill scale, rust, and coating shall be considered tightly adherent if they cannot be lifted with a dull putty knife. Shadows, streaks, and discolorations caused by stains of rust, stains of mill scale, and stains of previously applied coating may be present on the remainder of the surface.

2.2 The shape, configuration, and design of structures can lead to areas of limited accessibility for blast cleaning. Examples include crevices around rivets or fasteners, and behind or between tightly configured back-to-back angles. Because of the limited accessibility, these areas are exempt from the 10% restrictions established in Section 2.1. However, all surfaces in limited-access areas shall be subjected to the abrasive blast, and upon completion, old coating, rust, and mill scale are permitted to remain provided they are well-adherent as determined using a dull putty knife.

2.3 Acceptable variations in appearance that do not affect surface cleanliness as defined in Section 2.1 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat affected zones, blasting abrasives, and differences due to blasting technique.

2.4 When a coating is specified, the surface shall be roughened to a degree suitable for the specified coating system.

2.5 Immediately prior to coating application, the surface shall comply with the degree of cleaning specified herein.

2.6 Unit area for determinations shall be approximately 5776 mm^2 (9 in^2) (i.e., a square 76 mm x 76 mm [3 in x 3 in]).

2.7 ISO 8501-1:(latest edition)/SS 05 59 00(1) (Condition B Sa 2), or other visual standards of surface preparation may be specified to supplement the written definition.

NOTE: Additional information on visual standards is available in Section A.4 of Appendix A. Also note that Condition B Sa 2 of ISO 8501-1 does not depict the influence that previously applied coating may have on the appearance of the prepared surface. It is based on the preparation of a previously uncoated steel surface covered with rust and flaking mill scale.

3. References

3.1 The standards referenced in this standard are listed in Sections 3.4 and 3.5.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this standard, the requirements of this standard shall prevail.

3.4 SSPC: THE SOCIETY FOR PROTECTIVE COATINGS STANDARDS:

AB 1	Mineral and Slag Abrasives
AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
AB 3	Newly Manufactured or Re-Manufactured Steel Abrasives
PA Guide 3	A Guide to Safety in Paint Application
SP 1	Solvent Cleaning

3.5 INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) STANDARD:

ISO 8501-1:1988 /SS 05 59 00	Preparation of steel substrates before application of coatings and related products—Visual assessment of surface cleanliness

4. Procedures Before Blast Cleaning

4.1 Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1 or other agreed-upon methods.

4.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification).

NOTE: Additional information on surface imperfections is available in Section A.5 of Appendix A.

4.3 If a visual standard or comparator is specified to supplement the written standard, the condition of the steel prior to blast cleaning should be determined before the blasting commences.

NOTE: Additional information on visual standards and comparators is available in Section A.4 of Appendix A.

5. Blast Cleaning Methods and Operation

5.1 Clean, dry compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve this requirement.

5.2 Any of the following methods of surface preparation may be used to achieve an industrial blast cleaned surface:

5.2.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

5.2.2 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

5.2.3 Dry abrasive blasting using a closed cycle, recirculating abrasive system with centrifugal wheels and abrasive.

5.3 Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve an industrial blast cleaned surface by mutual agreement between those responsible for performing the work and those responsible for establishing the requirements.

NOTE: Information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Section A.9 of Appendix A.

6. Blast Cleaning Abrasives

6.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

(1) ISO 8501-1: (latest edition)/SS 05 59 00 is available from the Swedish Standards Institute (Standardisering-kommissionen i Sverige—SIS), Box 6455, S 113-92 Stockholm, Sweden, and SSPC: The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656, USA.

6.2 The cleanliness and size of recycled abrasives shall be maintained to ensure compliance with this specification.

6.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1, SSPC-AB 2 and SSPC-AB 3.

6.4 Any limitations on the use of specific abrasives, the quantity of contaminants, or the degree of allowable embedment shall be included in the procurement documents (project specification) covering the work, because abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements.

NOTE: Additional information on abrasive selection is given in Section A.2 of Appendix A.

