

GENERAL SPECIFICATION

CORROSION

GS EP COR 350

External protection of offshore and coastal structures and equipment by painting

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1. Scope

This General Specification defines the technical requirements for the execution of painting works of new built offshore or coastal structures and equipment. The specification is based on the use of high durability painting systems (as defined in [ISO 12944-1](#)) for facilities whose design life is anticipated to be more than **15 years**.

This specification does not cover painting systems for temporary equipment or equipment with design life less than 15 years, and for which alternative painting systems shall be submitted to Company for approval.

2. Reference documents

This document is the TOTAL E&P transposition of the TOTAL S.A. Harmonized GS GR COR 821.

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

Reference	Title
ASTM A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel-Parts, Equipment, and Systems
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D4752	Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub
ASTM D4940	Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives
ASTM D5162	Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
ASTM D7393	Standard Practice for Indicating Oil in Abrasives
DIN 50014	Standard atmospheres for conditioning and / or testing - Specifications
ISO 4628 (Parts 1; 2; 3; 4; 5)	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Parts 1; 2; 3; 4; 5
ISO 8501 (Parts 1; 3)	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness - Parts 1; 3

Reference	Title
ISO 8502 (Parts 3; 6; 9)	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness - Parts 3; 6; 9
ISO 8503 (Parts 1; 2)	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Parts 1; 2
ISO 9223	Corrosion of metals and alloys - Corrosivity of atmospheres - Classification, determination and estimation
ISO 11124 (Parts 2; 3)	Preparation of steel substrates before application of paints and related products - Specifications for metallic blast-cleaning abrasives - Parts 2; 3
ISO 11126 (Parts 4; 7; 9; 10)	Preparation of steel substrates before application of paints and related products - Specifications for non-metallic blast-cleaning abrasives - Parts 4; 7; 9; 10
ISO 12944 (Parts 1; 3; 4; 7; 8)	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Parts 1; 3; 4; 7; 8
ISO 16276 (Parts 1; 2)	Corrosion protection of steel structures by protective paints systems - Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating - Parts 1; 2
ISO 19840	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Measurement of, and acceptance criteria for, the dry-film thickness of coating on rough surfaces
RAL 840-HR	Colours standard
SSPC SP1	Solvent Cleaning - degreasing with solvent to remove all traces of oil, grease or other contaminants
UKCAA CAP 437	Standards for Offshore Helicopter Landing Areas-Seventh Edition

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP COR 356	Corrosion Protection of Fasteners
GS EP COR 355	External protection of piping and equipment by thermal spray coating



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3. Applicability

This general specification is applicable to all metallic structures, equipment, piping and fittings, pumps and electrical equipment, when an external coating has been specified by Company for a coastal or an offshore environment.

4. Definitions of terms

For the purpose of this document, the following terms and definitions apply:

Company:	Any entity of the TOTAL Group mentioned in the contract or the order.
Contractor:	Entity that enters into a Contract with the Company performing the work covered by this specification.
Inspector:	The certified person asked to make certain the respect of the applicable specifications and the quality of the coating.
Manufacturer:	Entity responsible for manufacturing products.
Operator:	The natural person who executes the surface preparation, the coating and/or the controls.
NDFT	Nominal Dry Film Thickness

5. Surfaces to be painted

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

5.1 Items not to be painted

Unless otherwise specified, the following surfaces are not required to be painted:

- Galvanized steel grating, stairs and associated galvanized fasteners
- Concrete structures
- Plastic and plastic coated materials, provided their resistance to UV has been demonstrated, and colour coding is not necessary
- Non-ferrous materials such as 90-10 and 70-30 copper nickel alloys, monel, aluminium bronze, titanium and nickel alloys when not thermally insulated
- Machined surfaces
- Stainless steel tubing.

5.2 Case of stainless steels

Stainless steels shall be painted when requested in the present specification. Only piping, pipelines and vessels or other pressure containing equipment are concerned.

Any paint containing Zinc shall be prohibited on stainless steels.



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When stainless steel is not required to be painted, surfaces under support and stickers shall be painted.

Where stainless steel is welded to carbon steel, the stainless steel section shall be painted 50 mm beyond the weld zone onto the stainless steel.

When requested painted in the present specification, stainless steel piping and fittings < 2" shall be pickled and passivated according [ASTM A380](#) and topcoated with a non-pigmented polyurethane topcoat (50 µm NDFT) suitable for stainless steel surfaces.

