



PTT Exploration and Production Public Company Limited

PTTEP Engineering General Specification
(Engineering and Development Group)

Standard

Painting of Onshore Structure and Facilities

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1.0 INTRODUCTION

PEGS (PTTEP Engineering General Specification) is the PTT Exploration and Production PCL internal publishes standard. The objective of PEGS is to promote the best practices collecting from all PTTEP execution projects and to standardize those best practice to the future projects.

Every 5 years or upon request by the internal user, PEGS will be reviewed by related subject experts to reach decisions/agreements, then the document will be updated and published to PTTEP intranet website. This is to ensure that all lessons learnt from users can be applied to the future projects as the benefit to PTTEP.

2.0 PURPOSE

The purpose of the PTTEP General Specifications (PEGS) is to provide general technical guidance for the activities associated with engineering design, procurement, installation, and construction (EPIC) project process, to achieve fitness of purpose, technical integrity and optimum life cycle cost for constructing PTTEP facilities.

3.0 SCOPE

This document defines the minimum technical requirements for the selection of paint systems, the execution of painting work and the inspection for new offshore or coastal structures and equipment. Quality Assurance and Inspection and Testing requirements for materials, manufacturing, fabrication, and installation activities for the Work are also defined by this specification.

The specification is based on the use of high durability painting systems for facilities whose design life is anticipated more than 15 years.

4.0 RESPONSIBLE ACTION PARTIES

N/A

5.0 DEFINITIONS

A number of different terms are commonly used to describe the work stages, processes, and approvals which take place during the early stages of a development. This can often be a source of confusion so the following section is intended to show the PTTEP preferred terminology as used in this document.

5.1 LANGUAGE

In this document, the words should and shall have the following meanings:

Shall	Indicates a course of action with a mandatory status. The term “shall” shall be used if a requirement is considered to be necessary to claim compliance with a PEGS document.
Should	Indicates a preferred course of action. Should is a non-mandatory word and is not forbidden, but use in the body of the text should be the exception. Where none mandatory terms are used, each paragraph within these clauses shall also have an associated commentary paragraph that provides the rationale for why the stated choices and modifications are appropriate and circumstance under which the stated choices and modifications might be different.

5.2 TERMINOLOGY

Terminology	Description
APPLICATOR	The COMPANY in charge of paint application and quality control which is eventually sub-contracted by the CONTRACTOR
Approval	The authorization in writing given by the COMPANY to the Contractor to proceed the work without releasing in any way the Contractor from any of his obligations to conform with the technical specifications, requisitions, etc. The words “Approve”, “Approved” and “Approval” shall be construed accordingly
Company	PTT Exploration and Production Public Company Limited and affiliates.
Contract Documents	The material requisitions, material specifications, etc. issued by the COMPANY and attached to the Contract or the Purchase Order
Contractor	Per contract: Contractor – ‘The contractor who is a PARTY to this CONTRACT and where the context so requires including, SUBCONTRACTORS utilized by CONTRACTOR for the performance of the WORK’
Inspector	The COMPANY’s or CONTRACTOR’s representative(s), (as applicable), or member(s) from an Inspection Agency duly appointed by the COMPANY or the SUPPLIER (as applicable) to act as its representative(s) for the purpose of the contract.
Manufacturer	The company or its sub-contractors selected by the COMPANY or the Contractor or the Supplier (as applicable) as the Manufacturer of the said material.
PPS	Designates Project Particular Specification detailing the additional tests and requirements or the possible modifications to the present specification, based on the particular design conditions or the local legislation of the project
Purchaser	The COMPANY or the Contractor or the Supplier (as applicable) which have placed the Purchase Order to the Supplier/Vendor/Manufacturer.

Terminology	Description
Supplier/Vendor	The company designed on the Purchase Order form or Contract as being the selected supplier of the said materials.
WORK	All activities defined in the Scope of Work

5.3 COMMON ACRONYMS

Set out below in alphabetical order are common acronyms as found within this document:

Reference	Description
ACQPA	Association of Certification and Qualification for Paint Anticorrosion
AY	Acrylic
CA	Certifying Agent
DFT	Dry Film Thickness
EP	Epoxy
EPES	Ester Epoxy
EPGF	Glass Flake Epoxy
EPHZ	Zinc Phosphate Epoxy
EPM	Modified Epoxy
EPPH	Phenolic Epoxy
EPRZ	Rich Zinc Epoxy [Zn] > 80% (ISO 12944-5)
EPVI	Vinylic Epoxy
EPZ	Poor Zinc Epoxy EPZ [Zn] < 80% (ISO 12944-5)
ESI	Zinc ethyl silicate
FROSIO	The Norwegian Professional Council for Education and Certification of Inspectors for Surface Treatment
FRP	Fibre Reinforced Plastic
ICP	Inorganic copolymer
NACE	National Association of Corrosion Engineers
PFP	Passive Fire Protection
PUR	Polyurethane
SI	Silicone
PVB	Polyvinyl Butyral
PVC	Polyvinyl Chloride
PY	Polyester
TM	Titanium Modified
SSPC	Society for Protective Coatings
UV	Ultra-Violet
VY	Vinyl-ester

6.0 REFERENCES

The reference documents listed below, including Industry Codes and Standards and COMPANY specifications, form an integral part of this Engineering General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published on the effective date of a contract.

The overall order of precedence of the applicable documents shall be:

1. Applicable Laws, Rules and Regulations of the country in which the system/equipment will be operated (if any);
2. Purchase Order/ Service Order/ Contract Documents (Only applicable for direct purchase by COMPANY);
3. Project Particular Specification (PPS), and relevant data sheet(s) if any;
4. COMPANY General Specification;
5. Codes and Standards in reference.

Any conflict between any of the Contract Documents, or between this specification and any other Contract Documents, shall be reported to COMPANY for decision. In such a case, and unless otherwise agreed or decided by COMPANY, it is understood that the more stringent requirement shall apply.

Exceptions to, or deviations from this specification are not permitted unless previously accepted in writing by COMPANY. For this purpose, requests for substitutions or changes of any kind shall be completed with all pertinent information required for COMPANY assessment. COMPANY's approval, nevertheless, will not, in any way, relieve the responsibility of the Contractor to meet the requirements of the industry Codes and Standards referred to and amended herein, in the event of conflict.

6.1 PTTEP INTERNAL REFERENCES

Internal documents applicable to this document are indicated in the table below.

Document Number	Document Title
EMS-EETP-RPR-001	Corrosion Management in Project Phase

6.2 INTERNATIONAL STANDARDS

International standards applicable to this document are indicated in the table below i.e. ISO, IEC or ITU.

Document Number	Document Title
ISO 8501-1 to 3	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness.
ISO 8502-1 to 4	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness
ISO 8502-6	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness: extraction of soluble contaminants for analysis – the Bresle method
ISO 8502-9	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness: Field method for conductometric determination of water-soluble salts.
ISO 8503-1 to 5	Preparation of steel substrates before application of paints and related products and surface roughness characteristics of blast-cleaned steel substrates
ISO 8504-1 to 3	Preparation of steel substrates before application of paints and related products. Surface preparation methods
ISO 12944-1 to 8	Paints and varnishes-Corrosion protection of steel structures by paint systems
ISO 11124-1 to 4	Preparation of steel substrates before application of paints and related products. Specifications for metallic blast-cleaning abrasives
ISO 11125-1 to 7	Preparation of steel substrates before application of paints and related products. Methods for testing metallic blast-cleaning abrasives
ISO 11126-7, 8, & 10	Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives: fused aluminium oxide, olivine sand and Almandite Garnet.

Document Number	Document Title
ISO 11127-1 to 7	Preparation of steel substrates before application of paints and related products. Test Methods for non-metallic blast-cleaning abrasives
ISO 1513	Paints and varnishes. Examination and preparation of samples for testing
ISO 19840	Paints and Varnishes-Corrosion Protection of Steel Structures by Protective Paint Systems. Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces.
ISO 2808	Paints and varnishes – Determination of film thickness
ISO 2409	Paints and varnishes. Cross-cut test
ISO 16276-2	Corrosion protection of steel structures by protective paint systems – Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating – Cross-cut testing and X-cut testing
ISO 4624	Paints and varnishes. Pull-off test for adhesion.
ISO 4628	Paints and varnishes -- Evaluation of degradation of coatings -- Designation of quantity and size of defects, and of intensity of uniform changes in appearance
ISO 16276-1	Corrosion protection of steel structures by protective paint systems – Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating – Pull-off testing
ISO 4628-1 to 6	Paint and varnishes – Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance
ISO 9223	Corrosion of metals and alloys, Corrosivity of atmosphere – Classification
ISO 7253	Paints and varnishes. Determination of resistance to neutral salt spray (fog)
ISO 787-10	General methods of test for pigments and extenders - Part 10: Determination of density. Pyknometer method
ISO 6270	Paints and varnishes - Determination of resistance to humidity (continuous condensation)
ISO 3678	Paints and varnishes. Print-free test
ISO 7724-1 to 3	Paints and varnishes. Determination of color and color difference
NF T 34 550	Paints and varnishes- Corrosion protection of steel

Document Number	Document Title
	structures by protective paint systems - Specifications
ASTM D 4940	Standard test method for conductimetric analysis of water soluble ionic contamination of blasting abrasives
ASTM D7393	Standard Practice for Indicating Oil in abrasives
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D 4752	Standard test method for measuring MEK resistance of ethyl silicate (inorganic) Zinc-rich primer by solvent rub
RAL 840 HR	Color standards
ACQPA	"Association pour la Certification et la Qualification en Peinture Anticorrosion". Painting system certified by ACQPA.
SSPC-SP 1	Surface preparation specification no.1 Solvent cleaning
SSPC-SP 16	Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

6.3 CODE AND OTHER STANDARDS

Codes, standards and regional legislation applicable to this document are indicated in the table below.

Document Number	Document Title
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D4752	Standard test method for measuring MEK resistance of ethyl silicate (inorganic) Zinc-rich primer by solvent rub
ASTM D 4940	Standard test method for conductimetric analysis of water soluble ionic contamination of blasting abrasives
ASTM D7393	Standard Practice for Indicating Oil in abrasives
ACQPA	"Association pour la Certification et la Qualification en Peinture Anticorrosion". Painting system certified by ACQPA.
NFT 34 550	Paints and varnishes- Corrosion protection of steel structures by protective paint systems - Specifications
SSPC-SP 1	Surface preparation specification no.1 Solvent cleaning
SSPC-SP 16	Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
RAL 840 HR	Color standards

7.0 REQUIREMENTS FOR PAINTING OF ONSHORE OF STRUCTURES AND FACILITIES

7.1 TECHNICAL CONTENT OF TENDERS

Tenders shall include the following information:

- 1) Proposed paint systems for each category / location of item to be painted
- 2) Product data sheets
- 3) Terms and conditions of guarantee,
- 4) A statement showing that all parties involved (CONTRACTOR, SUPPLIER, and APPLICATOR) will be carrying out the work according to the present specification, or if relevant, to the project particular specification. This statement shall also show that the guarantee is jointly underwritten by all parties and specify the durations and performance levels of the guarantee. This statement can consist in either a certificate of homologation by an approved organization or a letter signed by the head office of each party involved.
- 5) Maximum thickness tolerable for each coat and for the full system,
- 6) Surface preparation and painting procedures,
- 7) Inspection test plan with acceptance criteria and frequency of inspection,
- 8) A list of inspection and painting equipment to be used shall include copy of certificate,
- 9) Minimum and maximum intervals between coats for each system and according to climatic conditions
- 10) Conditions of application of the coats that make up the system
- 11) Methods of protection of items to be painted against adverse weather conditions
- 12) Colors to be used for each item of equipment and for the different coats, in accordance with the color chart chosen for the project by COMPANY
- 13) Certificates (ACQPA, FROSIO, NACE, SSPC, BGAS-CSWIP, or equivalent) of operators and inspectors

7.2 CERTIFICATION OF PERSONNEL

Operators shall be individually certified by an approved organization (ACQPA, FROSIO, SSPC, BGAS-CSWIP, etc.) or paint MANUFACTURER.

