



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN  
ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
(Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 1 of 61

## ***STYRENE PARK OFFSITE***

***Document Title:***

***General Painting Specification***

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
R3	10.Apr.21	ISSUED FOR APPROVAL	M.AJVAND	S. BEHNIAFAR	R. MEMAR
02	03.May.16	APPROVED FOR DESIGN	A.NIKZAD	M.R.SALIMI	S.MOTAMEN
01	18.Feb.16	APPROVED FOR DESIGN	A.NIKZAD	M.R.SALIMI	S.MOTAMEN
00	05.Dec.15	ISSUE FOR COMMENT	A.NIKZAD	M.R.SALIMI	S.MOTAMEN



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Rev. R3



Page 2 of 61

*Table of Contents*

<b>1. GENERAL</b>	<b>4</b>
<b>2. APPLICABLE CODES AND STANDARDS</b>	<b>5</b>
<b>3. REFERENCEDOCUMENT</b>	<b>7</b>
<b>4. DOCUMENTPRECEDENCE</b>	<b>7</b>
<b>5. DESIGN BASIS</b>	<b>7</b>
<b>6. COATINGAPPLICATION</b>	<b>13</b>
<b>7. EQUIPMENT USED FOR COATING PREPARATION AND APPLICATION</b>	<b>21</b>
<b>8.INSPECTION</b>	<b>ERROR! BOOKMARK NOT DEFINED.</b>
<b>9.COLOUR CODING OF PIPING SYSTEMS</b>	<b>30</b>
<b>10.MARKING WITH LETTERING AND SYMBOLS</b>	<b>31</b>
<b>11. GUARANTEE</b>	<b>34</b>
<b>12. APPROVEDSYSTEMS</b>	<b>34</b>
<b>13. SUBSTITUTIONRULE</b>	<b>34</b>
<b>14. ITEMS NOT TO BE PAINTED</b>	<b>34</b>
<b>APPENDIX 1</b>	<b>36</b>
<b>APPENDIX 2</b>	<b>37</b>
<b>APPENDIX 3</b>	<b>38</b>
<b>APPENDIX 4</b>	<b>39</b>
<b>APPENDIX 5</b>	<b>40</b>
<b>APPENDIX 6</b>	<b>42</b>
<b>APPENDIX 7</b>	<b>43</b>
<b>APPENDIX 8</b>	<b>44</b>
<b>APPENDIX 9</b>	<b>45</b>
<b>APPENDIX 10</b>	<b>46</b>
<b>APPENDIX 11</b>	<b>47</b>
<b>APPENDIX 12</b>	<b>48</b>
<b>APPENDIX 13</b>	<b>49</b>
<b>APPENDIX 14</b>	<b>50</b>
<b>APPENDIX 15</b>	<b>51</b>
<b>APPENDIX 16</b>	<b>52</b>
<b>APPENDIX 17</b>	<b>53</b>
<b>APPENDIX 18</b>	<b>54</b>

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
	<p>Document Title : General Painting Specification</p>		<p>Rev. R3</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>		<p>Page 3 of 61</p>	

<i>APPENDIX 19</i> .....	<i>54</i>
<i>APPENDIX 20</i> .....	<i>55</i>
<i>APPENDIX 21</i> .....	<i>56</i>
<i>APPENDIX 22</i> .....	<i>57</i>
<i>APPENDIX 23</i> .....	<i>58</i>

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		
	Document Title : General Painting Specification		
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 4 of 61

## 1. GENERAL

### 1.1 Introduction

*Creation and development of chain units of Styrene Monomer is the mission of Gohar Ofogh Industrial Park. This Company joint investment of 4 companies including Pad-Jam Petrochemical Complex, Asaluyeh Sadaf Chemical, Kimia Sanaye Dalahoo and Entekhab Group and is located in Asaluyeh.*

*Feed and utility lines and network construction, Styrene Monomer tank construction, Peroxide and its sidelong equipment warehouse are among this company's missions.*

### 1.2 Purpose of Document

*Scope of the present document is to explain the practices establishing the minimum requirements that the designer shall adhere to in order to ensure adequate engineering review of piping systems for the plant. The general scope of these activities is to verify that every piping arrangement is sufficiently flexible to allow each line to thermally expand or contract without overstressing pipes or equipment and adequately supported so that no damage occurs due to loads resulting from weight, pressure, wind, earthquake, differential settlement, shocks Settlement etc. The purpose of this specification is to ensure the sound and uniform approach to the review of the mechanical safety of piping and related systems and to produce evidence that this has been done satisfactorily.*

### 1.2 Definitions

*In construing this report, following word and expressions shall have the meaning as below:*

**Client/Owner:** Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.

**Engineering Consultant:** Fanavaran Tehran Farayand Company

**Manufacturer/Supplier/Vendor:** The organization to which the Purchaser order has been awarded.

**Will:** Is normally used in connection with the action by the "company" rather than by a contractor, supplier or vendor.