The non-pigmented polyurethane topcoat shall be submitted to Company for approval.

5.3 Painting of fastenings

Fastenings shall be painted according [GS EP COR 356](#).

5.4 Painting under personal protection (perforated guards/sheets)

When perforated guards or sheets are used as personal protection, painting system shall be selected as for un-insulated surfaces.

5.5 Thermal Spray Coating

When a thermal spray coating is required in this specification, thermal spray aluminium coating (TSA) or the thermal spray Zinc coating (TSZ) shall be in accordance with the [GS EP COR 355](#).

6. Selection of painting systems

The list and application areas of all painting systems are given in Appendix 2: List of painting systems.

6.1 Qualified Paint Manufacturer

Paint Manufacturer shall be selected among painting manufacturer listed in Appendix 3: Paint Manufacturers' systems.

6.2 Approved systems

The painting systems approved by Company are given in Appendix 3: Paint Manufacturers' systems.

6.3 Qualification of alternative painting systems

For **Paint Manufacturers already qualified**, new systems can be submitted to Company for approval at any time. The system shall fulfil internal qualification protocol from Company.

6.4 Substitution rule

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



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7. Qualification of the application procedures

7.1 Application procedure

A detailed application procedure shall be established for Company approval based on the requirements of this specification.

No painting work shall begin before the application procedure is approved by Company.

The application procedure follows [ISO 12944-8](#) and will include at the minimum the following information:

- Equipment/structure/piping to be coated
- Operating temperature of the equipment
- Type of substrate to be coated
- Surface preparation
- Methods of application and application requirements
- Painting cycle
- Painting Systems to be used
- Coating products to be used
- Product data sheets (abrasives and paint materials)
- Safety data sheets
- Health and safety requirements
- Test and inspections
- Certification of the personnel
- Handling and storage
- Repair method
- Template of painting daily report.

7.2 Application procedures tests

One month before work commences, all the selected painting systems shall be applied on samples representative of the structure to be painted.

The products used shall be sampled from the same batches as these intended for the works.

The painting system shall be applied in presence of the paint Manufacturer and the Company representative, in climatic conditions that are as similar as possible to the 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, using the same dedicated equipment that will be used during the work.

During surface preparation and paint application, all tests described in Appendix 1: Summary of tests and inspections shall be followed.



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

8. Kick off meeting

A technical kick off meeting shall be organized by the Contractor in the presence of Company specialists (HQ Corrosion Department), Applicator and Paint Manufacturer to review all the details regarding the work, application procedures, and inspection test plan.

All the documentation shall be submitted to Company for review at least two (2) weeks prior to this meeting.

Paint manufacturer shall provide Contractor with technical assistance.

All recommendations made by Paint Manufacturer other than these outlined in the present specification or in technical data sheets shall be supported by a written statement from the Paint manufacturer head office.

9. Surface preparation

9.1 Design and preparation before blasting of surfaces to be painted

All structures and equipment shall be designed according to [ISO 12944-3](#) international standard for high durability painting systems.

All sharp edges shall be rounded (minimum radius > 2 mm).

Preparation grades of welds and other areas with surface imperfections shall be grade P3 according [ISO 8501-3](#).

The design of the item to be painted shall be such that it creates no interstice, no inaccessible area and no rainwater retention areas.

All oil or grease shall be removed by washing the item to be treated with appropriate solvents or any other suitable means before beginning of the cleaning operations according to the [ISO 12944-4](#) or [SSPC SP1](#).

This includes bolt holes in piping assemblies.

Solvent swabbing shall only be used on minor areas, using clean rags and copious amounts of solvent.

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.

Opening in vessels, piping and other appurtenances shall be properly protected against entry of abrasive material.



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Special attention shall be paid to avoid splashes of zinc paint on equipment made of austenitic steels.

The surface preparation shall be carried out before assembling bolted assemblies.

9.2 Surface treatment

All surfaces to be coated shall be blast-cleaned to grade of cleanliness and surface profile specified for each system in Appendix 3: Paint Manufacturers' systems of this specification.

Defects and irregularities not detected during manufacturing, and which appear after surface preparation, shall be repaired using the most suitable mechanical means.