Inspectors shall be individually certified by an approved organization (ACQPA, FROSIO, NACE, SSPC, BGAS-CSWIP, etc.) minimum level 2 with peer review from the COMPANY representatives).

7.3 KICK OFF MEETING

A technical kick off meeting shall be organized by the CONTRACTOR in the presence of COMPANY, MANUFACTURER and APPLICATOR to define all the details regarding the work, application procedures, and inspection test plan. All the documentation shall be submitted to COMPANY for review prior to this meeting.

During this meeting, the CONTRACTOR shall provide the following:

- 1) Proposed paint system(s) for each piece of equipment to be painted, product data sheets, maximum thickness tolerable for each coat and for the full system, approval certificates for coatings in contact with specific products such as food products, jet fuel, etc. Some paint components are strictly forbidden i.e. Lead chromate. It shall be ensure that paint is lead free.
- 2) Storage and sampling of painting products and safety requirements.
- 3) Methods of protection of items to be painted against adverse weather conditions,
- 4) Surface preparation and painting procedures approved by the paint MANUFACTURER.
- 5) List of inspection and painting equipment to be used, inspection test plan with acceptance criteria and frequency of inspection.

MANUFACTURER shall provide APPLICATOR with technical assistance. All recommendations made by MANUFACTURER other than these outlined in datasheets or in the present specification shall be supported by a written statement from MANUFACTURER head office and the same warrantee period as suggested in the present specification shall be provided.

7.4 PROCUREMENT AND STORAGE OF ABRASIVE AND COATING PRODUCTS

7.4.1 ABRASIVE

Abrasives for use in blast cleaning carbon steels and low alloy steels are specified in ISO 8504-2.

The principal factors that are known to influence this performance are:

- a) The presence of rust and mill scale
- b) The presence of surface contaminants, including salts, dust, oil and greases
- c) The surface profile

Metallic abrasives' specifications shall be in accordance to ISO 11124-1 to 4.

Non-metallic abrasives' specifications shall be in accordance to ISO 11126-7, 8 & 10.

Suitable abrasives are:

- Chilled iron grit or shot.
- Steel and malleable iron grit or shot.
- Non-metallic abrasive (fused aluminium oxide and garnet.)

Aluminium oxide or garnet (free from any chloride or iron/steel contamination) shall be used for blasting stainless steel.

Reusable abrasive shall be steel shot and expendable abrasive shall be fused aluminium oxide and garnet. The use of copper slag or silica sand is prohibited. All abrasive shall be free of crystalline silica.

The abrasives shall be free from oil, grease, moisture etc. Re-used abrasive shall be clean, sharp and free from contaminants.

The abrasive shall be sized to produce the required anchor profile and graded to be free of clay, silt or other matter likely to become embedded in the steel surface.

Abrasives shall be sealed in watertight packaging. Any product delivered in defective packaging shall be rejected. Abrasives must be stored in such conditions as to avoid their degradation.

7.4.2 CONFORMANCE QUALITY CONTROL TEST

One test every 50 bags, or three test per bulk shipment

The performance of protective coatings of paint and related products applied to steel is significantly affected by the state of the steel surface immediately prior to painting.

1) ASTM D7393 Standard Practice for Indicating Oil in abrasives

Oil in abrasives is one of the cleanliness tests required for mineral and slag abrasives, recycled ferrous abrasives and new ferrous abrasives. Oil in abrasives can be transferred to the surface being cleaned, thus contaminating it. This can cause film defects, affect adhesion of the coating applied over it, and ultimate performance of the coating system.

Oil Content test as per ASTM D7393 shall be no visible.

2) ASTM D4940 Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives

Abrasive media may contain ionic contamination naturally (for example, beach sand), from manufacturing (quenching with contaminated water), transportation, storage or use (in the case of abrasive that is reused). Ionic contamination on the abrasive may transfer to the surface during abrasive blast cleaning, resulting in potential osmotic blistering, accelerated underfilm corrosion and premature coating failure.

Conductivity of abrasives shall be less than $150 \cdot 10^{-6}$ SIEMENS/cm as per ASTM D4940.

7.4.3 PAINTING PRODUCTS

Paint systems shall be free from Lead, Mercury, Cadmium, Hexavalent Chromium.

Lead containing paints, coal-tar epoxy paints and coal-tar urethane paints should not be used because of the associated health and environmental restrictions that apply.

All paints and paint materials used shall be obtained from MANUFACTURERS approved in Appendix 2. The paint (or range of paints) to be used shall be approved by COMPANY. Different brands or types of paints shall not be inter-mixed.

The products shall be delivered in MANUFACTURER's original sealed packaging. The packaging shall be clearly marked with MANUFACTURER's name or recognized trade mark, the product description, the colour reference number, the batch number, the fabrication date and the expiry date.

The quantities of paint and thinner required to perform the entire job shall be procured before the work commences, except in cases where the shelf life of the product is less than the anticipated duration of the work or volume of the product is very important.

The expiry dates from the fabrication dates are:

- 1) For zinc ethyl silicate: 6 months
- 2) For other products: 1 year
- 3) Specific cases: according to MANUFACTURER's recommendation with COMPANY approval.

Products must be stored under shelter and in such conditions as to avoid their degradation. All coating materials, thinners, solvents, etc. shall be stored in a suitably ventilated fireproofed building, separate from other painting consumables, shall be protected from ignition sources and shall remain within storage temperatures and storage conditions recommended by the coating MANUFACTURER.

Samples for testing the paint being used may be taken by the COMPANY at any time. Should a sample fail to meet the required specification, the CONTRACTOR shall remove this paint from areas already covered and recoat them with paint that meets the specification.

Appendix 1 specifies painting schedules for various types of equipment, indicating the paint system to be used.

Appendix 2 specifies the approved paint MANUFACTURER and the details for the paint systems specified in Appendix 1.

7.5 SURFACES TO BE PAINTED

All surfaces shall be painted using the relevant specified system, except when otherwise stipulated hereafter.

7.5.1 ITEMS NOT TO BE PAINTED

Unless otherwise specified, the following surfaces shall not be painted:

- 1) Galvanized steel gratings (except where damaged)
- 2) Concrete structures
- 3) Plastic and plastic coated materials provided their resistance to UV has been demonstrated, and color coding is not necessary.
- 4) Non-ferrous materials such as 90-10 and 70-30 copper nickel alloys, Monel, Aluminium bronze, and nickel alloys when not thermally insulated.
- 5) Machined surfaces

7.5.2 PAINTING REQUIREMENT FOR STAINLESS STEEL

The following requirements concern only piping, pipelines and pressure containing equipment. The temperatures mentioned below are the maximum operating temperatures.

7.5.2.1 UNDER THERMAL INSULATION

All heat insulated stainless steel piping and pressure vessels shall be painted as follows:

- 1) For temperatures below 25°C, the painting system is S21.
- 2) For temperatures between 25 °C and 120°C, the painting system is S22.

If application problems are experienced with small size piping, the thickness of the glass flake filled vinyl ester can be reduced to 500 microns (minimum thickness) but applied in two coats of 250 microns each.

Zinc containing paints are prohibited on stainless steel.

All stainless steel shall be painted on areas facing carbon steel pipe supports.

7.5.2.2 WITHOUT THERMAL INSULATION

Stainless steel AISI 304, 304L, 321, 316, 316L, Duplex stainless steel shall be painted for corrosive environment, hydrocarbon gas service, immersion service, underground service, near a cooling tower and high level of chlorides are present in the exposed environment.

- 1) With system S17 for temperatures up to 80 °C.
- 2) With system S18 for temperatures between 81 °C and 120 °C.
- 3) For temperatures between 121°C and 200 °C, and if necessary, system S19 shall be applied.

- 4) For temperatures between 201°C and 400 °C, and if necessary, system S20 shall be applied.

In all cases, and if necessary, system S19 shall be applied for $T > 120^{\circ}\text{C}$. TSA (Thermally Sprayed Aluminium) can also be used as an alternative.

All stainless steels to be protected from iron contamination when construction works are likely to continue after pickling and passivating. Temporary paint to protect against iron contamination (projections from power tooling & welding) can be used. If CONTRACTOR cannot demonstrate that stainless steel can be adequately protected, then all stainless steel shall be painted.

Zinc containing paints are prohibited on stainless steel.

All stainless steel shall be painted on areas facing carbon steel pipe supports.

7.6 PAINTING SYSTEMS

Painting systems are defined according to the following parameters:

- 1) Type of substrate
- 2) Atmosphere or environment
- 3) Minimum and maximum Operating temperatures.

7.6.1 REFERENCE CODE FOR PAINTING SYSTEMS FOR ONSHORE

7.6.1.1 CODING SYSTEM

Part I: atmosphere or environment

Atmosphere or environment	Category of corrosivity
Rural - RU	ISO 12944: C4-RU
Industrial – IN	ISO 12944: C5-I

Part II: Substrate

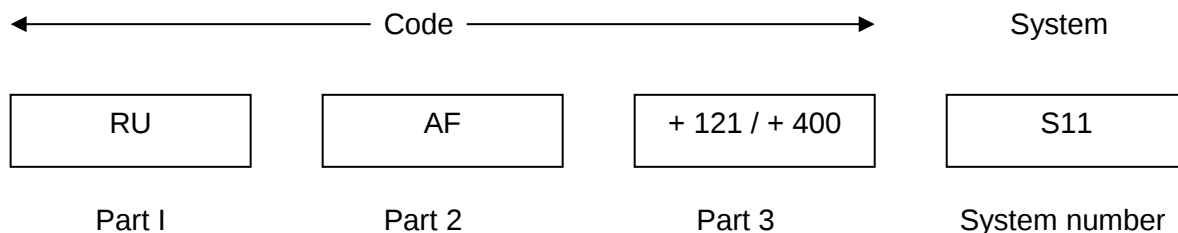
AF	Ferritic carbon steel or cast iron
AI	Austenitic stainless steel and special alloys
AG	Galvanized steels
AB	Zinc plated bichromated steels

Part III: Operating temperatures

This is a four digit code containing the symbol + or - and the maximum and minimum operating temperatures respectively.

7.6.1.2 IDENTIFICATION OF PAINTING SYSTEMS

Systems are identified as follows:



The list of paint systems according to this code is given in Appendix 1.

7.6.2 APPROVED SYSTEMS

New systems can be submitted for approval by COMPANY at any time by the SUPPLIERS already approved (Appendix 2) at SUPPLIERS expense. In that case, a full qualification program shall be submitted to COMPANY together with the name of the third party and independent laboratory which is proposed to perform the test program. COMPANY reserves the right to amend the proposed qualification program and to witness the testing at any stage. As a basis for durability testing, ISO 20340 applies. Other testing will be required depending on the concerned area (atmosphere, immersed or not, temperature etc). Some paint systems are approved by COMPANY based on the results of experience.