**May:** Is used where a provision is completely discretionary.



**Should:** Is used where a provision is advisory only.

**Shall:** Is used where a provision is mandatory.

**Contractor:** The Party Which Performs Erection & Construction Works.

**SubContractor:** The Party Which Contractor Awards Apart of Construction Works.

**Project:** Park Styrene Utility & Offsite Facility

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p>BINA EPC Contractor Co. (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 5 of 61

**CS:** *Carbon steel surfaces, including low alloy steels*  
**SS:** *Stainless steel surfaces, including high alloy steels*

### 1.3 Scope

*This General Design Rules is applicable to all external surfaces of piping and accessories for use on process & Utility piping system in for offsite area of Park styrene petrochemical plant Located in Phase II of petrochemical zone (Assalouyeh). The purpose of this Specification for Design is to define the painting of piping subject to corrosion and also main equipment. It includes different coating systems, the surface preparation required, the limits of paint, and the thickness to be applied and the application techniques.*

## 2. APPLICABLE CODES AND STANDARDS

### 2.1. General

*This specification is based on the NPC Engineering Standard NPCES-ES-TP-01 "Painting and color coding".*

### 2.2. List of applicable codes and standards

*The latest edition (at contractual date) of codes listed below are to be read in conjunction with this specification and are to be used as a minimum requirement for the supply of materials/work. For work on the job the safe working procedures laid down by the Owner must be adhered to.*

*For work carried out at Vendor premises it may be necessary to use other specifications and codes that conform to local and/or government requirements for safe working procedures. Where this is the case these local and governmental regulations shall prevail.*

*All materials, workmanship and testing except as specified otherwise herein, shall be in accordance with latest editions and supplements of the following specifications and Codes of Practice.*

#### **American Society for Testing and Materials (ASTM)**

ASTM A123	Zinc (hot-galvanized) coatings on product fabrication for rolled, pressed and forged steel shapes, plates, bars and strip.
ASTM A153	Zinc coating (hot-dip) on iron and steel hardware.
ASTM D3359	Measuring adhesion by tape test



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014



Rev. R3

Page 6 of 61

ASTM D4414	Measurement of wet film thickness by notch gauges.
ASTM D4541	Pull-off strength of coatings using portable adhesion testers
ASTM D4752	Measuring MEK resistance of ethyl silicate (inorganic) zinc-rich primers by solvent rub
ASTM D5402	Assessing the solvent resistance of organic coatings using solvent rubs

**International Organization for Standardization (ISO)**

ISO 1461	Hot-Dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.
ISO 2178	Non-magnetic coatings on magnetic substrates - Measurement of coating thickness -Magnetic method
ISO 2409	Paints and varnishes -Cross-cut test
ISO 2808	Paints and varnishes -Determination of film thickness ISO 4624
ISO 4628(1 to 6)	Paints and varnishes -Evaluation of degradation of paint coatings - Designation of intensity. Quantity and size of common types of defect
ISO 8501-1	Preparation of steel substrates before the 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
ISO 8502-3	Preparation of steel substrates before application of paints and related products -Tests for the assessment of surface cleanliness -Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 8502-6	Preparation of steel substrates before application of paints and related products -Tests for the assessment of surface cleanliness -Part 6: Extraction of soluble contaminants for analysis -The Bresle method
ISO 8503-2	Preparation of steel substrates before application of paints

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  <b>CONCEPTUAL, BASIC and DETAIL DESIGN</b>  <b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>			
	Document Title : General Painting Specification			
	Document No. : EI027-000-EB-PI-SPC-014		Rev. R3	Page 7 of 61

### 3. REFERENCE DOCUMENT

*In this publication reference is made to the publications listed below. The latest issue of each publication shall be used together with any amendments/supplements/revisions unless otherwise stated.*

#### **Project Specification**

*EI027-000-EB-PI-DWG-001*

*Standard Pipe Support*

### 4. DOCUMENT PRECEDENCE

*In case of conflict between requirements specified herein and the requirements of any other referenced document, the order of precedence shall be:*

- *This specification*
- *Paint Manufacturer technical data sheet*
- *Engineering Standard NPCES-ES-TP-01*
- *Codes and standards listed herein*
- *Rules of Art*

### 5. DESIGN BASIS

*The inspector or the company's representative shall be allowed free access to products and the work site. The applicator or the contractor shall make an office and*

*all means required for proper inspection available to the inspector, including Scaffolding access gangways, etc.*

*Approval shall be obtained for each stage, indicated below, before going on to the next stage:*

- *Location of the painting work, products and painted equipment storage conditions*
- *Equipment*
- *Surface preparation*
- *Primer or prime coat*
- *After each coat of paint*
- *Contractor's commitment*

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-che Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p> <p>Page 8 of 61</p>

### 5.1. Climatic parameters

*Coastal and marine environment shall be selected.*

*Note: climatic conditions are of great influence on the complete painting process and may seriously disturb the surface preparation and application activities as well as lead to changes in the choice of the protective coating systems.*

### 5.2. Process parameters

*Operating temperature range: -10°C to 470°C.*

### 5.3. Surfaces to be coated

*Carbon and alloy steel surfaces as per paragraph 6.6*

*Galvanized surfaces in acid areas and as per paragraph 10 (safety colours)*

### 5.4. Surfaces not to be coated

- *Insulated CS surfaces at temperature above 125°C*
- *Un insulated SS surfaces*
- *Insulated SS surfaces at temperature below 450°C*
- *Other non-ferrous metal surfaces (aluminum, copper alloys, etc.)*
- *Machined surfaces, such as flange faces*
- *Friction surfaces of assemblies using friction*
- *Surfaces used for identifications purposes, such as nameplates, serial number plates, valve identification signs, gauge glasses and guards, gauge faces and light fixtures, valve stems and flange bolts shall not be coated*
- *Non-metallic surfaces except when required (solar protection)*

### 5.5. Painting data

*Piping data shall be indicated on the line list document.*

### 5.6. Coating systems

#### 5.6.1. Exterior surfaces





Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 9 of 61



*The purpose of this paragraph is to illustrate the coating systems suitable for the piping. Coating systems will be chosen depending of nature of surface, presence of insulation or fireproofing and operating temperature.*