After treating any surface, all dust shall be removed using an industrial vacuum cleaner before paint is applied.

9.3 Blast cleaning

The air supply for blast cleaning shall be free of oil and water in accordance with [ASTM D4285](#).

After blast-cleaning, all dust shall be removed using a vacuum cleaner before application of the paint in order to achieve the maximum dust level 2 (quantity rating 2 max, particle size class 2 max) according [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 carried out ([ISO 8502-6](#) & [ISO 8502-9](#)) plus ferrous contamination for stainless steel surfaces.

For blast cleaning on automatic production line, Contractor shall ensure that the grit selected can achieve the required surface profile. This requirement includes determination of grit mix, as well as quantity and frequency of grit renewal.

Surface profile shall be checked twice per shift and the results shall be recorded.

Stainless steels shall be segregated, carbon steel supports for storage being systematically painted, and lifting equipment adapted to prevent iron contamination.

Stainless steel surfaces to be coated shall be etched or degreased and blasted.

The blast cleaning procedure shall be submitted to Company for approval.

9.4 Quality of abrasives

The properties of abrasives for use in blast cleaning steels shall meet the requirements of the relevant parts of [ISO 11124](#) and [ISO 11126](#) respectively.

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Approved abrasives are listed in the table below:

Type	Generic Name	Standard	Substrate
Metallic	Chilled iron grit	ISO 11124-2	Carbon Steel only
	Steel grit	ISO 11124-3	Carbon Steel only
Non-metallic	Staurite	ISO 11126-9	All
	Coal slag	ISO 11126-4	All
	Fused aluminium oxide	ISO 11126-7	All
	Almandite Garnet	ISO 11126-10	All

Abrasives shall be sealed in watertight packaging. Any product delivered in defective packaging will be rejected.

Abrasives shall be stored sheltered from the elements.

Abrasives shall be dry and clean.

Conductivity of abrasives shall be less than $150 \cdot 10^{-6}$ Siemens/cm as per [ASTM D4940](#).

Abrasives shall be Non-ferrous and chloride-free when used on stainless steel surfaces.

Abrasives containing more than 1% crystalline silica shall be strictly prohibited.

The use of silica sand is strictly prohibited.

9.5 Surface preparation of galvanized steel

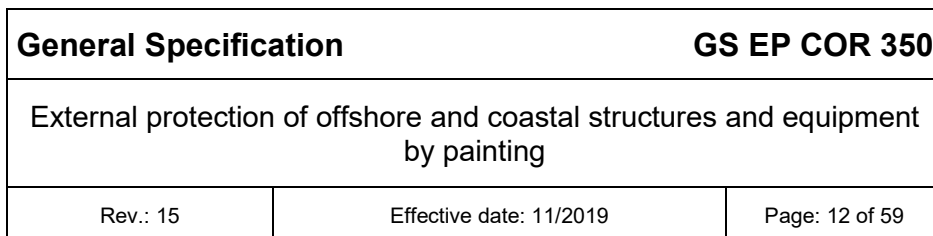
Galvanized steel to be coated shall be cleaned, degreased and sweep blasted. After sweep blasting, the thickness of the galvanizing is checked to confirm that it still in accordance with the requirement.

9.6 Items which have been previously shop primed

Shop primer is for a temporary protection only.

Shop primer shall be completely removed before application of the final painting system.

Surface preparation shall be in accordance with paragraph 9 of this specification, and grade of cleanliness and surface profile specified for each system in Appendix 3: Paint Manufacturers' systems of this specification.





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The only exception is inorganic zinc silicates where only post touch shall be applied using the repair system primer (zinc rich epoxy primer).

Stripe coat shall be performed with coating material taken from fully mixed kit.

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

Prior to apply a succeeding coat, all previous coatings shall be allowed to dry for at least the minimum time specified by the paint manufacturer.

The maximum over coating time allowed by the paint Manufacturer shall not be exceeded.

The paint Manufacturer's advice regarding the influence of the applied coating thickness, steel temperature, relative humidity, % of thinner added, should be taken into account in determining the correct over coating intervals.

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 are kept and made available to Company.

10.4 Zinc ethyl silicate

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

If relative humidity is below 60%, the painted surface 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 (Methyl Ethyl Ketone) 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.