The painting systems approved by COMPANY are given in Appendix 2.

7.6.3 SUBSTITUTION RULE

When selecting a painting system, a system designed to withstand environments with higher corrosivity shall always be applicable to lower corrosivity environments.

7.6.4 COLOR CODING

Color coding shall be according to the schedule defined for the project. Generally, colors will be chosen to match those of installations already present in the same block or country.

If the project has no specific requirements, then the color coding shall be according to Appendix 3.

In any case, the painting work carried out by CONTRACTOR shall include all color coding and marking required for service identification.

7.7 SURFACE PREPARATION

7.7.1 DESIGN AND PREPARATION BEFORE BLASTING OF SURFACES TO BE PAINTED

All structures and equipment shall be designed according to ISO international standard for high durability paint systems. All sharp edges shall be rounded (minimum radius > 2 mm).

The design of the item to be painted shall be such that it creates no interstice and inaccessible area. All oil or grease, soil, drawing and cutting compounds, and all other soluble contaminants shall be removed by washing the item to be painted with appropriate solvents or any other suitable means in accordance with SSPC SP1 before beginning blast-cleaning operations. This includes bolt holes in piping assemblies.

All surfaces should be washed with clean fresh water prior to blast cleaning.

Weld spatter and remains of temporary welds, deposits or surface defects shall be eliminated by appropriate means; removal by deep grinding is subject to COMPANY approval.

All mating surfaces of equipment subject to outdoor exposure shall be coated with the full coating system prior to assembly (saddles, skirts, base plates, bolted components, flanges, etc.). CONTRACTOR shall protect all equipment that is not to be painted or may be affected by the presence of abrasives or paint. Special attention shall be paid to avoid splashes of zinc paint on equipment made of austenitic steels.

Abrasive blasting shall not proceed if:

- 1) Temperature of the substrate is less than 3°C above the dew point,
- 2) The relative humidity is more than 85% RH,
- 3) The weather is rainy or foggy, except under shelter, and subject to verification of the atmospheric conditions.

CONTRACTOR shall keep a daily record of the dew point, relative humidity, ambient atmosphere and substrate temperatures (all measured before the work commences and twice per shift and when ambient conditions are obviously changing) to ensure that conditions are acceptable. These records shall be kept and made available to COMPANY.

7.7.2 BLAST CLEANING OF CARBON STEEL (AF)

The blast cleaning procedure shall be submitted to **COMPANY** for approval.

All surfaces to be coated shall be blast-cleaned according to:

- 1) The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- 2) The surface profile Ra (ISO 8503 standard: roughness meter with adapted cut-off or visiotactile surface profile comparator) specified for each system in Appendix 2.
- 3) The surface profile Rz shall be in accordance to ISO 8503-5 standard: Replica Tape method for the determination of surface profile.

After blast-cleaning, all dust must be removed using a vacuum cleaner or air blow before application of the paint (level 2 maximum of ISO 8502 – 3). All blast-cleaned surfaces shall be coated before the deterioration of the "grade of cleanliness". In any case, any surface that has been blast-cleaned shall be coated on the same day.

Before painting works commence, checks for the contamination of the surface by salts shall be checked (ISO 8502 – 6 & 9, 30 mg/m² maximum).

7.7.3 BLAST CLEANING OF CARBON STEEL (AF) ON AUTOMATIC PRODUCTION LINES

In addition to the requirements of 5.7.2:

- 1) All surfaces shall be blast-cleaned to grade of cleanliness Sa 3 (ISO 8501 -1).
- 2) CONTRACTOR shall ensure that the abrasives selected can achieve the required surface profile. This requirement includes determination of abrasives mix, as well as quantity and frequency of renewal. Surface profile shall be checked and recorded twice per shift.
- 3) Dust level shall be thoroughly checked (level 2 maximum of ISO 8502 – 3).

7.7.4 BLAST CLEANING OF STAINLESS STEEL (AI)

Stainless steel shall be segregated, carbon steel supports for storage shall be systematically painted, and lifting equipment shall prevent iron contamination. Stainless steel surfaces to be coated shall be etched or degreased and blast-cleaned with a non-ferrous and chlorine-free abrasive.

The blast cleaning procedure to be submitted to **COMPANY** shall include:

- 1) Abrasive composition to obtain a surface roughness of Ra = 25 to 45 microns
- 2) Dust level (level 2 maximum of ISO 8502 – 3)
- 3) Substrate contamination checks. Ferrous contamination / direct colorimetry method using Prussian blue (Potassium Ferricyanide) shall be used - no surface pollution shall be accepted.
- 4) The surface profile Rz shall be in accordance to ISO 8503-5 standard: Replica Tape method for the determination of surface profile.

7.7.5 SURFACE PREPARATION OF GALVANIZED STEEL (AG)

Galvanized steel to be coated shall be cleaned, degreased and etched using the product specified in the systems or abrasive blast-cleaned to SSPC-SP 16 cleanliness standard.

7.7.6 PREPARATION ZINC-PLATED BICHROMATED SURFACES (AB)

Zinc-plated bichromated surfaces shall be cleaned and degreased in accordance to SSPC-SP 1 Solvent Cleaning standard.

7.8 PAINT APPLICATION

7.8.1 SAMPLES FOR QA/QC PURPOSES

From each batch of products used during the work, the CONTRACTOR shall take two samples to be made available to COMPANY.

7.8.2 QUALIFICATION OF APPLICATION PROCEDURE FOR EACH SYSTEM

One month before work commences, all the selected systems shall be applied on test plates representative of the structure to be painted. The products used shall be sampled from the same batches as these intended for the work.

The system shall be applied in the presence of the MANUFACTURER of the paint and the COMPANY representative in the climatic conditions that are as similar as possible to worst case conditions that can be foreseen during the work on the construction site. Application shall be performed by the painting specialist who will be responsible for application during the work.

When the painting systems are fully cured, visual inspection, thickness measurement and adhesion testing shall be carried out to confirm that the performance of the painting systems meet those specified for each system in Appendix 2.

7.8.3 APPLICATION

7.8.3.1 GENERAL

Paint shall always be applied to surfaces that are dry, clean and degreased, for both coating on substrate and previous coat.

Painting work shall not proceed if:

- 1) Temperature of the substrate is less than 3°C above the dew point,
- 2) The relative humidity is more than 85% RH (90% RH for inorganic zinc silicates),
- 3) The weather is rainy or foggy, except under shelter, and subject to verification of the atmospheric conditions,
- 4) The minimum or maximum temperature of the ambient atmosphere and the substrate are within the limits given in the product data sheets (usually 10 °C for epoxy based paint and 5 °C for acryl-polyurethane topcoat).

CONTRACTOR shall keep a daily record of the dew point, relative humidity, ambient atmosphere and substrate temperatures (all measured before the work commences and twice per shift and when ambient conditions are obviously changing) to ensure that conditions are acceptable. These records shall be kept and made available to the COMPANY.

Application shall be by airless spray.

Stripe coats shall be applied by brush to all angles, corners, sharp edges, bolt or rivet heads, etc. with the same product as this to be applied on the surface to be painted. The only exception is inorganic zinc silicates where stripe coats shall be applied using the repair system primer i.e. zinc rich epoxy.

Different colors shall be used for all successive coats of the paint system. The finishing coat of the required color shall be sufficiently opaque to cover the shade of the undercoat.

The thickness of each coat, including frequency and tolerance shall be checked by the CONTRACTOR according to ISO 19840. The values shall be recorded and made available to COMPANY.

7.8.3.2 PRIMER

According to ISO 12944, two main categories of primer are defined according to the type of pigment they contain:

- Zinc-rich primers and Zinc Silicate primer are those in which the zinc dust pigment content of the non-volatile portion of the paint is equal to or greater than 80 % by mass. Maximum dry film thickness (DFT) for both zinc primers are 75 microns.
- Other primers are those containing zinc phosphate pigment or other anticorrosive pigments and those in which the zinc dust pigment content of the non-volatile portion of the paint is lower than 80 % by mass. Zinc chromate, Red lead, Cadmium and Calcium plumbates are not allowed to use for health and safety reasons.

7.8.3.3 ZINC ETHYL SILICATE

During application, the product shall be stirred at all times.

If relative humidity is low, it shall be sprayed with fresh water for at least two hours after application to enhance curing. Before the subsequent coat is applied, this primer shall be subjected to a MEK test as per ASTM D4752 to ensure that hydrolysis is complete. If complete hydrolysis is not obtained within eight days of application, the coating shall be completely removed and re-applied.

7.8.3.4 ZINC-PLATED BICHROMATED BOLTING

All surfaces of the bolting shall be coated. The topcoat shall be applied after assembly is completed.

7.8.3.5 PAINTING FASTENINGS

For bolting, the following applies:

Carbon steel and Low alloy steel nuts/bolts: It shall be either hot dip galvanised and painted or zinc plating and Xylan coating. Following two painting options are acceptable for the protection of hot dip galvanised or zinc plating on carbon steel bolting.

Option 1: In case carbon steel and Low alloy steel nuts/bolts are hot dip galvanised, the tie coat of the system S05 (30 microns of epoxy) and primer (DFT 30 microns) shall be applied before installation and the remaining layers (intermediate and finish coat) shall be applied after installation.

Option 2: In case carbon steel and Low alloy steel nuts/bolts are zinc plated, PTFE Fluoropolymer (Xylan 1070 or 1424, Blue color) coating shall be applied before application. There is no need to apply intermediate and final coats after installation.

For Option 1 and 2, in case of elevated temperature and high temperature service, the intermediate and final coats to be applied after installation shall be the system for elevated temperature and high temperature service.

Table 1: Coating of Carbon Steel and Low Alloy Steel Nuts/Bolts

Option 1 Hot dip Galvanised and Painting		Option 2* Zn plating and Xylan Coating	
S05 system		S05 system	
Before Installation	After Installation	Before Installation	After Installation
Hot dip galvanised and primer (DFT 30 micron)	Intermediate coat + PU for visible part	Zn plating + Xylan 1070 Blue color (25-40 micron) or Zn plating + Xylan 1424 Blue color (25-40 micron)	No paint after installation

Note: *Degreases with chemical is required before second coat application (Xylan coating)

Stainless steel nuts/bolts: Degreasing with solvent clean to SSPC-SP1 and Aluminium oxide sweep blasting are required as surface preparation before PTFE Fluoropolymer application.

PTFE Fluoropolymer can be applied directly to stainless steel nuts/bolts (no need primer). The approved PTFE Fluoropolymer products are Xylan 1070 and Xylan 1424, Green color and the thickness shall be 25 to 40 microns.

Table 2: Coating of Stainless Steel Nuts/Bolts

Sequences	Generic type	Paint name	DFT (micron)
Before installation	PTFE Fluoropolymer	Xylan 1424 or Xylan 1070 Green color	25-40
After installation	No paint after installation		

Zn plating or hot dip galvanised are prohibited for application on stainless steel surface because crack can be initiated.