<b>Item No.</b>	<b>Paint System</b>	<b>Painting System Description</b>	<b>Temperature range</b>
<b>1</b>	<b>P01</b>	<b>Non-insulated Carbon Steel Piping Surfaces</b>	<b><math>T \leq 120^{\circ}\text{C}</math></b>
<b>2</b>	<b>P05</b>	<b>Non-insulated Galvanized Piping Surfaces</b>	<b><math>T \leq 120^{\circ}\text{C}</math></b>
<b>3</b>	<b>P11</b>	<b>Non-insulated Carbon Piping Steel</b>	<b><math>120^{\circ}\text{C} &lt; T \leq 400^{\circ}\text{C}</math></b>
<b>4</b>	<b>P12</b>	<b>Carbon Steel insulated Piping Surfaces</b>	<b><math>T \leq 90^{\circ}\text{C}</math></b>
<b>5</b>	<b>P13</b>	<b>Carbon Steel insulated Piping Surfaces</b>	<b><math>90^{\circ}\text{C} &lt; T \leq 270^{\circ}\text{C}</math></b>
<b>6</b>	<b>P20</b>	<b>Non-insulated Stainless Steel Piping</b>	<b><math>T \leq 120^{\circ}\text{C}</math></b>
<b>7</b>	<b>P21</b>	<b>Non-insulated Stainless Steel Piping</b>	<b><math>120^{\circ}\text{C} &lt; T \leq 200^{\circ}\text{C}</math></b>
<b>8</b>	<b>P22</b>	<b>Non-insulated Stainless Steel Piping</b>	<b><math>200^{\circ}\text{C} &lt; T \leq 600^{\circ}\text{C}</math></b>
<b>9</b>	<b>P23</b>	<b>insulated Stainless Steel Piping</b>	<b><math>T \leq 120^{\circ}\text{C}</math></b>
<b>10</b>	<b>P24</b>	<b>Insulated Stainless Steel Piping</b>	<b><math>120^{\circ}\text{C} &lt; T \leq 250^{\circ}\text{C}</math></b>
<b>11</b>	<b>P30</b>	<b>Insulated Carbon Steel &amp; Stainless Steel Piping</b>	<b><math>270^{\circ}\text{C} &lt; T \leq 600^{\circ}\text{C}</math></b>
<b>12</b>	<b>P31</b>	<b>Internal surface of Storage Tanks (Raw Water , Fire Water, Service Water)</b>	<b>All</b>

**Note 1:** piping supports shall be painted in accordance with the relevant piping lines.

**Note 2:** Non-itemized piping material, such as valves and manifold shall be supplied as follows:

-External C.S. surface shall be cleaned by abrasive blasting to grade Sa 2.5 before applying 75  $\mu\text{m}$  of an approved inorganic zinc (zinc silicate) primer, unless otherwise specified.

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 10 of 61

*-Items made of S.S. shall be supplied unpainted.*

**Note 3:** Surfaces that have to be post weld heat treated (PWHT) shall be prepared and painted after heat treatment has been done.

**Note 4:** Surfaces that operate at cyclic temperatures, i.e. that normal operating temperature is below 90°C and are above 90°C for regeneration, shall be painted for the maximum operating temperature even if insulated.

### 5.7. Painting Codes

<i>Paint System</i>	<i>Appendix</i>
<b>P01</b>	<b>1</b>
<b>P05</b>	<b>3</b>
<b>P11</b>	<b>5</b>
<b>P12</b>	<b>6</b>
<b>P13</b>	<b>7</b>
<b>P20</b>	<b>12</b>
<b>P21</b>	<b>13</b>
<b>P22</b>	<b>14</b>
<b>P23</b>	<b>15</b>
<b>P24</b>	<b>16</b>
<b>P30</b>	<b>22</b>
<b>P31</b>	<b>23</b>

### 5.8. Original Manufacturer's coating systems

Packaged equipment (including mechanical parts, pressure vessels, piping and piping material, instruments, machinery, etc.) and equipment items, such as pumps, Diesel engine, electric motors, transformers, generators, hoists and instrumentation, etc. will be completely coated according to Manufacturers standard provided it complies with the following requirements.

Painting procedure including description of the coating system (type and trade name of coating products, number of coating layers, dry film thickness of each layer, etc.) shall be submitted to CONTRACTOR for written approval, together with product data sheets. This shall be done by filling in a Painting, Insulation and Fireproofing Data Sheet per item/group of items.

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p> <p>Page 11 of 61</p>

*The Manufacturer coating system must meet the required quality of corrosion protection adapted to the climatic and the corrosive conditions of the plant. Moreover, coating systems shall comply with the following:*

*Minimum requirements for Manufacturer coating system*

- *For carbon steel surfaces at temperature below 120°C, the coating system shall be based on two-component products, including no less than 50 µm of primer containing an approved corrosion inhibitive pigment. The total dry film thickness of the system shall be no less than 150 µm.*
- *For carbon steel surfaces at operating temperature above 120°C up to 400°C, the coating system shall consist of the following:*

*One coat of two-component inorganic zinc primer at minimum 75 µm dry film thickness, two coats of heat resistant inorganic coating.*

- *Stainless steel equipment and piping surfaces requiring corrosion protection shall be coated with paint materials compatible with stainless steel. Paint material shall not include sulphur, zinc, lead, copper or their compounds, or leach able chlorides/halides.*
- *Colour shall be in accordance with article 9 of this specification.*