10.5 Protection of adjacent equipment

During the surface preparation and painting work, all precautions shall be taken by the Contractor to provide protection against paint and abrasive spray of equipment adjacent to the equipment to be painted (Manufacturer plates, visible moving parts of machinery, pumps, valves (stem of valves in particular), instrumentation, electrical cables, spark gaps, cable shield/armors groundings, equipotential bondings, tank breather valves, surrounding tanks, stud bolts and nuts for piping assembly unless otherwise specified by the Company.

The spraying of paint with zinc content **shall be imperatively avoided** on equipment made of austenitic stainless steels or on nickel-rich alloy steels.

The Contractor **shall take the necessary precautions** to protect any equipment subject to the above risks. If any damage is caused by the Contractor to adjacent equipment, the Contractor shall be responsible for all necessary cleaning and repair works.

A particular care shall be taken in regards to tanks free vents or pressure relief devices protection: it is essential to prevent paint, water or abrasive ingress inside such devices.



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The Contractor shall also ensure that protections do not prevent correct operation of these devices when the tank is maintained in operation, e.g. to prevent the tank from flattening on product pumping.

The Company shall ensure regularly that these devices are properly maintained before start of tank operations.

For tanks not operated during the Contractor works, the Company shall ensure that all protections have been adequately removed by the Contractor before the tank operations can be restarted.

10.6 Work organization

In order to achieve high quality and durability of the anticorrosion systems, the paint system should be fully applied in the workshop, before the equipment is delivered to the site.

Special precautions **shall be taken** to protect the coatings against any damage during transportation, handling and installation operations.

11. 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 are applied:

11.1 Major defects (paint products, application, non-conformity of test results)

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

11.2 Minor defects (localized appearance, mechanical damage, scratches, etc.)

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

When open abrasive blasting is not permitted, vacuum blasting machine is used for spot repair.

11.3 Thickness defects

A building-up of the insufficiently thick areas shall be carried out, taking into account:

- The recoating interval of the support coat
- The composition of the various coats.

A repair procedure shall be defined and submitted to the Company representative for approval.



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12. Checks, inspection and acceptance

12.1 Checks

Throughout the duration of the work, Contractor's Quality Control department shall check all points given in Appendix 1: Summary of tests and inspections and record the results in its daily quality control report.

Execution and supervision of paint work is as per defined in [ISO 12944-7](#).

12.2 Inspection test plan

An inspection test plan including all the points of Appendix 1: Summary of tests and inspections shall be prepared and submitted to Company for approval.

The Inspection Test Plan shall clearly indicate frequency of testing for each check.

12.3 Company inspection

The Company inspector shall reserve the right to intervene at any time during the inspection of products and their application.

Company Inspector shall have free access to storage areas, workshops, yards where the works will be performed.

Contractor will also provide Company Inspector with all office facilities necessary for the execution of his work (telephone, internet, handling equipment, measuring instruments with valid calibration certificates, etc.).

Upon arrival of Company Inspector on site, Contractor shall supply him with all relevant documentation regarding the works to be carried out.

12.4 Provisional acceptance

For provisional acceptance, Company shall check that all inspections set out in Appendix 1: Summary of tests and inspections have been carried out and that all results are satisfactory.

13. Contractor obligations

13.1 Technical support

The Contractor shall provide the technical support of the Manufacturer.

The Manufacturer shall be represented on the work site, at the minimum at the start of the work, to advise the Contractor on the use of its products.

Additional follow-up visits on the work site by the Manufacturer may be requested by the Company.



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13.2 Work preparation

Before the start of the site works, the Contractor shall supply the following:

- A work schedule covering the surface preparation and painting systems application works
- A list of methods applied for satisfactory completion of the works, surface preparation, application, inspections and protection of personnel and the surrounding environment
- Data sheets of the products and their safety data sheets
- The homologation certificates for applied painting systems
- A list of operator and inspector personnel with their certifications.

During the site works, the Contractor maintains a work site log, available at any times, keeping the Company Representative informed of work progress. All important work site changes shall be entered in this log: weather, progress of work, problems encountered, inspection results, etc.

13.3 Certification of personnel

13.3.1 Operators

Operators shall be individually certified by an approved organization (ACQPA, FROSIO, or equivalent).

13.3.2 Inspectors

Inspectors shall be individually certified in accordance with NS 476 (Inspector certified level III) or NACE certified coating inspector level III.