7. Procedures Following Blast Cleaning and Immediately Prior to Coating

7.1 Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP 1 or another method agreed upon by those parties responsible for establishing the requirements and those responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning, or other methods agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

NOTE: The presence of toxic metals in the abrasives or paint being removed may place restrictions on the methods of cleaning permitted. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

7.3 After blast cleaning, surface imperfections that remain (e.g., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers, etc.) shall be removed to the extent required in the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Section 2.4.

NOTE: Additional information on surface imperfections is contained in Section A.5 of Appendix A.

7.4 Any visible rust that forms on the surface of the steel after blast cleaning shall be removed by recleaning the rusted areas to meet the requirements of this standard before coating.

NOTE: Information on rust-back (re-rusting) and surface condensation is contained in Sections A.6, A.7, and A.8 of Appendix A.

8. Inspection

8.1 Work and materials supplied under this standard are subject to inspection by a representative of those responsible for establishing the requirements. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and supplier shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

9. Safety and Environmental Requirements

9.1 Because abrasive blast cleaning is a hazardous operation, all work shall be conducted in compliance with applicable occupational and environmental health and safety rules and regulations.

NOTE: SSPC-PA Guide 3, “A Guide to Safety in Paint Application,” addresses safety concerns for coating work.

10. Comments

10.1 Additional information and data relative to this standard are contained in Appendix A. Detailed information and data are presented in a separate document, SSPC-SP COM, “Surface Preparation Commentary.” The recommendations contained in Appendix A and SSPC-SP COM are believed to represent good practice, but are not to be considered requirements of the standard. The sections of SSPC-SP COM that discuss subjects related to industrial blast cleaning are listed below.

Subject	Commentary Section
Abrasive Selection	5
Degree of Cleaning	11.6
Film Thickness	10
Wet Abrasive Blast Cleaning	9

Appendix A. Explanatory Notes

A.1 FUNCTION: Industrial blast cleaning (SSPC-SP 14/NACE No. 8) provides a greater degree of cleaning than brush-off blast cleaning (SSPC-SP 7/NACE No. 4), but less than commercial blast cleaning (SSPC-SP 6/NACE No. 3). It should be specified only when a compatible coating will be applied. The primary functions of blast cleaning before coating are: (a) to remove material from the surface that can cause early failure of the coating system and (b) to obtain a suitable surface roughness and to enhance the adhesion of the new coating system. The hierarchy of blasting standards is as follows: white metal blast cleaning, near-white blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning.

A.2 ABRASIVE SELECTION: Types of metallic and non-metallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). It is important to recognize that blasting abrasives may become embedded in or leave residues on the surface of the steel during preparation. While normally such embedment or residues are not detrimental, care should be taken to ensure that the abrasive is free from detrimental amounts of water-soluble, solvent soluble, acid-soluble, or other soluble contaminants (particularly if the prepared steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are given in SSPC-AB 1, "Mineral and Slag Abrasives," SSPC-AB 2, "Cleanliness of Recycled Ferrous Metallic Abrasives," and SSPC-AB 3, "Newly Manufactured or Re-Manufactured Steel Abrasives."

A.3 SURFACE PROFILE: Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth (or height) is dependent upon the size, shape, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent upon the thickness of the coating to be applied. Large particle sized abrasives (particularly metallic) can produce a profile that may be too deep to be adequately covered by a single thin film coat. Accordingly, it is recommended that the use of larger abrasives be avoided in these cases. However, larger abrasives may be needed for thick film coatings or to facilitate removal of thick coatings, heavy mill scale, or rust. If control of profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical maximum profile heights achieved with commercial abrasive media are shown in Table 8 of the Surface Preparation Commentary (SSPC-SP COM). Surface profile should be measured in accordance with NACE Standard RP0287 (latest edition), "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape," or ASTM D 4417[2] (latest edition), "Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel."

A.4 VISUAL STANDARDS: ISO 8501-1:(latest edition)/ SIS SS 05 59 00, Photograph BSa2, depicts the appearance of a surface that is consistent with the definition of an industrial blast.

A.5 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the service is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features that are difficult to properly cover and protect include crevices, weld porosities, laminations, etc. The high cost of the methods to remedy surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such surface repair work is essential because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4 of SSPC-SP COM and NACE Standard RP0178 (latest edition), "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service" contain additional information on surface imperfections.

