



**HELLENIC GAS
TRANSMISSION
SYSTEM OPERATOR**

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**TECHNICAL JOB
SPECIFICATION**

P-3

REVISION 1

DATE 27/09/2011

**LIQUEFIED NATURAL GAS PLANTS
PAINTING & PROTECTIVE COATINGS**

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QUALITY ASSURANCE PAGE

CHANGES LOG

Para. 1.1,
Para. 3.0,
Table 1 added

REVISIONS LOG

Rev. No	Rev. Date	REASON FOR CHANGE	Made By	Approved By
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REFERENCE DOCUMENTS

ELOT EN 14582

[Characterization of waste - Halogen and sulfur content - Oxygen combustion in closed systems and determination methods]

ELOT EN ISO 1461

[Hot dip galvanized coatings on fabricated iron and steel articles -- Specifications and test methods]

ELOT EN ISO 2808

[Paints and varnishes -- Determination of film thickness]

ELOT EN ISO 8501-1

[Preparation of steel substrates before application of paints and related products -- Visual assessment of surface cleanliness -- Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings]

ELOT EN ISO 8503-2

[Preparation of steel substrates before application of paints and related products -- Surface roughness characteristics of blast-cleaned steel substrates -- Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel -- Comparator procedure]

ELOT EN ISO 8504-3

[Preparation of steel substrates before application of paints and related products- Surface preparation methods- Part 3: Hand and power tool cleaning]

ELOT EN ISO 11126-7

[Preparation of steel substrates before application of paints and related products- Specifications for non-metallic blast cleaning abrasives- Part 7: Fused aluminium oxide]

ELOT EN ISO 12944-1

[Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 1: General introduction]

ELOT EN ISO 12944-2

[Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 2: Classification of environments]

ELOT EN ISO 12944-3

[Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 3: Design considerations]

ELOT EN ISO 12944-4

[Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 4: Types of surface and surface preparation]

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ELOT EN ISO 12944-5

[Paints and varnishes – Corrosion protection of steel structures by protective paint systems -- Part 5: Protective paint system]

ELOT EN ISO 12944-6

[Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 6: Laboratory performance test methods]

ELOT EN ISO 12944-7

[Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 7: Execution and supervision of paint work]

ELOT EN ISO 12944-8

[Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 8: Development of specifications for new work and maintenance]

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1 1.0

GENERAL

- 1.1 This specification covers the requirements for surface preparation and application for shop and field protective coatings when necessary, such as in vessels and exchangers, pumps casings and compressors, structural steel, electrical and instrument equipment, carbon and ferritic alloy steel as well as austenitic stainless steel piping and fittings and surfaces of concrete containers.
- 1.2 The applicable International and European standards are detailed in section 15.0 of this specification.

2.0 EXTENT OF PAINTING

- 2.1 Structural steel, equipment (e.g. vessels, heat exchangers, tanks and pumps) and above ground piping, shall be externally painted in accordance with the standards specified in paragraph 15.0 of this Specification.
- 2.2 Electrical equipment, machinery and skid mounted packages shall be painted in accordance with the manufacturers' standard and section 8.0 of this specification.
- 2.3 Pressure equipment shall not be painted until after completion of all heat treatment, pressure testing and examinations.
- 2.4 The following items do not require preparation or painting except where otherwise specified in the specific job requirements:
- a) Carbon steel surfaces of insulated equipment and piping having an operating temperature of 93°C and over or under -1°C except as required by Project requirements.
 - b) Buried bare steel piping with operating temperatures above 149°C
 - c) Brickwork, concrete, fireproofing, exterior concrete, building floors, and pavement not subject to attack from corrosive substances.
 - d) Cement sheeting, brass, copper, slate, glass, tile and similar weather resisting materials.
 - e) Aluminum or galvanized metal including insulation weatherproofing.
 - f) Screwed items of valves, or gasket contact surfaces.
 - g) Finished machined parts of machinery.
 - h) Any equipment furnished completely primed and finish painted by the manufacturer (e.g. Instruments, Instrument boards, motors) unless specifically required to repair paint damage or to match a color scheme.
 - j) Internal surfaces of tanks.