## **5.9. Bulk valves**

### **5.9.1. Carbon steel valves**

*Carbon steel valves shall be coated as follows:*

*At Manufacturer's shop*

1. *Surface shall degreased before any surface preparation*
2. *Sandblasting to Sa 2 ½ according to ISO 8501-1*
3. *Apply 1 coat of inorganic ethyl zinc silicate to 25 µm. Paint material shall have a temperature resistance at least of 470°C*
4. *Intermediate and finish coats, when required, shall be applied in accordance with relevant paint system as defined in this specification.*

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  <b>CONCEPTUAL, BASIC and DETAIL DESIGN</b>  <b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>			
	<p>Document Title : General Painting Specification</p>			
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>		<p>Rev. R3</p>	<p>Page 12 of 61</p>

### 5.9.2. Alloy steel valves

*Low alloy steel valves shall be coated as follows:*

*At Manufacturer's shop:*

5. *Surface shall degreased before any surface preparation*
6. *Sandblasting to Sa 2 ½ according to ISO 8501-1*
7. *Apply 1 coat of pure or aluminium silicone to 25 µm.*  
*Paint material shall have a temperature resistance at least of 470°C*
8. *Intermediate and finish coats, when required, shall be applied in accordance with relevant paint system as defined in this specification.*



### 5.9.3. High alloy and stainless steel valves

*High alloy and stainless steel valves shall be delivered to site uncoated.*

## 5.10. Coating composition

*All coating products used in shop or on site shall meet the NPCES-ES-TP-01- Rev 0 specification and the following requirements.*

- a) *All coating product formulation shall respect the local legislation of the place of application (e.g. VOC, isocyanates, etc) and to some extent they shall comply with the legislation of the country/state where the plant is built.*
- b) *Coatings shall be free of heavy metals such as arsenic, barium, cadmium, lead, mercury, silver, chromium, and selenium. However, zinc coatings containing barium sulphate and less than 0.01% lead are acceptable.*
- c) *Two pack finish coats for un insulated surfaces up to 90°C shall be based on acrylic or aliphatic polyurethane media. Where isocyanine cured products are not allowed, alternative finish products shall be submitted to Owner for approval. Finish coat shall have gloss retention and weather/UV resistance.*
- d) *Epoxy coatings shall be based on a polyamide or amine adduct cured two pack epoxy media and shall be pigmented with titanium dioxide and/or light fast coloured pigments to provide the necessary opacity, film build and weather resistance.*

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		
	Document Title : General Painting Specification		
	Document No. : EI027-000-EB-PI-SPC-014		Rev. R3

- e) *Silicone coatings shall be based on a one-pack formulation. They may comprise leafing aluminium pigment dispersed in the silicone or modified silicone media. The coating shall be capable of withstanding continuous exposure to temperatures up to 580°C when required.*
- f) *Inorganic zinc (zinc silicate) primers shall be based on ethyl silicate media and shall contain not less than 85 % metallic zinc by weight in the dry film. They shall be two component products.*

## 6. COATING APPLICATION

### 6.1. Material supply

*CONTRACTOR shall supply all painting material and thinners necessary for the execution of this job.*

*Painting SubContractor is responsible for supplying all other materials, equipment tools for execution and testing, including consumables like solvents for surface cleaning, sand for sandblasting, etc.*

### 6.2. Sources of materials

*Only the materials generically specified for a given service in this specification as detailed in Appendixes are to be used. Mixing products of different Coating Manufacturers in the same layer/application for any given system is NOT acceptable. Next layer coating of different Coating Manufacturer than prior coat is to be individually supported by written statements from each Coating Manufacturer involved as to compatibility and integrity of finished coating system.*

*All paint and coating materials shall be delivered in the Coating Manufacturer unopened original containers. In good state and correctly labeled, Label shall feature the Coating Manufacturer's name, brand name, batch number, shelf life and date of manufacture as a minimum.*

### 6.3. Equipment for surface preparation and coating application

*The coating SubContractor shall supply and transfer to site all the equipment and blasting material necessary to carry out the cleaning masking and painting work in accordance with this specification and Coating Manufacturer's recommendations. Test equipment including the;*

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-eh Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN</b> <b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p> <p>Page 14 of 61</p>

wet and dry film thickness gauges, blast profile testers, pinhole holiday detectors, hydrometers, temperature measuring devices, shall be provided by the coating SubContractor.

## 6.4. Surface preparation and cleaning

### 6.4.1. General

*The following method of surface preparation shall be used.*

*In all cleaning methods the equipment and tools used shall be of suitable design and quality to properly complete the works to the specification. Where compressed air is used air lines shall be provided with effective, well maintained oil and water traps. Efficient well maintained air filters shall be provided to control dust as per mentioned in ASTM D4285.*

*During cleaning, all weld areas and attachments shall be given special attention to ensure all welding flux and spatter is removed by the use of solvents, files scrapers, chipping hammers, power or hand brushes or grinders fitted with flexible grinding discs.*



*Prior to the commencement of any of the cleaning methods detailed below, the surface to be cleaned shall have all oil; grease or wax removed by swabbing with a suitable emulsion cleaner. The surface shall then be washed down with clean fresh water to remove dirt, stains and residues. Where necessary, hand brushing shall be included to ensure a clean surface.*

*Safety -The continuous inhalation of fine dust created during blast cleaning can be a health hazard. Nozzle operators and other involved personnel must wear the appropriate protective equipment at all times during blast cleaning operations; e.g.. Operators shall be supplied with*