For dungeons (long nut), system S05 will be applied after installation

7.8.4 REPAIRS

Any defect shall be repaired before the application of further coats. Subject to the agreement of COMPANY, and after determining the type and size of the defects, the following methods of repair shall be applied:

7.8.5 MAJOR DEFECTS

The paint shall be removed completely by abrasive blast-cleaning and the entire system shall be re-applied.

7.8.6 MINOR DEFECTS (LOCALIZED APPEARANCE, MECHANICAL DAMAGE, SCRATCHES, ETC.)

Subject to the agreement of the **SUPPLIER** of the product, the system shall be removed by localized blast-cleaning, the edges of the sound coating shall be feathered back about 50 mm, and the repair system shall be applied.

7.9 INSPECTION

7.9.1 INSPECTION TEST PLAN

An inspection test plan including all the points mentioned below shall be prepared and submitted to COMPANY for approval.

Inspection test plan must be accord with [10008-STD-6-INT-001](#), PEGS-12060-INT-001

Prior to surface preparation, during surface preparation and paint application CONTRACTORS' Quality Control department shall check the following points and record the results in its quality control report.

Raw materials and conditions for storage

- 1) Data sheets of the products, shelf life, storage requirements
- 2) Storage under shelter

Construction quality:

- 1) Rounding of corners, sharp edges to 2 mm radius minimum,
- 2) Form, quality and continuity of welds.

Climatic conditions for surface preparation and coating application

- 1) Temperature of substrate at least 3 °C above dew point,
- 2) Maximum humidity 85% RH (90% for the application of inorganic zinc silicates)
- 3) For paint application, ambient temperature >10 °C for epoxy, >5 °C for polyurethane.

It shall be measured before the work commences and twice per shift when ambient conditions are obviously changing.

Surface preparation quality:

- 1) Grade of cleanliness: Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- 2) Cleanliness: no grease or oil, dust level 2 maximum according to ISO 8502-3.
- 3) Anchoring profile: 50 to 75 µm in accordance to ISO 8503-5 standard for ferrous substrates, and > 19 µm in accordance to SSPC-SP 16 for non-ferrous substrates.
- 4) Contamination including chlorides: according to ISO 8502-6 and 9, 30 mg/m² maximum.

Coating quality

- 1) State of curing of primer and of each coat.
 - 2) For inorganic zinc silicate: record of spraying with fresh water to enhance hydrolysis (if relevant) and results of MEK test: Level 5 according to ASTM D4752.
 - 3) Interval between coats (in accordance to SUPPLIER product datasheets).
 - 4) Wet film thickness for each coat immediately after application.
 - 5) Number of coats, DFT of each coat and of the final system according to ISO 19840.
 - 6) Appearance and color.
 - 7) Visual inspection results: no defects such as "orange peel", cracking, bubbling, pinholes, runs and sags, blistering, etc.
- 8) Adherence test
- The tests shall be carried out only when the system is completely dry and fully polymerized.
 - Systems with DFT less than 200 µm: cross-cut test class 0 according to ISO 2409 and ISO 16276-2
 - Systems with DFT above 200 µm: pull-off test according to ISO 4624 and ISO 16276-1: Unless specified, the minimum values acceptable are 3 MPa for checks made with mechanical equipment (type Ersad, Satec, or equivalent) and 5 MPa for checks made with hydraulic equipment (Type PAT or equivalent). The equipment must be fitted with a gauge indicating the pulling force. The exception is: 4 Ma for S12 with mechanical tester.

7.9.2 COMPANY INSPECTION

COMPANY inspector shall have free access to storage areas, workshops, and yards where the work will be performed. CONTRACTOR shall also provide COMPANY inspector with all office facilities necessary for the execution of his work (telephone, fax, handling equipment, measuring instruments with valid calibration certificates, etc.) and with all relevant documentation regarding the work to be carried out.

7.9.3 PROVISIONAL ACCEPTANCE

For provisional acceptance, COMPANY shall check that all inspections set out in section 13.1 have been carried out and that all results are satisfactory.

7.9.4 GUARANTEE

The works shall be covered by a specific guarantee: Beginning of warranty period starts from the effective date of the Provisional Acceptance Certificate.

- 1) The guarantee shall be jointly underwritten by CONTRACTOR, APPLICATOR, and SUPPLIER.
- 2) The guarantee shall be provided for duration of 5 years except the guarantee period for the system S10, S12, S13, S14, S15 are 3 years and for the system S11 is only 1 year.
- 3) The maximum degree of rust shall be Ri2 according to ISO 4628.
- 4) The maximum degree of cracking, blistering, or flaking shall be 3S3 according to ISO 4628.
- 5) For the galvanized surfaces and zinc-plated bichromated surfaces, only cracking, blistering and flaking shall be considered.

7.9.5 FINAL ACCEPTANCE

An inspection shall be carried out at the end of the guarantee period to determine if any claims are raised.

7.10 TECHNICAL FILE

CONTRACTOR shall hand over a technical file to COMPANY at the end of the work which shall include:

- 1) All inspection reports
- 2) Provisional acceptance reports
- 3) Guarantee certificates
- 4) Insurance certificates for the guarantee
- 5) Paint systems used, product ordering reference number and all MANUFACTURER details
- 6) Repair procedure

8.0 APPENDICES

Appendix 1. List of Paint Systems

Important warning:

- 1) Interval time between coats shall be as per MANUFACTURER data sheet
- 2) For inorganic zinc silicates, interval considers water spray for 2 hours after application “if RH below 65%”
- 3) Temperatures indicated are minimum /maximum operating temperatures.
- 4) Lead chromates in paint are strictly forbidden.

Deck and equipment			
Item	Code	System	Remarks
Structure	IN AF - 010/ + 080	S01 S01 second	
Floors	IN AF - 010/ + 080	S02	
Galvanized surfaces	IN AG - 010/ + 080	S05	All galvanized surfaces except gratings, stairs and associated galvanized fasteners
Zn/bi-Cr surfaces	IN AB - 010/ + 080	S06	Above 80 degree C, use same system as adjacent surfaces
304, 321,316, 304L, 316L SS T< 80C	IN AI - 010/ + 080	S17	
304, 321,316, 304L, 316L , 904L, DSS T< 120C	IN AI - 010/ + 120	S18	
304, 321,316, 304L, 316L , 904L, DSS T< 200C	IN AI - 010/ + 200	S19	
304, 321,316, 304L, 316L , 904L, DSS T< 400C	IN AI - 010/ + 400	S20	
Carbon Steel High Temperature < 120C	IN AF - 010/ + 120	S10	
Carbon Steel High Temperature < 400C	IN AF + 121/ + 400	S11	Flare type structure

Pressure vessels, piping, and exterior of storage tanks			
Item	Code	System	Remarks
Carbon steel, Non insulated			
T < 80°C	IN AF -010/+080	S01 S01 second	Extended 1.5 m down inside floating roof tanks
81 < T < 120°C	IN AF +081/+120	S10	Including adjacent surfaces
121 < T < 400° C	IN AF +121/+400	S11	Including adjacent surfaces
Carbon steel, Insulated			
T < 90°C	IN AF -010/+090	S12	
90 < T < 200°C	IN AF +090/+200	S13	
Other			
Vessels base structure	IN AF -010/+080	S01 S01 second	
Galvanized surfaces	IN AG - 010/ +080	S05	All galvanized surfaces except gratings, stairs and associated galvanized fasteners
Zn/bi-Cr surfaces	IN AB - 010/ + 080	S06	Above 80 degrees C, use same system as adjacent surfaces
Stainless steels, Non insulated			
304, 304L, 321, 316, 316L T < 80°C	IN AI - 010/ + 080	S17	
304, 304 L, 321, 316, 316 L, 904L, DSS 81°C < T < 120°C	IN AI - 010/ + 120	S18	
304, 304 L, 321, 316, 316 L, 904L, DSS 121°C < T < 200°C	IN AI - 010/ + 200	S19	
304, 304 L, 321, 316, 316 L, 904L, DSS 201°C < T < 400°C	IN AI - 010/ + 400	S20	
Stainless steels, Insulated			
All stainless steels	IN AI - 010/ + 025	S21	
All stainless steels	IN AI - 010/ + 120	S22	

Appendix 2. Approved SUPPLIERS and SUPPLIER's System

LIST OF APPROVED SUPPLIERS

SUPPLIER	Code	Office No.	Mobile No.	Email address
CARBOLINE	C	+66(0) 2 323 2800	+66(0) 8 1628 6240	sumarin@dimetsiam.com
HEMPEL	H	+66(0) 2 392 1226	+66(0) 9 0880 9678	kesinee_cws@tcputhai.com
INTERNATIONAL COATING	I	+66(0) 2 744 1299	+66(0) 8 2486 2498	pongprawut.onkaew@akzonobel.com
JOTUN	J	+66(0) 2 022 9888	+66(0) 8 9201 1172	somchai.wiwatbenchaphol@jotun.com
PPG Sigma*	P	+66(0) 2 319 4190	+66(0) 9 2501 4411	Tongrath.Luekitna@ppg.com
PPG Amercoat*	A	+66(0) 2 319 4190	+66(0) 9 2501 4411	Tongrath.Luekitna@ppg.com

Remark: PPG Sigma and PPG Amercoat are taken care by PPG Company.

System No: S01

Zone: Deck and Equipment (Operating temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit-medium (G) (ISO 8503-2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carbozinc 11	ESI	60	Carbozinc 858	EPRZ	60
	Tie-coat	Carboguard 890	EP	200	Carboguard 890	EP	200
	Intermediate	Carbothane 134	PUR	60	Carbothane 134	PUR	60
Hempel	Final coat						
	Primer	Galvosil 15700	ESI	75	Avantguard 750	EPRZ	75
	Tie-coat	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
International Coating	Intermediate	Hempathane 55210	PUR	50	Hempathane 55210	PUR	50
	Final coat						
	Primer	Interzinc 22	ESI	60	Interzinc 52	EPRZ	60
Jotun	Tie-coat	Intergard 475 HS	EP	150	Intergard 475 HS	EP	150
	Intermediate	Interthane 990	PUR	50	Interthane 990	PUR	50
	Final coat						
PPG Sigma	Primer	Resist 86	ESI	60	Barrier	EPRZ	60
	Tie-coat	Penguard Midcoat or	EP	150	Penguard Midcoat or	EP	150
	Intermediate	Penguard Universal Hardtop XP	PUR	50	Penguard Universal Hardtop XP	PUR	50
PPG Amercoat	Final coat						
	Primer	SigmaZinc 158	ESI	60	SigmaZinc 109HS	EPRZ	60
	Tie-coat	SigmaCover 456	EP	130	SigmaCover 456	EP	130
PPG Amercoat	Intermediate	SigmaDur 550	PUR	50	SigmaDur 550	PUR	50
	Final coat						
	Primer	Dimetcote 9	ESI	75	Amercoat 68G	EPRZ	75
PPG Amercoat	Tie-coat	Amercoat 383H	EP	125	Amercoat 383H	EP	125
	Intermediate	Amercoat 450HS (T)	PUR	50	Amercoat 450HS (T)	PUR	50
	Final coat						

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 5 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 3 MPa (mechanical tester)