A.6 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (e.g., chlorides and sulfates) develops rust-back rapidly at intermediate and high humidities. These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during blast cleaning if the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface, and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in SSPC-SP 12/NACE No. 5. Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-TU 4, "Technology

(2) Available from ASTM (American Society for Testing and Materials), 100 Barr Harbor Drive, West Conshohocken PA 19428-2959, USA.

Update on Field Methods for Retrieval and Analysis of Soluble Salts on Substrates."

A.7 RUST-BACK: Rust-back (re-rusting) occurs when freshly cleaned steel is exposed to moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, if chemical contamination is not present (see Section A.6), it is best to blast clean and coat a surface the same day. Severe conditions may require more expedient coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating (see Section A.6).

A.8 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of the steel surface be at least 3 °C (5 °F) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations and to avoid the application of coating over a damp surface.

A.9 WET ABRASIVE BLAST CLEANING: Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing. It may be necessary that inhibitors be added to the water or applied to the surface immediately after blast cleaning to temporarily prevent rust formation. The use of inhibitors or the application of coating over slight discoloration should be in accordance with the requirements of the coating manufacturer. CAUTION: Some inhibitive treatments may interfere with the performance of certain coating systems.

A.10 FILM THICKNESS: It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry film thickness of the coat-ng above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured the procedures in SSPC-PA 2 (latest edition), "Measurement of Dry Coating Thickness with Magnetic Gauges" should be used.

A.11 MAINTENANCE AND REPAIR PAINTING: When this standard is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, the cleaning shall be performed across the entire area specified. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning shall be applied 100% to all weld seams. If the entire structure is to be prepared, this degree of cleaning shall be applied to 100% of the entire structure. SSPC-PA Guide 4 (latest edition), "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

SSPC: The Society for Protective Coatings

SURFACE PREPARATION STANDARD NO. 15

Commercial Grade Power Tool Cleaning

1. Scope

1.1 This standard covers the requirements for power tool cleaning to provide a commercial grade power tool cleaned steel surface and to retain or produce a minimum 25 micrometers (1.0 mil) surface profile.

1.2 This standard differs from SSPC-SP 3, Power Tool Cleaning, in that a higher degree of surface cleanliness is required and a minimum surface profile of 25 micrometers (1.0 mil) will be retained or produced. See definition in Section 2.4 below.

1.3 This standard differs from SSPC-SP 11, Power Tool Cleaning to Bare Metal, in that stains of rust, paint, or mill scale may remain on the surface.

2. Definition

2.1 A commercial grade power tool cleaned steel surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, rust, coating, oxides, mill scale, corrosion products, and other foreign matter, except as noted in Section 2.2.

2.2 Random staining shall be limited to no more than 33 percent of each unit area of surface as defined in Section 2.6. Staining may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted.

2.3 Acceptable variations in appearance that do not affect surface cleanliness as defined in Sections 2.1 and 2.2 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat affected zones, or the use of a variety of power tools.

2.4 The surface profile roughness shall be a minimum of 25 micrometers (1.0 mil), as measured in accordance with Method C of ASTM D 4417 or other mutually agreed-upon method (see Note 10.1). NOTE: The appearance of a profile resulting from power tool cleaning is different from the appearance of a profile created by abrasive blast cleaning.

2.5 Immediately prior to paint application, the surface shall comply with the degree of cleaning specified herein.

2.6 Unit area for determining staining shall be approximately 6400 mm^2 (9 in^2) (i.e., a square 80 x 80 mm [3 x 3 inches]).

3. Surface Preparation Power Tools and Media

3.1 SURFACE CLEANING POWER TOOLS: Any tool on which the media described in Section 3.3 can be properly mounted and used is acceptable. These tools may or may not alter or destroy the existing surface profile.

3.2 IMPACT AND OTHER PROFILE PRODUCING POWER TOOLS: Any tool on which the media of Section 3.4 can be properly mounted and used to produce the required surface profile is acceptable.

3.3 SURFACE CLEANING MEDIA: The media used to clean the surface shall consist of the following:

3.3.1 Non-woven abrasive wheels and discs constructed of a non-woven synthetic fiber web material of continuous undulated filaments impregnated with an abrasive grit. (A list of suitable types of media is found in Note 10.2.)