*clean fresh air and provided with full protective hood, hearing protection, safety footwear, gloves, heavy-duty overalls and aprons. All associated personnel shall be supplied with eye protection, face mask and hoods during blasting as a minimum level of protection. Nozzle operators and assistants shall be fully trained in safe use of their equipment.*

### 6.4.2. Abrasive blast cleaning

*In this method, mill scale, rust and other surface contaminants shall be removed using blast or centrifugally propelled abrasives. After the specified standard has been achieved, all dust, loose materials and abrasive residues shall be removed from the cleaned surface and the surface shall be coated before contamination or flash rusting occurs as it's mentioned in ISO 8502-3.*

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 15 of 61

*Contaminants such as oil, greases, chemicals or soil shall be removed prior to abrasive cleaning by the use of a suitable emulsion cleaner. The surface shall be cleaned as specified in the annexes.*

*The applicable standard for surface preparation shall be the latest edition or revision of the international norm ISO 8501-1.*

*After blast cleaning and before application of the priming coat the surface shall be vacuum cleaned to remove dust and abrasives. Due care shall be exercised to prevent the abrasive grit entering inside equipment and pipe work. On completion of blasting operations, the inside of equipment and piping shall be inspected and cleaned out if the presence of abrasive grit is detected.*

*The use of abrasives containing silica is not permitted. The abrasive must be free from oil, grease, moisture, etc. Re-used abrasive shall be clean and reasonably sharp. They shall not be rusted or noticeably worn or dull when compared with fresh material and must be free from contaminants.*

*Re-used abrasive shall be approved by Owner and shall meet the requirements as specified above.*

*Following the blast cleaning to the specified quality surfaces shall be brushed or blown clean with dry, oil-free compressed air or shall be cleaned by vacuum to remove all dust blast-cleaning abrasive from the surface and in particular from pockets and comers. Any surface showing signs of handling contamination after blasting shall be solvent cleaned and re-blasted.*

*Blast cleaning shall not commence unless a protective coating can be applied before contamination or flash rusting occur.*

*Blasting shall not be done outside normal daylight work hours unless authorized by Owner.*

*Blasting operations shall not be carried out unless surfaces to be prepared are 3°C above ambient air dew point.*

#### **6.4.3. Protection for surfaces not to be coated**



 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>		
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p>	<p>Page 16 of 61</p>

*Protect all surfaces not to be coated from damage and from products by adequate temporary coverings during all operations of surface preparations and painting. Remove coating that may ill particular, stainless steel and non-ferrous surfaces shall be from blasting, overspray and coatings intended for carbon steel, especially coatings containing zinc. Protected*

#### **6.4.4. Galvanized surfaces**

*Surface preparation shall consist of thoroughly degreasing and treating with a mordant/etching solution. After the reaction period the surfaces shall be washed down with clean water.*

*Alternatively, sweep blast cleaning is acceptable after thorough degreasing. Dust from blast cleaning operation shall be removed as previously described.*

*Note: Weathered galvanized surfaces should be wire brushed first to remove all corrosion products.*

#### **6.4.5. Stainless steel surfaces**

*Surface preparation shall consist of thoroughly degreasing followed by sweep blast cleaning to Sa 1 (ISO 8501-1). The blast media shall be suitable for stainless steel in order to prevent any ferrous contamination and shall be free of any contaminant ( e.g. chlorides and halides ). Anchor profile shall be 25-40 microns.*

#### **6.4.6. Weld areas and sharp edges**

*All weld seams, sharp edges and surface irregularities shall be contoured and surface irregularities ground smooth as required.*

#### **6.4.7. Anchor profile**



*Unless otherwise specified, the surface profile after blast cleaning shall have a min/max. Height of 50-75 microns with rough peaks to 100 microns (Rz).*

#### **6.4.8. Manual and Mechanical (power-Tool) Cleaning**

*In this process dirt, rust, mill scale and/or paint remains are removed and the metal surface prepared by hand chipping, scraping or wire brushing or preferably where possible by powered hand tools such as powered wire brushes or needle guns to achieve the specified standard.*

*Manual cleaning shall only be carried out when the use of power tools is prohibited and with the permission of Owner.*



 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 17 of 61

*The quality of surface cleanliness achieved by manual or mechanical cleaning is specified in Appendixes.*

*On completion of the surface preparation, all dust and other foreign materials shall be removed and the primer coat applied before any contamination or rusting occur, but in, any case within four hours. Should the cleaned surface be left uncoated overnight surface preparation shall be repeated prior to painting.*

#### **6.4.9. Quality of abrasive**

*Abrasive shall be sealed in watertight packaging any product delivered in defective I packaging shall be rejected products must be 1 stored sheltered from the elements. Conductivity of abrasives shall be less than ISO.10-6 SIEMENS / CM as per ASTM D4940. The use of copper slag is prohibited.*

### **6.5. Preparation and application of coating material**

#### **6.5.1. General**

*Coating SubContractor shall adhere strictly to the instructions and recommendations as prescribed by the coating Manufacturers for the preparation and application of all coating materials. Successive coats shall have a contrasting colors or tints*

#### **6.5.2. Coating preparation**



*Coating components shall be power-stirred to obtain a homogenous consistency. No hand stirring is allowed for quantities greater than 5 liters. Before further use, coating shall be allowed to stand for a time long enough to remove aeration caused by stirring.*

*Two-pack or multiple pack coating systems shall be mixed in the proportions and under the conditions recommended by the Manufacturer. The mixed coating shall not be used on expiry of its "pot life".*

*The mixed coating shall color match with other prepared products of the same coat.*

*Coatings visually showing deterioration such as settling, separation, gelling, skin formation, etc. shall be discarded.*