System No: S01 Second

Zone: Deck and Equipment (Operating temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit-medium (G) (ISO 8503-2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carbozinc 858	EPRZ	60	Carbozinc 858	EPRZ	60
	Tie-coat	Carboguard 893	EP	200	Carboguard 893	EP	200
	Intermediate Final coat	Carbothane 134	PUR	50	Carbothane 134	PUR	50
Hempel	Primer	N/A	N/A	N/A	N/A	N/A	N/A
	Tie-coat						
	Intermediate Final coat						
International Coating	Primer	Interzinc 52	EPRZ	60	Interzinc 52	EPRZ	60
	Tie-coat	Intergard 475 HS	EP	150	Intergard 475 HS	EP	150
	Intermediate Final coat	Interthane 990	PUR	50	Interthane 990	PUR	50
Jotun	Primer	N/A	N/A	N/A	N/A	N/A	N/A
	Tie-coat						
	Intermediate Final coat						
PPG Sigma	Primer	SigmaPrime 200	EP	125	SigmaPrime 200	EP	125
	Tie-coat	SigmaPrime 200	EP	100	SigmaPrime 200	EP	100
	Intermediate Final coat	SigmaDur 550	PUR	50	SigmaDur 550	PUR	50
PPG Amercoat	Primer	Amercoat 68G	EPRZ	75	Amercoat 68G	EPRZ	75
	Tie-coat	Amercoat 383H	EP	125	Amercoat 383H	EP	125
	Intermediate Final coat	Amercoat 450HS (T)	PUR	50	Amercoat 450HS (T)	PUR	50

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 5 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 4 MPa (mechanical tester)

System No: S02

Zone: Floors (Temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit-medium (G) (ISO 8503-2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carbozinc11	ESI	60	Carbozinc858	EPRZ	60
	Tie-coat						
	Intermediate	Carboguard 890GF	EPGF	300	Carboguard 890GF	EPGF	300
Hempel	Final coat	Carbothane 134	PUR	50	Carbothane 134	PUR	50
	Primer	N/A	N/A	N/A	N/A	N/A	N/A
	Tie-coat						
International Coating	Intermediate						
	Finish coat						
	Primer	Interzone 954	EPM	350	Interzone 954	EPM	350
Jotun	Tie-coat						
	Intermediate	Resist 86	ESI	60	Barrier 80	EPRZ	60
	Finish coat	Penguard Tie coat 100	EP	30			
PPG Sigma	Primer	Jotamastic 87 GF	EPGF	200	Jotamastic 87 GF	EPGF	250
	Tie-coat						
	Intermediate						
PPG Amercoat	Final coat	SigmaShield 880	EPM	300	SigmaShield 880	EPM	300
	Primer	Dimetcote 9	ESI	75	Amercoat 68G	EPRZ	75
	Tie-coat						
PPG Amercoat	Intermediate	Amerlock 400GF	EPGF	300	Amerlock 400GF	EPGF	300
	Final coat						

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 5 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 3 MPa (mechanical tester)

System No: S02 Second

Zone: Floors (Temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit-medium (G) (ISO 8503-2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carbozinc 859 P	EPRZ	60	Carbozinc 859 P	EPRZ	60
	Tie-coat Intermediate Final coat	Carboguard 890 GF	EPGF	300	Carboguard 890 GF	EPGF	300
Hempel	Primer	Avantguard 750	EPRZ	75	Avantguard 750	EPRZ	75
	Tie-coat Intermediate Finish coat	Hempadur 15570 Hempadur Multistrength 45540	EPM EPM EPM	30 200	Hempadur 15570 Hempadur Multistrength 45540	EPM EPM EPM	30 200
International Coating	Primer	Interseal 670HS	EPM	175	Interseal 670HS	EPM	175
	Tie-coat Intermediate Finish coat	Interseal 670HS	EPM	175	Interseal 670HS	EPM	175
Jotun	Primer Tie-coat Intermediate Finish coat	N/A	N/A	N/A	N/A	N/A	N/A
PPG Sigma	Primer	SigmaZinc 109 HS	EPRZ	60	SigmaZinc 109 HS	EPRZ	60
	Tie-coat Intermediate Finish coat	SigmaShield 880	EPM	300	SigmaShield 880	EPM	300
PPG Amercoat	Primer	Amercoat 68G	EPRZ	75	Amercoat 68G	EPRZ	75
	Tie-coat Intermediate Final coat	Amerlock 400GF	EPGF	300	Amerlock 400GF	EPGF	300

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 5 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 3 MPa (mechanical tester)

System No: S05

Zone: Galvanised surfaces (Operating temperature < 80 deg C)

Surface preparation: Sweep blast according to ASTM D6386 or
Brush blast according to SSPC-SP16

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carboguard 893 SG	EP	150	Carboguard 893 SG	EP	150
	Tie-coat						
Hempel	Intermediate	Carbothane 134	PUR	50	Carbothane 134	PUR	50
	Final coat						
Hempel	Primer	Hempadur 15553	EPM	30	Hempadur 15553	EPM	30
	Tie-coat						
Hempel	Intermediate	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
	Final coat	Hempathane 55210	PUR	50	Hempathane 55210	PUR	50
International Coating	Primer	Interseal 670HS	EPM	125	Interseal 670HS	EPM	125
	Tie-coat						
Jotun	Intermediate	Interthane 990	PUR	50	Interthane 990	PUR	50
	Final coat						
Jotun	Primer	Penguard Express	EP	150	Penguard Express	EP	150
	Tie-coat						
PPG Sigma	Intermediate	Hardtop XP	PUR	50	Hardtop XP	PUR	50
	Final coat						
PPG Sigma	Primer	SigmaPrime 200	EP	125	SigmaPrime 200	EP	125
	Tie-coat						
PPG Amercoat	Intermediate	Sigmadur 550	PUR	50	Sigmadur 550	PUR	50
	Final coat						
PPG Amercoat	Primer	Amerlock 400	EPM	125	Amerlock 400	EPM	125
	Tie-coat						
PPG Amercoat	Intermediate						
	Final coat	Amercoat 450HS(T)	PUR	50	Amercoat 450HS(T)	PUR	50

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 5 years - Only cracking blistering, and flaking requirements

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

System No: S06

Zone: Zinc-plated bichromated surfaces

- 1) Surface preparation: Solvent clean according to SSPC-SP-1
- 2) Roughness: 25 to 30 microns

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carboguard 893 SG	EP	150	Carboguard 893 SG	EP	150
	Tie-coat						
	Intermediate						
Hempel	Final coat	Carbothane 134	PUR	50	Carbothane 134	PUR	50
	Primer	Hempadur 15553	EPM	30	Hempadur 15553	EPM	30
	Tie-coat						
International Coating	Intermediate	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
	Final coat	Hempathane Topcoat 55210	PUR	50	Hempathane Topcoat 55210	PUR	50
Jotun	Primer	Interseal 670HS	EPM	125	Interseal 670HS	EPM	125
	Tie-coat						
	Intermediate	Interthane 990	PUR	50	Interthane 990	PUR	50
PPG Sigma	Final coat	Penguard Express	EP	150	Penguard Express	EP	150
	Primer	Hardtop XP	PUR	50	Hardtop XP	PUR	50
	Tie-coat						
PPG Amercoat	Intermediate	SigmaPrime 200	EP	125	SigmaPrime 200	EP	125
	Final coat	Sigmadur 550	PUR	50	Sigmadur 550	PUR	50
PPG Amercoat	Primer	Amerlock 400	EPM	125	Amerlock 400	EPM	125
	Tie-coat						
	Intermediate	Amercoat 450HS(T)	PUR	50	Amercoat 450HS(T)	PUR	50
	Final coat						

Remarks

- Only on thermally insulated piping or to prevent corrosion risk in interstices
- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.

Specific guarantee requirements: 5 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 4 MPa (mechanical tester)

System No: S10

Zone: Carbon steel surfaces subject to high temperatures (80 °C < T < 120 °C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carboguard 890	EP	100	Carboguard 890	EP	100
	Tie-coat	Carboguard 890	EP	100	Carboguard 890	EP	100
	Intermediate	Carboguard 890	EP	100	Carboguard 890	EP	100
Hempel	Final coat	Carboguard 890	EP	100	Carboguard 890	EP	100
	Primer	Avantguard 750	EPRZ	75	Avantguard 750	EPRZ	75
	Tie-coat	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
International Coating	Intermediate	Hempathane 55210	PUR	50	Hempathane 55210	PUR	50
	Final coat	Hempathane 55210	PUR	50	Hempathane 55210	PUR	50
	Primer	Interseal 670 HS	EPM	100	Interseal 670 HS	EPM	100
Jotun	Tie-coat	Interseal 670 HS	EPM	100	Interseal 670 HS	EPM	100
	Intermediate	Interseal 670 HS	EPM	100	Interseal 670 HS	EPM	100
	Final coat	Interseal 670 HS	EPM	100	Interseal 670 HS	EPM	100
PPG Sigma	Primer	Tankguard Storage	EPPH	120	Tankguard Storage	EPPH	120
	Tie-coat	Tankguard Storage	EPPH	120	Tankguard Storage	EPPH	120
	Intermediate	Tankguard Storage	EPPH	120	Tankguard Storage	EPPH	120
PPG Amercoat	Final coat	Tankguard Storage	EPPH	120	Tankguard Storage	EPPH	120
	Primer	SigmaPrime 200	EP	125	SigmaPrime 200	EP	125
	Tie-coat	SigmaPrime 200	EP	100	SigmaPrime 200	EP	100
PPG Amercoat	Intermediate	SigmaPrime 200	EP	100	SigmaPrime 200	EP	100
	Final coat	SigmaPrime 200	EP	100	SigmaPrime 200	EP	100
	Primer	Amerlock 400GF	EPGF	125	Amerlock 400GF	EPGF	125
PPG Amercoat	Tie-coat	Amerlock 400GF	EPGF	125	Amerlock 400GF	EPGF	125
	Intermediate	Amerlock 400GF	EPGF	125	Amerlock 400GF	EPGF	125
	Final coat	Amerlock 400GF	EPGF	125	Amerlock 400GF	EPGF	125

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 3 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 3 MPa (mechanical tester)

System No: S11

Zone: Carbon steel surfaces subject to high temperatures (120 °C < T < 400 °C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carbozinc 11	ESI	60	Thermaline 4700 Thermaline 4700	SI SI	25 25
	Tie-coat	Thermaline 4700	SI	20			
	Intermediate	Thermaline 4700	SI	20			
	Final coat						
Hempel	Primer	Galvosil 15700	ESI	75	Silicon ALU 5691 Silicon ALU 5691	SI SI	25 25
	Tie-coat	Silicon ALU 56914	SI	25			
	Intermediate	Silicon ALU 56914	SI	25			
	Final coat						
International Coating	Primer	Interzinc22	ESI	50	Intertherm 50 Intertherm 50	SI SI	20 20
	Tie-coat	Intertherm 50	SI	20			
	Intermediate	Intertherm 50	SI	20			
	Final coat						
Jotun	Primer	Resist 86	ESI	60	Solvalitt Solvalitt	SI SI	20 20
	Tie-coat	Solvalitt	SI	20			
	Intermediate	Solvalitt	SI	20			
	Final coat						
PPG Sigma	Primer	SigmaZinc 158	ESI	60	SigmaTherm 540 SigmaTherm 540	SI SI	25 25
	Tie-coat	SigmaTherm 540	SI	25			
	Intermediate	SigmaTherm 540	SI	25			
	Final coat						
PPG Amercoat	Primer	Dimetcote 9	ESI	75	Amercoat 878 Amercoat 878	SI SI	25 25
	Tie-coat	Amercoat 878	SI	25			
	Intermediate	Amercoat 878	SI	25			
	Final coat						

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 1 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 3 MPa (mechanical tester)

System No: S12

Zone: Insulated carbon steel surfaces (< 90 °C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carboguard 890	EP	150	Carboguard 890	EP	150
	Tie-coat	Carboguard 890	EP	150	Carboguard 890	EP	150
	Intermediate	Carboguard 890	EP	150	Carboguard 890	EP	150
Hempel	Final coat	Carboguard 890	EP	150	Carboguard 890	EP	150
	Primer	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
	Tie-coat	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
International Coating	Intermediate	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
	Final coat	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
	Primer	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
Jotun	Tie-coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Intermediate	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Final coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
PPG Sigma	Primer	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
	Tie-coat	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
	Intermediate	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
PPG Amercoat	Final coat	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
	Primer	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Tie-coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
PPG Amercoat	Intermediate	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Final coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Primer	Amerlock 400	EPM	125	Amerlock 400	EPM	125
PPG Amercoat	Tie-coat	Amerlock 400	EPM	125	Amerlock 400	EPM	125
	Intermediate	Amerlock 400	EPM	125	Amerlock 400	EPM	125
	Final coat	Amerlock 400	EPM	125	Amerlock 400	EPM	125

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.