3.3.2 Coated abrasive discs (sanding pads), coated abrasive flap wheels, coated abrasive bands, or other coated abrasive devices capable of running on power tools.

3.3.3 Other materials that produce the requirements of Sections 2.1 through 2.6.

3.4 IMPACT AND PROFILE PRODUCING MEDIA: The media used to produce a surface profile shall consist of the following:

3.4.1 Rotary impact flap assembly: Flaps of a flexible loop construction with abrasive media bonded to the peening surfaces of each of the studs fastened to the loop.

3.4.2 Needle gun: A bundle of steel needles (actually chisels) is mounted in front of a piston that strikes them several times per second and pushes them against the surface being cleaned.

3.4.3 Cutter bundles consist of a number of carbon steel or tungsten carbide cutter assemblies that abrade a coating when rotated against a surface.

3.4.4 Hammer (flailer) assemblies consist of a number of carbon steel fingers that abrade a coating when rotated against a surface.

3.4.5 Suitable tools and media that produce the profile requirements of Section 2.4 are listed in Note 10.2.

4. Referenced Standards

4.1 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern, unless otherwise specified. Standards marked with an asterisk (*) are referenced only in the Notes, which are not requirements of this specification.

4.2 If there is a conflict between the requirements of any of the cited reference standards and this standard, the requirements of this standard shall prevail.

4.3 SSPC STANDARDS:

*	**PA 2**	Measurement of Dry Coating Thickness with Magnetic Gages
*	**PA Guide 4**	Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems
	SP 1	Solvent Cleaning
	SP 3	Power Tool Cleaning
	SP 11	Power Tool Cleaning to Bare Metal
*	**VIS 3**	Visual Standard for Power- and Hand-Tool Cleaned Steel

4.4 ASTM INTERNATIONAL STANDARD:[1]

D 4417	Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

5. Procedure for Power Tool Cleaning

5.1 Before power tool cleaning, visible deposits of oil, grease, or other materials that may interfere with coating adhesion shall be removed in accordance with SSPC-SP 1 or other agreed-upon methods. Nonvisible surface contaminants such as soluble salts shall be treated to the extent specified by the procurement documents [project specifications] (see Note 10.3).

5.2 Surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag shall be removed from the surface to the extent required by the procurement documents [project specifications] (see Note 10.4).

6. Power Tool Cleaning Methods

6.1 Any method or combination of methods of surface preparation may be used to achieve a commercial grade power tool cleaned surface. The surface produced shall meet the requirements of Sections 2.1, 2.2, and 2.4 (see Notes 10.2 and 10.5).

6.2 Other methods of surface preparation may be used to achieve a commercial grade power tool cleaned surface by mutual agreement between the contracting parties.

7. Procedures Following Power Tool Surface Preparation

7.1 Power tool prepared surfaces shall meet the requirements of this standard at the time of painting. Prior to painting, remove all visible deposits of oil and grease by any of the methods specified in SSPC-SP 1. (See Note 10.6.3 for information on oil contamination.) Remove dirt, dust, or similar contaminants from the surface. Acceptable methods include brushing, blowing-off with oil free, clean, dry compressed air; vacuum cleaning; wiping with a clean dry cloth; or other methods agreed upon by the contracting parties.

8. Inspection

8.1 Surfaces prepared under this standard are subject to timely inspection by the purchaser or an authorized representative. The contractor shall correct such work as is found defective under this standard. In case of a dispute, the

[1] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-1959. Standards downloadable from www.astm.org

arbitration or settlement procedure established in the procurement documents shall be followed. If no arbitration procedure is established, the procedure specified by the American Arbitration Association shall be used.

8.2 The procurement documents covering work or purchase shall establish the responsibility for testing and for any required affidavit certifying full compliance with the standard.

9. Disclaimer

9.1 While every precaution is taken to ensure that all information furnished in SSPC standards and specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials, coatings, or methods specified herein, or of the specification or standard itself.

9.2 This standard does not attempt to address problems concerning safety associated with its use. The user of this standard, as well as the user of all products or practices described herein, is responsible for instituting appropriate health and safety practices and for ensuring compliance with all governmental regulations.

10. Notes

Notes are not requirements of this standard.