#### **6.5.3. Coating Application**

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p>BINA EPC Contractor Co. (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p> <p>Page 18 of 61</p>

*Painting shall be done according to the application instructions of the Coating Manufacturer and shall be performed by skilled and experienced staff, aware of health and hazard issues related to painting activities.*

*Coating may be applied by brush; roller, conventional spray or airless spray methods as approved or specified by the coating Manufacturer. Brush or rollers used shall be of a suitable size and shape and shall be kept clean by use of approved solvents. Where rollers are used, the nap shall be of sufficient length to work the coating well into the surface. Air compressor shall not be allowed to deliver air at temp above 110oC.*

*When using conventional spray or airless spray methods, all the equipment shall have adequate, well-maintained pressure regulating devices, effective strainers, traps, and separators, suitable size hoses and clean, well-maintained guns. The traps and separators for removing oil and water maintained from the compressed air shall be such that air atomizing guns will not deposit oil or water when directed on to a clean surface for 15 seconds.*

*Nozzles shall be of the correct size and provide the most suitable spray shape for the most effective and economical application of the coating without excessive overspray.*

*The specified coating thickness shall be achieved at all protrusions, corners and crevices after roller application.*



*All coating materials shall be applied evenly in a normal full coat free from mud cracking, wrinkling, sagging, curtaining, cissing, fish eyes. Orange peeling, pinholes, brush and roller marks and other defects.*

*The dry film thickness shall be measured from the peaks of the grit blast profile and suitable pieces of grit blasted steel shall be prepared to enable the thickness meters to be calibrated in accordance with the indications from the equipment Manufacturer.*

*Due care shall be exercised whilst spraying to prevent overspray and contamination of other surfaces by the use of shields, etc.*

*Under no circumstances shall zinc or aluminum in the form of coating pigments or metal spray be allowed to come into contact with stainless steels, nickel based alloys or copper based alloys.*

#### **6.5.4. Priming**

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
	<p>Document Title : General Painting Specification</p>		<p>Rev. R3</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>		<p>Page 19 of 61</p>	

*The priming coat shall be applied as soon as possible after the surface preparation has been carried out and before any contamination of the cleaned surface. The specified surface preparation is understood to be the one at the moment of the application.*

*Angles, comers, sharp edges, bolt or rivet heads shall be stripe-coated by brush. This coat shall be the same product as the primer. but should be of a different color for identification purpose.*

#### **6.5.5. Subsequent coat**

*When the primer coat has cured and its correct application and thickness has been confirmed and the primer surface has, if necessary, been cleaned to remove dust/moisture the specified protective coating shall be applied.*

*When more than one coat is required the Coating Manufacturer's recommendations on over coating time shall be complied with.*

*Wet film thickness should be checked when each coat is applied to ensure that the full coating thickness will be achieved in the specified number of coats. Total system dry film thickness shall also be in accordance with this specification.*

*A final coat shall be applied in accordance with the undercoat over coating time recommended by the Coating Manufacturer.*

*The final coat shall provide a smooth. Even finished coating surface, where gloss finish coats are applied, and the surface shall be smooth glosses finish with no breaks in the surface.*

*The multicoated system shall be free of all the defects previously mentioned.*

#### **6.5.6. Drying times**

*Each coat shall be allowed to cure thoroughly in accordance with the Coating Manufacturer's instructions for over coating before the next coat is applied. Curing times are highly dependence on local conditions.*

#### **6.5.7. Weather conditions**

*Painting SubContractor shall measure and record local conditions of temperature and humidity during blasting, painting and curing.*

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p>BINA EPC Contractor Co. (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p> <p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p> <p>Page 20 of 61</p>

*Coating shall only be applied when suitable weather conditions prevail. Coating shall not be applied under the following conditions or when such conditions are likely to prevail before the coating is cured.*

- 1. At temperatures below 10°C (or according to Coating Manufacturer recommendation) or when the temperature is likely to fall below this figure before the surface film is dry or on surfaces registering low temperatures.*
- 2. When the relative humidity of the atmosphere exceeds 85 %.*
- 3. The steel temperature is less than 3°C above the dew point.*
- 4. During foggy or misty conditions.*
- 5. Before dew or moisture has evaporated.*
- 6. When it is raining or rain is imminent.*

*Guidelines for weather and other atmospheric suitability shall be agreed with OWNER but painting SubContractor shall remain responsible for scheduling his activities.*

*Coating which is contaminated during curing, for example by dust, condensation or rain, shall, if deemed necessary by OWNER be removed and redone.*

#### **6.5.8. Contrasting coatings**



*Where it is necessary to apply more than one coat of a particular product to obtain a specified dry film thickness, and then the first coat shall be selected sufficiently different in color, in order to distinguish from the subsequent coats.*

#### **6.5.9. Storage of materials**

*All products shall be received in sealed containers, clearly marked with product description, reference number, batch number and date of manufacture. Thinners, solvents, etc. shall be stored in a well-ventilated fireproof building, separate from other painting consumables. The building temperature shall be controlled if necessary in order that the coating products will not suffer from local climatic conditions.*

#### **6.5.10. Painting before installation**

*Prepared welding edges and surfaces within 50 mm to 75 mm of welding shall be left uncoated or coated with an approved welding primer only.*

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p>BINA EPC Contractor Co. (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 21 of 61

*All surfaces that will be inaccessible after assembly or installation shall be cleaned and coated before installation. Such surfaces include underneath of baseplate, skids, saddles, etc. When painting is carried out before installation, all reasonable steps shall be taken by the painting*