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- k) Aluminum pigmented or white insulation coating (fabric, reinforcement and mastic).

- 2.5 Requirements for painting of pipework to suit temperature conditions involved shall include the entire pipework system comprising pipe, fittings, flanges, strainers, traps etc., together with valves where manufacturers' standard finish does not offer sufficient protection for the environmental conditions involved.
- 2.6 All uninsulated portions of insulated equipment comprising vessel nozzles, manway covers, valves, relief valves, etc. shall be painted to suit temperature conditions involved.
- 2.7 All supports, including skirts, legs, saddles, etc. shall be coated with the paint system specified for the temperature range up to 93°C.
- 2.8 The paint system shall generally be based on the maximum operating temperature of the equipment and pipework, this being with the exception of items affected by requirements of paragraph 2.7 and items where high temperatures are involved for steam out, paragraph 2.9 and all predictable non-operating conditions involving elevated metal wall temperatures for periods of either recurring frequency and/or prolonged duration.
- 2.9 Where indicated on piping, exchanger, vessel or any other relevant data sheets, that piping or items of equipment are to be subjected to a pre-commissioning steam cleaning process, the paint system employed shall take into account the designated steam out temperature and shall be suitable for the temperature range 94°C to 350°C.

1 3.0 SPECIFIC REQUIREMENTS

- 3.1 The specific requirements for surface preparation applicable to both shop and field protective coatings shall be designed in accordance with the requirements of **ELOT EN ISO 12944-4, ELOT EN ISO 8501-1 and ELOT EN ISO 8503-2.**
- 3.2 The specific requirements for paint type, color and thickness applicable to both shop and field protective coatings shall be designed in accordance with the requirements of **ELOT EN ISO 12944-5.**
- 3.3 The specific requirements for method of paint application to both shop and field protective coatings shall be designed in accordance with the requirements of **ELOT EN ISO 12944-7.**
- 3.4 Where conflicts arise between this Specification and any other contract and related document, the Contractor shall obtain a written ruling before proceeding with the work affected.

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4.0 SURFACE PREPARATION

- 4.1 Surface preparation and pretreatment shall be in accordance with the requirements of **ELOT EN ISO 12944-4**, **ELOT EN ISO 8501-1** and **ELOT EN ISO 8503-2**.
- 4.2 The type of abrasive, particle size and maximum profile shall be agreed with individual paint manufacturers for each type of paint used. The maximum particle size shall be no larger than that passing through the appropriate mesh screen size to suit the centre line profile height requirements.
- 4.3 For inorganic zinc silicate primed surfaces the abrasive shall be hard sharp and angular, for which reason shot shall not be acceptable.
- 4.4 Flange faces, valves, and other items which could be damaged by abrasive blasting shall not be abrasively blast cleaned but shall be cleaned by hand or power tool cleaning in accordance with the requirements of **ELOT EN ISO 8504-3**.
- 4.5 In the case of austenitic stainless steel piping or equipment, all surfaces requiring painting shall be lightly blast cleaned with a suitable silica safe abrasive low in chlorides and heavy metal elements such as aluminum oxide (according to **ELOT EN ISO 11126-7**) or a propriety abrasive based on inert aluminum silicate. In cases where blast cleaning is absolutely impossible, an alternative method of surface preparation may be used providing this has the prior approval of the Owner.
- 4.6 Any solvent used in the shop or field cleaning of stainless steel surfaces shall be an organic solvent free from metallic elements and have less than 50 ppm chloride content.

5.0 RUST PREVENTIVE COMPOUNDS

- 5.1 During transit, a suitable rust preventive compound shall be used for protection.

6.0 INORGANIC AND ORGANIC ZINC RICH PRIMERS

- 6.1 Zinc rich primers shall conform to the requirements of **ELOT EN ISO 12944-5**, except that the %Zn by weight in the dry film shall be between 82% and 90% for inorganic coatings, and between 85% and 90% for organic coatings, and shall be no less than 82% and 85% respectively.