10.1 MEASUREMENT OF SURFACE PROFILE: Surface profile comparators and other visual or tactile gauges used for abrasive blast cleaning are not suitable for measuring the profile produced by power tools because of the differences in appearance. One acceptable procedure is use of replica tape, as described in Method C of ASTM D 4417. Replica tapes are valid for profiles in the following ranges:

Coarse	20 to 50 micrometers	0.8 to 2.0 mils
Paint Grade	33 to 84 micrometers	1.3 to 3.3 mils
Extra-Coarse	38 to 115 micrometers	1.5 to 4.5 mils

Because of the limitations in compressibility of the mylar film, even very smooth surfaces will give readings of 13 micrometers (0.5 mil) or greater using the replica tape.

The contracting parties may agree to measure profile with a mechanical or a digital profile gage.

10.2 SUITABLE TOOLS AND MEDIA: This list of items that are mentioned in the text of this standard is intended solely to guide the user to typical types of equipment and media that are available to meet the specification. The items mentioned do not include all of the tools or products available, nor does their mention constitute an endorsement by SSPC.

- Rotary impact cleaning using a rotary tool and rotary peening flaps
- Rotary impact cleaning using a rotary tool and cutter bundle
- Needle guns
- Right angle sanders with abrasive discs or wheels
- Right angle sanders with non-woven abrasive discs or wheels
- Straight shaft grinders with non-woven abrasive discs or wheels
- Hammer assemblies

10.3 RUST-BACK: Rust-back (rerusting) occurs when freshly cleaned steel is exposed to conditions of high humidity, moisture, contamination, or a corrosive atmosphere. The time interval between power tool cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, it is best to clean and coat a surface on the same day. Severe conditions may require coating more quickly, while for exposure under controlled conditions, the coating time may be extended. Under no circumstances should the steel be permitted to rust-back before painting, regardless of time elapsed.

10.4 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the environment is severe. Generally, coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features that are difficult for a coating to properly cover and protect include crevices, weld porosity, laminations, etc. The high cost of methods to remedy the surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adherent contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations, should be removed during the power tool cleaning procedure. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such repair work is essential, since the timing of the repairs may occur before, during, or after the power tool cleaning operations. Section 4 of the “Surface Preparation Commentary” (SSPC-SP COM) contains additional information on surface imperfections.

10.5 SELECTION OF TOOLS AND MEDIA

10.5.1 Selection of Tools: Power tools should be selected based on the size and speed rating of the media. These requirements may differ from one type of medium to another and should be taken into consideration if more than one type of medium will be used in the surface preparation process. Power tools should be selected that will produce enough power to perform the cleaning operation efficiently. Operator fatigue should be considered in the selection of power tools.

10.5.2 Selection of Media: If an acceptable surface profile existed prior to preparing the surface, cleaning media, such as found in Section 3.3, should be selected that will remove surface contaminants without reducing the existing profile, if possible. If the surface profile is reduced below the required minimum when preparing the surface, or if there is no profile prior to surface preparation, surface profiling media, such as found in Section 3.4, should be selected that will produce an acceptable surface profile as required by this standard. When power tool cleaning rusted surfaces, it is important to avoid embedding or peening rust into the substrate. These factors may require employing more than one type of medium in order to obtain the desired result.

Power wire brushes or sanding discs when used alone will not produce the required surface profile and may remove or degrade an existing profile to an unacceptable level. Exceedingly heavy deposits of corrosion products should be removed using hand or power tools prior to using surface profiling media. After removal of excessive corrosion, a structural inspection may be warranted.

Further information on the selection of power tools and media is contained in the *SSPC Painting Manual, Volume 1–Good Painting Practice.*

10.6 OPERATION OF TOOLS: Prior to operation of tools, read the manufacturer's instructions. Additional information on the operation of power tools can be found in the *SSPC Painting Manual, Volume 1–Good Painting Practice.*

10.6.1 Observe the recommended operating speed (ROS). The maximum operating speed (MOS) does not necessarily give the most effective cleaning.

10.6.2 The rotational speed (RPM) rating of some power tools and the cleaning media may not be compatible and could result in physical injury to the operator or persons in the immediate area.

10.6.3 When air driven tools are used, the exhaust could contain oil and/or moisture that could easily contaminate the recently prepared surface.