Specific guarantee requirements: 3 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 4 MPa (mechanical tester)

System No: S13

Zone: Insulated carbon steel surfaces (< 200 °C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
	Tie-coat	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
	Intermediate	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
Hempel	Final coat	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
	Primer	Hempadur 85671	EPPM	100	Hempadur 85671	EPPM	100
	Tie-coat	Hempadur 85671	EPPM	100	Hempadur 85671	EPPM	100
International Coating	Intermediate	Hempadur 85671	EPPM	100	Hempadur 85671	EPPM	100
	Final coat	Hempadur 85671	EPPM	100	Hempadur 85671	EPPM	100
	Primer	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
Jotun	Tie-coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Intermediate	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Final coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
PPG Sigma	Primer	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
	Tie-coat	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
	Intermediate	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
PPG Amercoat	Final coat	Tankguard Storage	EPPH	200	Tankguard Storage	EPPH	200
	Primer	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Tie-coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
PPG Amercoat	Intermediate	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Final coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Primer	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125
PPG Amercoat	Tie-coat	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125
	Intermediate	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125
	Final coat	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.

Specific guarantee requirements: 3 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 4 MPa (mechanical tester)

System No: S14

Zone: Machines (Temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carboline 858 P	EPRZ	60	Rustbond	EP	50
	Tie-coat						
	Intermediate	Carboguard 893	EPM	125	Carboguard 893	EPM	125
Hempel	Final coat	Carbothane 134	PUR	50	Carbothane 134	PUR	50
	Primer	Avantguard 750	EPRZ	75	Avantguard 750	EPRZ	75
	Tie-coat						
International Coating	Intermediate	Hempadur 45881	EPM	150	Hempadur 45881	EPM	150
	Final coat	Hempathane 55210	PUR	50	Hempathane 55210	PUR	50
	Primer	Interzinc 52	EPRZ	60	Interzinc 52	EPRZ	60
Jotun	Tie-coat						
	Intermediate	Intergard 670 HS	EPM	125	Intergard 670 HS	EPM	125
	Final coat	Interthane 990	PUR	50	Interthane 990	PUR	50
PPG Sigma	Primer	Barrier 80	EPRZ	50	Barrier 80	EPRZ	50
	Tie-coat						
	Intermediate	Penguard Midcoat or Penguard	EP	150	Penguard Midcoat or Penguard	EP	150
PPG Amercoat	Final coat	Universal Hardtop XP	PUR	50	Universal Hardtop XP	PUR	50
	Primer	SigmaPrime 200	EP	125	SigmaPrime 200	EP	125
	Tie-coat						
PPG Amercoat	Intermediate	SigmaPrime 200	EP	100	SigmaPrime 200	EP	100
	Final coat	SigmaDur 550	PUR	50	SigmaDur 550	PUR	50
	Primer	Amercoat 68G	EPRZ	75	Amercoat 68G	EPRZ	75
PPG Amercoat	Tie-coat						
	Intermediate	Amercoat 383H	EP	125	Amercoat 383H	EP	125
	Final coat	Amercoat 450HS(T)	PUR	50	Amercoat 450HS (T)	PUR	50

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 3 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 4 MPa (mechanical tester)

System No: S15

Zone: Open rooms / Workshops, Sub concrete floor
(Temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer Tie-coat Intermediate Final coat	Carbozinc11 Carboguard 890 Carboguard 890	ESI EP EP	60 100 100	Carbozinc11 Carboguard 890 Carboguard 890	ESI EP EP	60 100 100
Hempel	Primer Tie-coat Intermediate Final coat	N/A	N/A	N/A	N/A	N/A	N/A
International Coating	Primer Tie-coat Intermediate Final coat	Interzinc 22 Interseal 670 HS	ESI EPM	60 150	Interzinc 22 Interseal 670 HS	ESI EPM	60 150
Jotun	Primer Tie-coat Intermediate Final coat	Resist 86 Penguard Midcoat or Penguard Universal	ESI EP	60 150	Barrier 80 Penguard Midcoat or Penguard Universal	EPRZ EP	60 150
PPG Sigma	Primer Tie-coat Intermediate Final coat	SigmaPrime 200 SigmaCover 456	EP EP	150 130	SigmaPrime 200 SigmaCover 456	EP EP	150 130
PPG Amercoat	Primer Tie-coat Intermediate Final coat	Dimetcote9 Amercoat 385	ESI EP	75 125	Amercoat 68G Amercoat 358	ESI EP	75 125

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 3 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 3 MPa (mechanical tester)

System No: S15 Second

Zone: Open rooms / Workshops, Sub concrete floor
(Temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer Tie-coat Intermediate Final coat	Carbozinc859P Carboguard 890 SG Carboguard 890 SG	EPRZ EP EP	60 100 100	Carbozinc859P Carboguard 890 SG Carboguard 890 SG	EPRZ EP EP	60 100 100
Hempel	Primer Tie-coat Intermediate Final coat	Avantguard 750 Hempadur Mastic 45881	EPRZ EPM	75 150	Avantguard 750 Hempadur Mastic 45881	EPRZ EPM	75 150
International Coating	Primer Tie-coat Intermediate Final coat	Interzinc 52 Interseal 670 HS	EPRZ EPM	60 200	Interzinc 52 Interseal 670 HS	EPRZ EPM	60 200
Jotun	Primer Tie-coat Intermediate Final coat	N/A	N/A	N/A	N/A	N/A	N/A
PPG Sigma	Primer Tie-coat Intermediate Final coat	N/A	N/A	N/A	N/A	N/A	N/A
PPG Amercoat	Primer Tie-coat Intermediate Final coat	Amercoat 68G Amercoat 385	EPRZ EP	75 125	Amercoat 68G Amercoat 385	EPRZ EP	75 125

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 3 years
Qualification / acceptance requirements: Minimum mechanical pull-off test value of 3 MPa (mechanical tester)

System No: S16

Zone: Air conditioned rooms (Temperature < 80 deg C)

Surface preparation:

- 1) Grade of cleanliness: Sa 3 (ISO 8501-1: 2007). For repair system: Sa 2½
- 2) Roughness: 50 to 75 microns or Grit –medium (G) (ISO 8503 -2: 2012)

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer Tie-coat Intermediate Final coat	Carboguard 890	EP	100	Carboguard 890	EP	100
Hempel	Primer Tie-coat Intermediate Final coat	Galvasoil 15700	ESI	75	Galvasoil 15700	ESI	75
International Coating	Primer Tie-coat Intermediate Final coat	Interzinc 22	ESI	60	Interzinc 22	ESI	60
Jotun	Primer Tie-coat Intermediate Final coat	Resist 86	ESI	60	Resist 86	ESI	60
PPG Sigma	Primer Tie-coat Intermediate Final coat	SigmaZinc 158	ESI	60	SigmaZinc 158	ESI	60
PPG Amercoat	Primer Tie-coat Intermediate Final coat	Dimetcote 9	ESI	75	Amercoat 68G	EPRZ	75

Remarks

- The grade of cleanliness Sa 3 (ISO 8501 standard) for shop blasting and minimum Sa 2.5 (ISO 8501 standard) for outdoor application.
- Maximum DFT for zinc primer is 75 microns

Specific guarantee requirements: 5 years

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

System No: S17

Zone: Non-insulated 304, 304L, 321, 316 and 316 L stainless steels for temperatures < 80 °C

1. Surface preparation: Sweep blast by chloride free aluminum oxide or garnet or Grit-Coarse (C) (ISO – 8503-2)
2. Roughness: 25 to 45 microns

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carboguard 893 SG	EP	150	Carboguard 893 SG	EP	150
	Tie-coat						
Hempel	Intermediate	Carbothane 134	PUR	50	Carbothane 134	PUR	50
	Final coat						
Hempel	Primer	Hempadur 15553	EPM	30	Hempadur 15553	EPM	30
	Tie-coat						
	Intermediate	Hempadur Mastic 45881	EPM	150	Hempadur Mastic 45881	EPM	150
	Final coat	Hempathane Topcoat 55210	PUR	50	Hempathane Topcoat 55210	PUR	50
International Coating	Primer	Interseal 670HS	EPM	150	Interseal 670HS	EPM	150
	Tie-coat						
Jotun	Intermediate	Interthane 990	PUR	50	Interthane 990	PUR	50
	Final coat						
PPG Sigma	Primer	Penguard Express	EP	150	Penguard Express	EP	150
	Tie-coat						
PPG Amercoat	Intermediate	Hardtop XP	PUR	50	Hardtop XP	PUR	50
	Final coat						
PPG Sigma	Primer	SigmaPrime 200	EPM	125	SigmaPrime 200	EPM	125
	Tie-coat						
PPG Amercoat	Intermediate	Sigmadur 550	PUR	50	Sigmadur 550	PUR	50
	Final coat						
PPG Amercoat	Primer	Amerlock 400	EPM	125	Amerlock 400	EPM	125
	Tie-coat						
PPG Amercoat	Intermediate	Amercoat 450HS(T)	PUR	50	Amercoat 450HS(T)	PUR	50
	Final coat						

Remarks

Specific guarantee requirements: 5 years - Only cracking blistering, and flaking requirements

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

System No: S18

Zone: Non-insulated 304, 304L, 321, 316, 316L, 904L and Duplex stainless steels for 80 °C < Temperature < 120 °C

1. Surface preparation: Sweep blast by chloride free aluminum oxide or garnet or Grit-Coarse (C) (ISO – 8503-2)
2. Roughness: 25 to 45 microns