Certification shall be delivered by the following approved organizations:

- ACQPA
- FROSIO
- NACE.

13.4 End-of project technical file

The technical file, handed over by the Contractor and co-signed by the Manufacturer to Company, at the end of the work, includes, among other things:

- The paint system(s) selected
- The location of each paint system on the structure
- The product data sheet and references of the batches used
- The certificate(s) specifying the durations, criteria and performance levels of the guarantees
- The insurance certificate covering the guarantee
- All inspection and test reports

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- The provisional acceptance reports
- The individual certificates of operators and inspectors.

14. Paint system guarantee

The Work shall be covered by a specific guarantee given by Contractor to complete Guarantees and warranties defined in the Engineering, Procurement, Supply, Construction and Commissioning Contract (EPSCC 1113 Article 20 “guarantees and warranties”).

Beginning of Warranty Period as defined for each paint system in Appendix 3: Paint Manufacturers' systems starts from the effective date of the Provisional Acceptance Certificate for painting works.

Contractor guarantees that the Work shall be covered by performance warranties in accordance with the following requirements of the Contract:

- The maximum degree of rust of Ri2 according to [ISO 4628-3](#)
- The maximum degree of cracking, blistering, or flaking of 3S3 according to [ISO 4628-1](#), [ISO 4628-2](#), [ISO 4628-4](#) and [ISO 4628-5](#).

Guarantee shall be provided for the duration defined for each paint system in Appendix 3: Paint Manufacturers' systems of this specification.

The paint system's anti-corrosion and resistance guarantee is jointly supported by the Contractor / Manufacturer.

The Contractor shall hand over to the Company, the insurance certificate from an insurance company covering this guarantee.

The guarantee is imperative. The Contractor cannot, under any circumstances, deny responsibility if the painting systems, qualified by the Manufacturer and applied according to his recommendations and the requirements of this specification, do not perform accordingly within the guarantee period.

The guarantee shall take effect from the date of acceptance of the complete painting system.

In cases where the substrates have had a primary coat or intermediate coat applied in the factory, the guarantee shall apply to the complete painting system.

A contradictory procedure for inspection of the painting systems during the guarantee period shall be agreed between the Company, the Contractor and the Manufacturer. This procedure shall define the modalities of this inspection and in particular its frequency.

The repair of a painting system already applied on (a piece of) equipment shall be covered by a guarantee running until the expiry date of the initial guarantee of that equipment.

The guarantee period shall be suspended during the period extending between the date on which the defect was observed and that on which the repair work is accepted.

For mechanical equipment, pumps, valves, electrical equipment, the painting system shall be guaranteed against corrosion by the supplier for at least 5 years Ri2 according to [ISO 4628-3](#).



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15. End of guarantee inspection/ Final acceptance

At the end of the Warranty Period a joint inspection of Work by Company and Contractor shall be carried out before issuance of the Final Acceptance Certificate for coating works to determine if any claims are raised.

The Contractor and the Manufacturer shall take all measures to make the necessary repairs within the times specified by Company.

16. Technical content of tenders

Tenders include the following information:

- Proposed paint systems for each category/location of item to be painted.
- Product data sheets and Material safety data sheets.
- Proposed qualification program if any.
- List of derogations to the present General Specification, if any. Derogations will not be granted for painting systems after Contract award.
- Terms and conditions of guarantee.
- A statement showing that all parties involved (Contractor, Paint Manufacturer, and Applicator) will be carrying out the work according to the present specification, or if relevant, to the project particular specification, including derogations duly agreed by HQ Corrosion Department before Contract award. 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 OHGPI or a letter signed by the head office of each party involved.
- Maximum thickness tolerable for each coat and for each full painting system.
- Surface preparation and painting procedures.
- Inspection test plan with acceptance criteria and frequency of inspection in accordance with Appendix 1: Summary of tests and inspections.
- A list of inspection and painting equipment to be used.
- Colours to be used for each item of equipment and for the different coats, in accordance with the colour chart chosen for the project by Company.
- Methods of protection of items to be painted against adverse weather conditions.
- Certificates (ACQPA, FROSIO, NACE, or equivalent) of Operators and Inspectors.

17. Colour coding

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

If the project has no specific requirements, the colour coding is according to Appendix 4: Colour coding.

Particular attention will be paid to the use of stickers on unpainted stainless steel surfaces.