10.6.4 The media used with power tools have a finite life. They should be replaced when they do not produce the specified profile,

10.7 FUNCTION: The type of power tool surface preparation described in this standard removes adherent material, producing a surface that is, except for staining, free from rust, mill scale, and old coatings. The surface must also have a minimum 25 micrometers (1 mil) surface profile. Commercial grade power tool cleaning produces a greater degree of cleaning than SSPC-SP 3 (which does not remove adherent material) and a lesser degree of cleaning than SSPC-SP 11, which requires the removal of all visible materials and stains. Commercial grade power tool cleaning may be considered for coatings that can tolerate a small degree of staining or residual contaminants. The added surface preparation costs, compared to SSPC-SP 3, should be justified by the expected increase in coating performance.

This standard is suitable where a roughened, cleaned surface is required, but where abrasive blasting is not feasible or permissible. The surfaces prepared according to this standard should not be compared to surfaces cleaned by abrasive blasting. Although this method produces surfaces that "look" like a "commercial blast," they are not necessarily equivalent to those surfaces produced by abrasive blast cleaning. The contracting parties must agree on the appropriateness of the finished surface to accept the specified coating system. Selection of power tools and cleaning media should be based on (1) the condition of the surface prior to surface preparation; (2) the extent of cleaning that is required; and (3) the surface profile required.

10.8 PROFILE: The type of power tools to be used depends upon whether an acceptable profile exists on the surface to be cleaned. The ability of the various types of media to produce a profile or to preserve an existing profile is limited. The media of Section 3.3 produce a profile of approximately 13 micrometers (0.5 mils), whereas the media of Section 3.4 may produce a profile of 25 micrometers (1 mil) or more. The profile depends on the abrasive embedded in the rotary flaps or the diameter and sharpness of the needles. Impact tools may produce sharp edges or cut into the base metal if not used properly.

It is important to determine whether the profile requirements for the specified coating system can be met by this power tool cleaning method of surface preparation.

10.9 VISUAL STANDARDS: SSPC-VIS 3 provides a suitable comparative visual standard for SSPC-SP 3 and SSPC-SP 11. This standard falls between the two referenced standards in terms of cleanliness (see Section 2.2). Visual standards for blast-cleaned steel are not suitable for

assessing surfaces power tool cleaned to a commercial grade. Because power tool cleaning is a time and effort-sensitive method of cleaning, it is advisable to prepare a 5 to 9 m^2 (50 to 100 ft^2) test area to an acceptable level agreed upon by the contracting parties, and cover it with a clear lacquer to save it as a standard during the power tool cleaning operation. A 30 x 30 cm (12 x 12 inch) steel test plate can also be power tool cleaned to an acceptable level and sealed to serve as a project standard. Alternatively, such a field standard could be protected with a volatile corrosion inhibitor, tablet or impregnated paper, with or without a desiccant, and kept in a sealed plastic bag. This would permit examination of the surface profile.

10.10 INACCESSIBLE AREAS: Because of the shape and configuration of the power tools themselves, some areas of a structure may be inaccessible for cleaning. These areas include surfaces close to bolt heads, inside corners, and areas with limited clearance. Areas that are inaccessible by this method of surface preparation should be cleaned using an alternative method that may result in a different degree of surface cleanliness and surface profile. The contracting parties should agree upon the alternative method before starting the project.

10.11 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is recommended that the temperature of the steel surface be at least 3°C (5°F) above the dew point during power tool cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during power tool cleaning operations. It is equally important to continue to monitor the surface temperature/dew point relationship until the coating is applied in order to avoid painting over a damp surface, unless the selected coating is specifically intended for application on damp substrates.

10.12 FILM THICKNESS: It is essential that ample coating be applied after power tool cleaning to adequately cover the peaks of the surface profile. The dry film thickness above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate according to contract documents or manufacturer's specifications, premature rust through or failure will occur. To assure that coating thickness is properly measured, the procedures in SSPC-PA 2 should be used.

10.13. MAINTENANCE AND REPAIR PAINTING: When this specification is used in maintenance painting, specific instructions should be given on the extent of surface to be power tool cleaned or spot cleaned. SSPC-PA Guide 4 provides a description for retaining old sound paint, removing unsound paint, feathering, and spot cleaning.