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
	Tie-coat	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
	Intermediate	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
Hempel	Final coat	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
	Primer	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
	Tie-coat	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
International Coating	Intermediate	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
	Final coat	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
	Primer	Interplus 256	EPM	150	Interplus 256	EPM	150
Jotun	Tie-coat	Interplus 256	EPM	150	Interplus 256	EPM	150
	Intermediate	Interthane 990	PUR	50	Interthane 990	PUR	50
	Final coat	Interthane 990	PUR	50	Interthane 990	PUR	50
PPG Sigma	Primer	Penguard Express	EP	150	Penguard Express	EP	150
	Tie-coat	Penguard Express	EP	150	Penguard Express	EP	150
	Intermediate	Penguard Express	EP	150	Penguard Express	EP	150
PPG Amercoat	Final coat	Penguard Express	EP	150	Penguard Express	EP	150
	Primer	Hardtop XP	PUR	50	Hardtop XP	PUR	50
	Tie-coat	Hardtop XP	PUR	50	Hardtop XP	PUR	50
PPG Sigma	Intermediate	Hardtop XP	PUR	50	Hardtop XP	PUR	50
	Final coat	Hardtop XP	PUR	50	Hardtop XP	PUR	50
PPG Sigma	Primer	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Tie-coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Intermediate	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
PPG Amercoat	Final coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Primer	Amerlock 400GF	EPGF	250	Amerlock 400GF	EPGF	250
	Tie-coat	Amerlock 400GF	EPGF	250	Amerlock 400GF	EPGF	250
PPG Amercoat	Intermediate	Amerlock 400GF	EPGF	250	Amerlock 400GF	EPGF	250
	Final coat	Amerlock 400GF	EPGF	250	Amerlock 400GF	EPGF	250
	Primer	Amerlock 400GF	EPGF	250	Amerlock 400GF	EPGF	250

Remarks

Specific guarantee requirements: 5 years - Only cracking blistering, and flaking requirements

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

System No: S19

Zone: Non-insulated 304, 304L, 321, 316, 316L, 904L and Duplex stainless steels for 120 °C < Temperature < 200 °C

1. Surface preparation: Sweep blast by chloride free aluminum oxide or garnet or Grit-Coarse (C) (ISO – 8503-2)
2. Roughness: 25 to 45 microns

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
	Tie-coat	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
	Intermediate	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
Hempel	Final coat	Thermaline 450 EP	EPPH	100	Thermaline 450 EP	EPPH	100
	Primer	Hempadur 85671	EPPH	100	Hempadur 85671	EPPH	100
	Tie-coat	Hempadur 85671	EPPH	100	Hempadur 85671	EPPH	100
International Coating	Intermediate	Hempadur 85671	EPPH	100	Hempadur 85671	EPPH	100
	Final coat	Hempadur 85671	EPPH	100	Hempadur 85671	EPPH	100
	Primer	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
Jotun	Tie-coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Intermediate	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Final coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
PPG Sigma	Primer	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
	Tie-coat	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
	Intermediate	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
PPG Amercoat	Final coat	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
	Primer	SigmaShield 400	EPM	80	SigmaShield 400	EPM	80
	Tie-coat	SigmaShield 400	EPM	80	SigmaShield 400	EPM	80
PPG Amercoat	Intermediate	SigmaShield 400	EPM	80	SigmaShield 400	EPM	80
	Final coat	SigmaShield 400	EPM	80	SigmaShield 400	EPM	80
PPG Amercoat	Primer	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125
	Tie-coat	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125
	Intermediate	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125
PPG Amercoat	Final coat	Amercoat 90HS	EPPH	125	Amercoat 90HS	EPPH	125

Remarks

Specific guarantee requirements: 5 years - Only cracking blistering, and flaking requirements

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

System No: S20

Zone: Non-insulated 304, 304L, 321, 316, 316L, 904L and Duplex stainless steels for 200 °C < Temperature < 400 °C

1. Surface preparation: Sweep blast by chloride free aluminum oxide or garnet or Grit-Coarse (C) (ISO – 8503-2)
2. Roughness: 25 to 45 microns

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer Tie-coat Intermediate Final coat	Thermaline 4700	SI	50	Thermaline 4700	SI	50
Hempel	Primer	Silicone Aluminium 56914	SI	25	Silicone Aluminium 56914	SI	25
	Tie-coat	Silicone Aluminium 56914	SI	25	Silicone Aluminium 56914	SI	25
	Intermediate Final coat	Silicone Aluminium 56914	SI	25	Silicone Aluminium 56914	SI	25
International Coating	Primer	Intertherm 50	SI	20	Intertherm 50	SI	20
	Tie-coat Intermediate Final coat	Intertherm 50	SI	20	Intertherm 50	SI	20
Jotun	Primer	Solvalitt	SI	20	Solvalitt	SI	20
	Tie-coat Intermediate Final coat	Solvalitt	SI	20	Solvalitt	SI	20
PPG Sigma	Primer	SigmaTherm 540	SI	25	SigmaTherm 540	SI	25
	Tie-coat Intermediate Final coat	SigmaTherm 540	SI	25	SigmaTherm 540	SI	25
PPG Amercoat	Primer	Amercoat 878	SI	25	Amercoat 878	SI	25
	Tie-coat Intermediate Final coat	Amercoat 878	SI	25	Amercoat 878	SI	25

Remarks

Specific guarantee requirements: 5 years - Only cracking blistering, and flaking requirements

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

System No: S21

Zone: Insulated 304, 304L, 321, 316, 316L, 904L and Duplex stainless steels for Temperature < 25 °C

1. Surface preparation: Sweep blast by chloride free aluminum oxide or garnet or Grit-Coarse (C) (ISO – 8503-2)
2. Roughness: 25 to 45 microns

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Carboguard 893 SG	EP	100	Carboguard 893 SG	EP	100
	Tie-coat	Carboguard 893 SG	EP	100	Carboguard 893 SG	EP	100
	Intermediate						
Hempel	Final coat						
	Primer	Hempadur 15553	EPM	30	Hempadur 15553	EPM	30
	Tie-coat	Hempadur Mastic 45881	EPM	200	Hempadur Mastic 45881	EPM	200
International Coating	Intermediate						
	Final coat						
	Primer	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
Jotun	Tie-coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Intermediate						
	Final coat	Penguard Express	EP	200	Penguard Express	EP	200
PPG Sigma	Primer	SigmaPrime 200	EP	80	SigmaPrime 200	EP	80
	Tie-coat	SigmaPrime 200	EP	80	SigmaPrime 200	EP	80
	Intermediate						
PPG Amercoat	Final coat						
	Primer	Amerlock 400	EP	125	Amerlock 400	EP	125
	Tie-coat						
	Intermediate						
	Final coat						

Remarks

Specific guarantee requirements: 5 years - Only cracking blistering, and flaking requirements

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

System No: S22

Zone: Insulated 304, 304L, 321, 316, 316L, 904L and Duplex stainless steels
for 25 °C < Temperature < 120 °C

1. Surface preparation: Sweep blast by chloride free aluminum oxide or garnet or Grit-Coarse (C) (ISO – 8503-2)
2. Roughness: 25 to 45 microns

SUPPLIER	System details	Coating system			Repair system		
		Reference	Binder	Thick (µm)	Reference	Binder	Thick (µm)
Carboline	Primer	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
	Tie-coat	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
	Intermediate	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
Hempel	Final coat	Thermaline 450 EP	EPPH	150	Thermaline 450 EP	EPPH	150
	Primer	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
	Tie-coat	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
International Coating	Intermediate	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
	Final coat	Versiline CUI 56990	ICP	150	Versiline CUI 56990	ICP	150
	Primer	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
Jotun	Tie-coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Intermediate	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
	Final coat	Intertherm 228HS	EPPH	100	Intertherm 228HS	EPPH	100
PPG Sigma	Primer	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
	Tie-coat	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
	Intermediate	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
PPG Amercoat	Final coat	Tankguard Storge	EPPH	200	Tankguard Storge	EPPH	200
	Primer	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Tie-coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
PPG Amercoat	Intermediate	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
	Final coat	SigmaShield 400	EPM	100	SigmaShield 400	EPM	100
PPG Amercoat	Primer	Amerlock 400GF	EPGF	150	Amerlock 400GF	EPGF	150
	Tie-coat	Amerlock 400GF	EPGF	150	Amerlock 400GF	EPGF	150
	Intermediate	Amerlock 400GF	EPGF	150	Amerlock 400GF	EPGF	150
	Final coat	Amerlock 400GF	EPGF	150	Amerlock 400GF	EPGF	150

Remarks

Specific guarantee requirements: 5 years - Only cracking blistering, and flaking requirements

Qualification / acceptance requirements: Minimum mechanical pull-off test value of 2 MPa (mechanical tester)

Appendix 3. Color Coding

1. Colors

Basic colors are:

- Yellow – RAL 1003
- Black – RAL 9005
- Red – RAL 3001
- Aluminum grey for high temperature

2. Piping identification

Pipes shall be identified according to carried fluid as stipulated in the attached color coding tables.

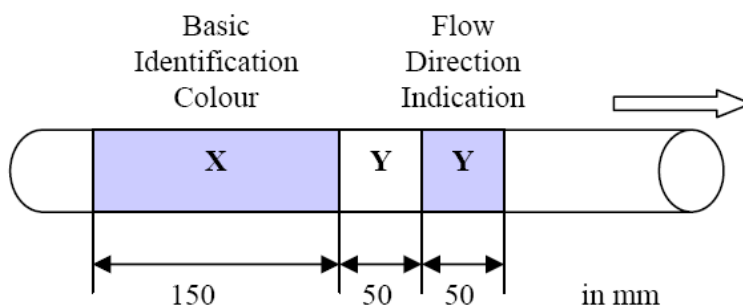
Note 1: The basic identification color shall be sprayed as a band X mm wide around the pipe at a maximum of 2 m intervals and on either side of each valve, fitting, wall penetration and any other places where identification of the fluid is necessary.

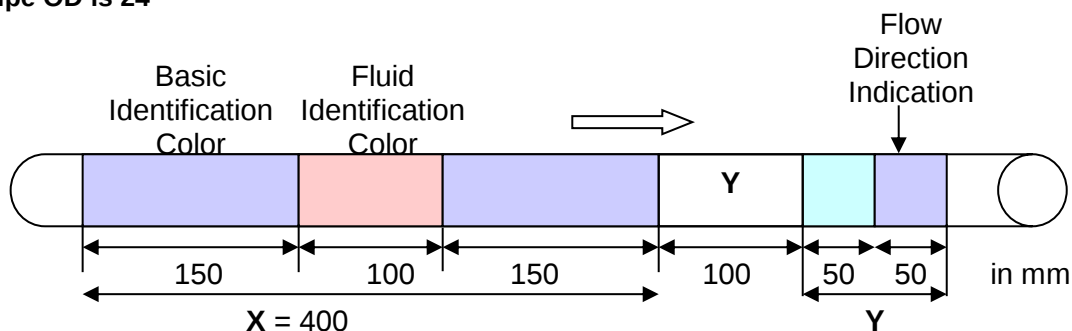
Note 2: The fluid identification color shall be sprayed as a band Y mm wide all around the pipe and placed in the middle of the basic identification color.