7.0 PAINT APPLICATION

- 7.1 Unless otherwise specified the application of paint shall be in accordance with **ELOT EN ISO 12944-7** and the paint manufacturers' recommendations.
- 7.2 The paint applicator shall be responsible for ensuring that he is in possession of the latest available issue of the paint data sheets printed by the paint manufacturer of the particular batch of paint to be applied. Such data shall include specific recommendations and instructions concerning shelf life, pot life, thinners,

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directions for thinning and mixing, drying time, curing time, recommended spray equipment, safety equipment, cleaning solvent and any other provisions for application of both prime and finish coats. These recommendations shall be considered an inherent part of this Specification and followed accordingly.

- 7.3 Unless otherwise agreed, materials for succeeding coats on any one surface shall be the products of the manufacturer furnishing the initial priming coat or coats for that particular surface, in accordance with **ELOT EN ISO 12944-5**. All successive coats must however be compatible with prime coats.
- 7.4 Paint shall be applied only when the ambient or the surface temperature is between 10°C and 49°C unless specified otherwise.
- 7.5 Contaminated surfaces requiring corrosion resistant paints shall be thoroughly cleaned by washing with clean uncontaminated water or a suitable solvent for the removal of the contaminant. Each applied coat, when dry, shall be similarly cleaned before application of the succeeding coat. In the case of zinc silicate primed surfaces, zinc salts shall be removed by thorough manual scrubbing with stiff brushes in conjunction with a high pressure hose spray of clean uncontaminated water.
- 7.6 All dry thicknesses as specified shall be strictly adhered to within a tolerance of -0 /+20% unless otherwise agreed by the Owner. The film thickness of each coat shall be checked with calibrated film thickness gauges, using the magnetic resistance or eddy currents principle, such as Elcometer, Micro-test, Tinsley, etc. The equipment shall be calibrated at least twice daily in accordance with the Manufacturers' recommendations.
- 7.7 In order to achieve the specified dry film thickness, frequent checks of wet film thickness shall be carried out during the paint application with film thickness gauges such as the Elcometer wheel or comb type.
- 7.8 In the event of the film thickness not meeting the specified requirements, additional coat(s) of the paint concerned shall be applied in compliance with the specified requirements.

8.0 MANUFACTURERS' STANDARD PAINT SYSTEM

- 8.1 Where the equipment suppliers' standard preparation, priming and finish coat system is permitted, this shall be subject to the following provisions:
- a) The coating system is oil resistant.
 - b) For normal operating temperatures up to 80°C, this is applied in a minimum of three coats to an overall dried film no less than 150 microns, employing two component coatings that are self-curing or chemically curing and not dependant or air drying to attain full hardness.
 - c) For normal operating temperatures in excess of 80°C, a heat resisting paint system capable of withstanding these conditions is used.

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- d) Paint application is over a blast cleaned surface or, in the case of components where blast cleaning is impracticable, a power tool cleaned surface.
- e) Information is provided concerning type of touch-up paint to be used in the field in way of damaged areas.
- f) The system is approved in writing by the Owner.

9.0 AUSTENITIC STAINLESS STEEL SURFACES

9.1 All austenitic stainless steel piping and equipment shall be coated with a protective paint system in accordance with the systems described in **ELOT EN ISO 12944-5**.

9.2 For all priming and or finishing coats applied to austenitic stainless steel, the coating manufacturer shall produce a certification to confirm that the coating is free of contaminants i.e. metallic pigments, sulphur or chlorine which would harmfully affect stainless steel at ambient or elevated temperatures. The certification shall include a chemical analysis for halogens in accordance with **ELOT EN 14582** and shall provide confirmation that the halogen content is below 200 ppm.

9.3 For all priming and finishing coats applied to austenitic stainless steel in cryogenic service, the coating manufacturer shall produce certificates in the form of test results to demonstrate that the applied coating will remain stable when subjected to operating temperatures within the range of +120°C to -170°C and when subjected to cyclic conditions of temperature and thermal shock.

10.0 STRUCTURAL STEEL

10.1 All structural steel shall be hot dip galvanized when its weight is less than 44.3 kg/m, such as in the case of ladders, handrails, grating and toe plates. Heavier structural steel shall be painted. All galvanized surfaces that require painting shall be given a pretreatment wash primer before the paint system is applied. Bolting shall be galvanized when the structural steel is required to be galvanized.