*SubContractor had to reduce the minimum damages to the coating system before and during installation.*

*Metal contact surfaces -i.e. bolted joints in structures- should be coated with one full layer of the specified primer on both surfaces immediately before bolting up. Fretting surfaces where friction grip is required shall not be coated.*

#### **6.5.11. Shipping, handling and storage of coated items**

*Coated items shall not be handled or moved until all coatings have been properly dried or cured as required in the Coating Manufacturer's instructions.*

*Coated items shall be handled with equipment such as wide belt slings, web belts, and wide padded skids selected to prevent damage to the coating. Handling equipment likely to cause damage to the coating shall not be used. Items such as chains, cables, hooks, tongs, metal bars, and narrow skids shall not be permitted to come in contact with the coating. Dragging or skidding coated items shall not be permitted.*

*Coated items shall be loaded, padded, and secured for transport in such a manner that the coating will not be damaged in transit.*

*Coated items shall be separated so that the items do not bear against each other.*

*Coated items shall be stacked off the ground using suitable means (e.g. parallel height ridges of rock-free sand, wooden timbers placed under the uncoated pipe ends) to avoid damages of the coating.*

## **7. EQUIPMENT USED FOR COATING PREPARATION AND APPLICATION**

*The SubContractor shall be in possession of the latest issue of the product data sheets and material safety data sheets. The SubContractor shall also obtain the written recommendations of the Coating Manufacturer on storage, preparation and application of the paint products. These documents shall be submitted to the Owner before the commencement of work.*

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>			
	<p>Document Title : General Painting Specification</p>			
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>		<p>Rev. R3</p>	<p>Page 22 of 61</p>

*The SubContractor shall supply and transport to site. all the equipment and materials necessary to carry out the cleaning, masking, and painting work in accordance with the specification.*

*The SubContractor shall provide the evidence that his equipment is suitable and adequate to produce the standard of surface preparation and paint application required by the specifications.*

*The equipment will include, but not be limited to:*

- *Paint brushes, rollers and spraying equipment (including air compressors), etc.*
- *Power and hand wire brushes, chipping hammers. Scrapes and abrasive cleaning equipment including blast abrasives, hoses, nozzles, compressors, etc.*
- *Mechanical paint mixing and stirring equipment, volume calibrated containers. -scaffolding, ladders, cradles,*
- *Personnel safety equipment including goggles, masks, screens and other protective equipment used in association with blast cleaning and paint spraying,*
- *Test equipment including wet and dry film thickness gauges, blast profile testers. Pinhole holiday detectors, flow cups, hydrometers, temperature and viscosity measuring devices and visual metal cleaning standards.*



### **7.1. Blasting equipment**

*All blasting equipment supplied will have a current inspection certificate from a third party independent source if required.*

*The pressure and volume of the compressed air supply for blast cleaning shall meet the work requirement and shall be sufficiently free of oil and water contamination to ensure that the cleaning process is not impaired. Traps, separators and filters shall be emptied and cleaned regularly.*

### **7.2. Hand tools**

*Chipping, scraping and steel wire brushing using manual or power driven tools shall be of a type acceptable to Owner.*

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-che Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p> <p>Page 23 of 61</p>

### **7.3. Spray equipment**

*All spray equipment supplied will have a current inspection certificate from a third Party independent source if required.*

*The pressure and volume of the compressed air used for spray application shall meet the work requirement and be free from oil and water contamination. Traps, separators and filters shall be emptied and cleaned regularly.*

*The size of spray nozzle shall be as per Coating Manufacturer recommendations.*

## **8. INSPECTION**

### **8.1. General**

*The following inspection and testing shall be performed during the application of coating systems:*



- *Visual examination of surface preparation in accordance with the international standards*
- *Profile checking with a suitable "profilometer" according to ISO 8503*
- *Thickness checking (acceptance criteria shall be per (SSPC -PA 2 -Rule 80- 20))*
- *Curing checking*
- *Roughness checking*
- *Adhesion checking*

### **8.2. Thickness check**

*Dry paint thickness shall be measured with a magnetic probe such as micro test or elcometer or equivalent. The equipment shall be calibrated at least twice daily in accordance with the Coating Manufacturers' recommendations.*

*It is suggested that, in order to achieve the specified dry-film thickness, wet-film thickness be checked during the coating application with wet film thickness gauges such as the elcometer wheel or comb type.*



	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>			
	<p>Document Title : General Painting Specification</p>		<p>Rev. R3</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>		<p>Page 24 of 61</p>	

*It is imperative that the magnetic probe be calibrated for each thickness of coating steel support with a non-magnetic block whose thickness is as close as possible to the coating being checked.*

*Each coat's thickness and total thickness shall be checked. Make (5) separate spot measurements spaced evenly over each section of the structure 10 square meters in area (divide the entire surface in 10 square meter areas).*

*If the dry film thickness does not meet the specified value, additional coats shall be applied. Except for inorganic zinc (zinc silicate) primers that shall be re-blasted and re-applied at the required dry film thickness.*

*Inorganic zinc (zinc silicate) primers applied at dry film thickness greater than 100µm or showing mud-cracking shall also be re-blasted and re-applied at the required dry film thickness.*

*Before over coating it shall be checked, with solvent recommended by the paint manufacturer, that the hydrolysis is complete by soaking the surface with a rag impregnated with the recommended solvent.*

*Thickness checking shall be made after the application of the zinc silicate coat thickness shall be in the range 50 t 90 microns.*

*For each successive coat, the minimal allowable shall be at least 80% of the specified thickness, the maximum thickness shall not exceed 150% of the specified thickness.*