Note 3: Code indications, (i.e. information regarding the nature of the fluid and direction of flow arrows), shall be painted in black letters on the white pipe background adjacent to the basic

Pipe OD				
	≤ 6"	> 6" - ≤ 12"	> 12" - ≤ 24"	> 24"
X mm	150	250	400	600
Y mm	50	75	100	150

Example 1: Pipe OD is 4"

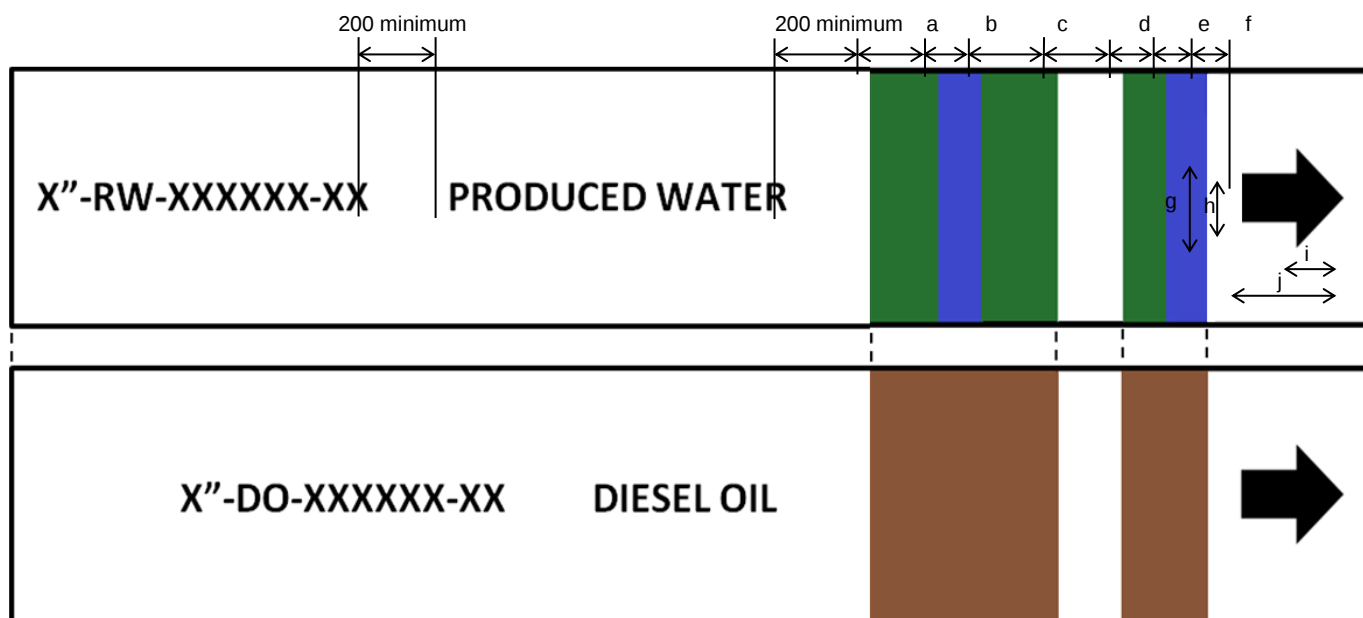


Example 2: Pipe OD is 24"


- Dimension of pipe identification marking:

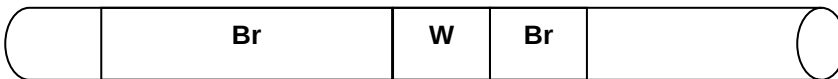
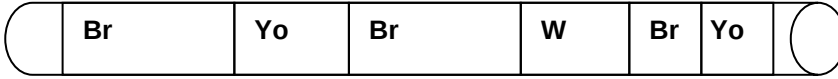
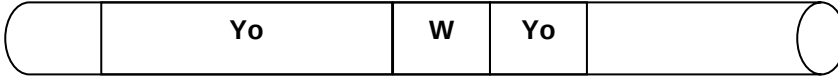
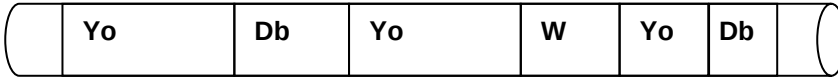
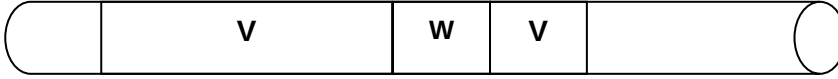
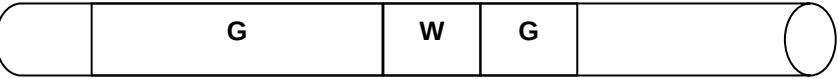
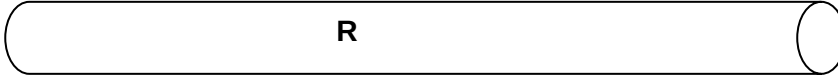
	Pipe O.D			
	2"	> 2" to ≤ 8"	> 10" to ≤ 12"	>14"
Font Height (mm.)	3/4"	1 1/4"	1 1/2"	2"
Font Width (mm.)	1/2"	3/4"	1"	1 1/2"

- Color code marking dimension

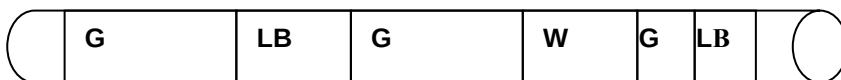


Pipe Diameter	Dimensions (mm.)									
O.D.	a	b	c	d	e	f	g	h	i	j
Up to 4"	56	38	56	50	25	25	30	15	20	35
6" - 12"	94	62	94	75	37.5	37.5	50	25	35	60
14" - 20"	150	100	150	100	50	50	65	35	45	80
24" – 36"	225	150	225	150	75	75	95	50	70	120

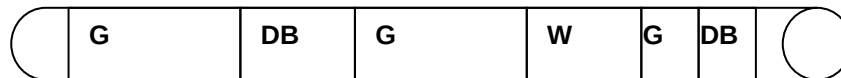
Color code for

Crude oil	HC				
Diesel oil	DO				
Helifuel	HC				
Naphta	NH				
LP oil mud	LM				
Mud oil	MO				
Hydraulic oil	HO				
Lube oil	LO				
Seal oil	SO				
Condensate /NGL	CD				
Process gas	PG				
Flare gas	FL				
Hydrocarbon gas	HG				
Fuel gas	FG				
Gas injection	GI				
Exhaust	EX				
Inert gas	IG				
Instrument air	IA				
Plant air	PA				
Atmospheric vent	ATH				
Halon Gas	HLG				
Glycol	GLC				
Methanol	ME				
Freon	F				
Chemical injection	CL				
Bulk barites	BB				
Bulk cement	BC				
Water injection	WI				
Process water	PW				
Fire water	FW				

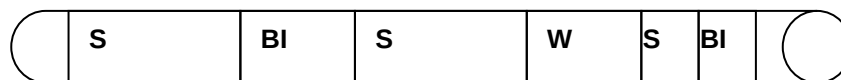
Sea water SW
Cooling water CW
Drinking water DW
Utility fresh water UW
Cold water CWS
Chilled water CHW



Hot water service HWS



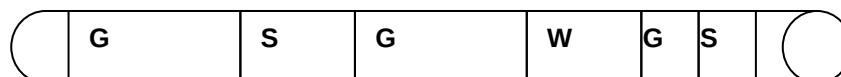
HP steam SH



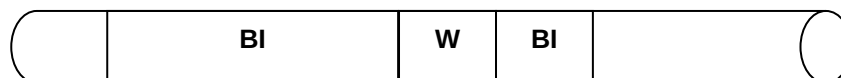
LP steam LH



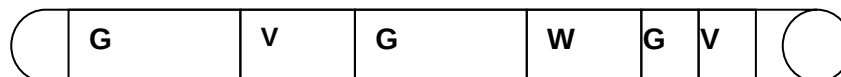
LP steam condens. SC



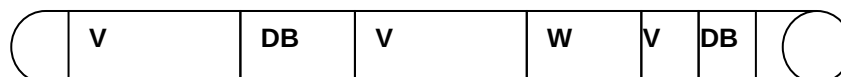
Waste sewage WS
Oily waste OL
Open drain OD
Hyro. Closed drain DR
Waste oil drain DR



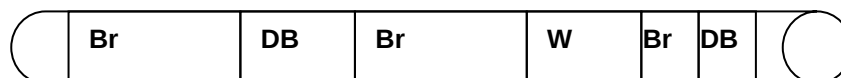
Cement liquid CE



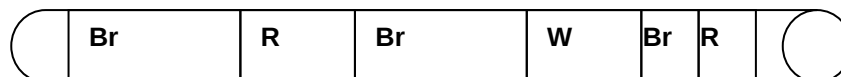
High pressure cement HPC CE



High pressure oil mud HM



Kill fluid KF



Color for Topcoat of All Other Equipment and Platform Areas

3.1 Exterior

1)	Pipe supports, pipe racks	Same as surrounding structure
2)	Lighting posts	White
3)	Guard rails (Handrails)	White
4)	Pedestal cranes (moving parts)	Red/white stripes
5)	Pedestals	Same as surrounding structure
6)	Tanks, vessels, heat exchangers	White
7)	Pipework Base color:	White (Identification: See Appendix 1 above)
8)	All equipment and packages	Light grey
9)	Internal walls/ceilings of equipment enclosures	White
10)	Internal flooring of equipment enclosures	Brown red
11)	Fire pump enclosures: External walls	Red
	Internal walls & ceiling	White
12)	Control Panels	Light grey
13)	Moving parts and overhead obstructions	Red/white stripes
14)	Firefighting equipment and piping	Red
15)	Stairways and associated structures	White
16)	Runway beams (external and internal)	Yellow/black stripes
17)	Escape routes (external and internal)	Black/yellow stripes
18)	Drilling derricks and radio tower	Red/white stripes
19)	Floors, decks and walkways	Brown red
20)	Doors	Green
21)	Buildings, walls, doors & window frames (except for Fire Pump Enclosures)	White
22)	Helideck structural	Yellow
23)	Helideck Surface	Green
24)	Helideck markings	White/yellow
25)	Grating	Same as support frame color
26)	Flare (excepted top of flare to be Aluminium)	Red/white

3.2 Interior of Technical Areas/Buildings

1)	Structural Steel	Yellow
2)	Cladding and Ceiling *	White
3)	Floors *	Brown red
4)	Tanks, Vessels, Heat exchangers and pipework	White
5)	Piping identification:	see section 2
6)	Pumps and Motors	Light grey
7)	Skids and Packages	Light grey
8)	Main generator and emergency generator packages	Light grey
9)	Compressor Enclosures	Light grey
10)	Control Panels, gear switch, and transformers	Light grey
11)	Firefighting Equipment (inc. diesel engine and piping)	Red
12)	Doors	Green
13)	First Aid Box	Green
14)	Instruments	MANUFACTURER's standard
15)	Moving parts and overhead obstructions	Red/white stripes
16)	Escape Routes	Black/yellow stripes

* Except Control Room, Technical Room, Laboratories and other specific areas. Color choice for these to be determined based on Vendor's standard systems or COMPANY requirements.

Interior of living quarter modules and offices is to be submitted to COMPANY approval.

4. Colors

The Colors specified shall be in accordance to RAL K1.
SUPPLIER color names or reference numbers shall not be used as reference.

	Color	Code for Pipeline	RAL Reference Marking
1)	Yellow	Y	1007
2)	Red	R	3001
3)	Brown red	BR	3009
4)	Light blue	LB	5015
5)	Dark blue	DB	5003

	Color	Code for Pipeline	RAL Reference Marking
6)	Light grey	LG	7035
7)	Traffic grey	TG	7042
8)	White	W	9010
9)	Black	Bl	9005
10)	Green	G	6001
11)	Violet	V	4005
12)	Yellow ochre	Yo	1006
13)	Brown	Br	8003
14)	Silver grey	S	7001

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