11.0 BUILDINGS

11.1 Administrative type buildings, control houses, and control rooms shall be painted in accordance with the architectural specifications and drawings. The painting of other types of buildings shall be in accordance with this specification.

12.0 MARKING

12.1 Vessels and heat exchangers shall be stenciled with the-equipment number and duty in "Black Letters" on an aluminium background.

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13.0 TRANSIT PROTECTION OF LNG TANK PLATES

13.1 To prevent widespread corrosion of metallic plate surfaces during transit, storage and following erection, the plates shall receive the following protective treatment.

- a) Blast cleans to SA 2 1/2 in shop.
- b) Prime coat with inorganic zinc weldable preconstruction primer 25 microns dried film thickness in shop.
- c) Coat all plate edges with Deoxaluminite protection or equal.

13.2 The transit protection shall be left intact after tank erection with the exception of the inside of the inner tank shell and floor plates which shall be blast cleaned to Sa 2 1/2 and cleaned free of all contaminants prior to commissioning.

13.3 The inorganic zinc transit protection primer applied to the inside of the outer shell plates shall be of a type chemically compatible with the secondary insulation system, i.e. polyurethane foam and any associated secondary priming coat application, or cellular glass and any associated adhesives.

14.0 REPAIRS

14.1 When part of the full protective system has been applied by the equipment manufacturer, the work shall be completed on site making good any damage or deficiency of part of the general painting. Where the full system has been applied by the equipment manufacturer, additional painting shall be kept to the minimum necessary to obtain uniformity of color. In general, field instruments shall not be repainted.

14.2 Any repairs to damage of abutting property, vehicles; and other portions of the structure due to the painting operations shall be the responsibility of the contractor unless otherwise specifically covered in the special provisions for the painting job.

15.0 EUROPEAN AND INTERNATIONAL STANDARDS AND SPECIFICATIONS

15.1 The following standards shall be used when referenced in the Project Design Specification:

ELOT EN ISO 1461 Hot dip galvanized coatings on fabricated iron and steel articles -- Specifications and test methods

ELOT EN ISO 2808 Paints and varnishes -- Determination of film thickness

ELOT EN ISO 8501-1 Preparation of steel substrates before application of paints and related products -- Visual assessment of surface cleanliness -- Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings

ELOT EN ISO 8503-2 Preparation of steel substrates before application of paints and related products -- Surface roughness characteristics of blast-cleaned steel substrates -- Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel -- Comparator procedure

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ELOT EN ISO 8504-3 Preparation of steel substrates before application of paints and related products- Surface preparation methods- Part 3: Hand and power tool cleaning.

ELOT EN ISO 11126-7 Preparation of steel substrates before application of paints and related products- Specifications for non-metallic blast cleaning abrasives- Part 7: Fused aluminium oxide.

ELOT EN ISO 12944-1 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 1: General introduction

ELOT EN ISO 12944-2 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 2: Classification of environments

ELOT EN ISO 12944-3 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 3: Design considerations

ELOT EN ISO 12944-4 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 4: Types of surface and surface preparation

ELOT EN ISO 12944-5 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 5: Protective paint systems

ELOT EN ISO 12944-6 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 6: Laboratory performance test methods

ELOT EN ISO 12944-7 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 7: Execution and supervision of paint work

ELOT EN ISO 12944-8 Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 8: Development of specifications for new work and maintenance

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TABLE 1: FINAL COAT COLOURS

ITEM	COLOUR	RAL
Steel Structures	Blue	5010
Towers, Vessels, Heat Exchangers	Aluminum	9006
Storage Tanks	White	9010
Fire Fighting Equipment	Red	2002
Rotating Machinery	Blue	5014
Electric Motors	Grey	7030
Piping:-		
Firefighting	Red	2002
Process	White	9010
Cooling Water	Green	6029
Safety Facilities	Yellow	1021
(Safety valves, CSO/CSC valves, safety showers, handrails of platform, ladders and safety cages)		
Electrical Equipment:-	Grey	7030
transformers and grounding resistors		
Switchboards	Hold	

NOTE:

The colours are defined according to the following code: "RAL 840 HR"
issued by Deutscher Hornen Ausschuss.