*For the total system, the minimal allowable thickness shall be at least 80% of the specified thickness; the maximum thickness shall not exceed 200% of the specified thickness unless the paint remains soft or shows mud cracks or range skin or wrinkling which causes rejection of the paint.*

*Surface with coat thickness out of tolerance shall:*

- Be sand blasted if too thick and repainted
- Receive an additional paint coat to obtain specified thickness

### **8.3. Humidity check**

*The air's relative humidity shall be measured with a psycho meter. Surface preparation and/or paint application operations shall not commence until relative humidity shall be measured and*



	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		
	Document Title : General Painting Specification		
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 25 of 61

*recorded a minimum of six (6) times a day whence two (2) times before commencement of work. Moisture on the surface being prepared or paint shall be measured every day with a surface moisture indicator before beginning surface preparation operations or applying coat of paint.*

#### **8.4. Drying/curing check**

*For each coat, the curing shall be checked by assessing the solvent resistance.*

*Test shall be performed according to ASTM D5402 for organic coatings or according to ASTM D4752 for inorganic zinc (zinc silicate) primers.*

#### **8.5. Roughness check**

*Total angular roughness (Rt) of the surface shall be measured after preparation and recorded or an impression made with:*

- Rugotest LCA-CEA No.3 Ba 11 degree or equivalent.
- Tested "Press-O-Film" pads or equivalent.
- Electronic roughness tester (perthometer type or equivalent)



*A minimum of one measurement or impression shall be made per square meter of prepared surface.*

#### **8.6. Adhesion check**

*The coating shall be examined for adhesion between coats and for adhesion of the first coat to the substrate by tape test according to ISO 2409 or ASTM D3359.*

*An adhesion pull-off test shall be carried out at any location where there is evidence of any sort of failure in any coating including, but not limited to lifting of coats or loss of adhesion between layers in coating system.*

*The adhesion pull-off test result shall be carried out in accordance with ISO 4624 or ASTM D4541.*

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3      Page 26 of 61</p>

*Coating whose adhesion pull test result is less than 30 kg/cm<sup>2</sup> (3 MPa) shall be considered to have failed, except on silicon based coatings.*

*Paint adherence shall be checked as per ASTM method D3359.method A (X cut) shall be used for paint film thicker than 125 microns. Method B (lattice pattern) shall be used for paint film thicker than 125 microns; Method B (lattice pattern) shall be used for paint film up to 125 microns.*

#### **Test method A:**

*An X-cut is made in the film to the substrate; pressure sensitive tape is applied over the cut and then removed. Acceptable ratings are 5A (\*no peeling or removal) or 4A(trace peeling or removal along incisions or at their intersections).*

#### **Test method B:**



*A lattice patter with either six or eleven cuts in each direction (cross cut) is made in the film to the substrate, pressure sensitive tape is applied over lattice and then removed, and adhesion is evaluated, pressure sensitive tape is applied over lattice and then removed, and adhesion is evaluated by comparison with descriptions and illustrations. Spacing between the cut lines shall be 1mm for film thickness up to 50 microns and 2mm for film thickness from 50 to 125 microns. Acceptable results are rate 5B (the edges of the cuts are completely smooth. none of the squares of the lattice is detached) or 4B (small flakes of the coating are detached at the intersections: less than 55 of the area are affected)if the test is unsatisfactory, the entire surface shall be blast cleaned and repainted. Recoating after this destructive test is at the applicator's expense.*

### **8.7. Porosity check (for internal lining only)**

*Coating integrity shall be checked with a direct current holiday detector. The electrode shall consist of an eighty (80) cm<sup>2</sup> cellulose sponge soaked 1% detergent solution in potable water.*

*The instrument shall be calibrated and check every hour to indicate a coating porosity of 80000ohms under a voltage of 67.5 volts between the ground and wet sponge. A resistance of 90000 ohms indicates no porosity.*

*Sponge displacement speed on the surface shall not exceed 0.3 meters per second (18m/min). The sponge shall be moved back and forth so that it passes over the same area twice. The*

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>			
	<p>Document Title : General Painting Specification</p>		<p>Rev. R3</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>		<p>Page 27 of 61</p>	

*measurement is taken on the second pass a minimum of ten percent of the painted surface shall be examined. If there is any porosity, the inspector or the company representative shall have the entire painted surface inspected.*

*An alternating current holiday detector may be used. in this case, the voltage between painted steel service and the test electrode shall be 5 volts per micron of paint coat thickness.*

*The inspector shall mark defective areas foe repair.*

*Any porous area shall be repaired in accordance with paragraph 7.4.when the number of pores is greater than 3 per square meter, the entire area shall be blast cleaned and repainted as per this specification.*

#### **8.8. Extended inspection**

*Any extension of the inspection time due to the above cited reasons and repairs shall not be Billed as additional costs.*

#### **8.9. Inspection results**

*All quality control results shall be written up into reports. All reports shall be submitted to the owner during provisional acceptance of the paint.*

#### **8.10. Repair of defects or damages**

*Any defect or damage that may occur shall be repaired before the application of further coats.*

*Areas that are to be over coated shall be thoroughly cleaned free from grease, oil and other contaminants and shall be dry.*

*The surfaces shall then be prepared to the standard as specified. Edges of sound coating around the repair area shall be feathered back approximately 50 mm for a smooth transition. If necessary, vacuum blasting equipment shall be used for surface preparation.*

*Subsequently additional compatible coats shall be applied, until they meet the specification. Those additional coats shall be blend in with final coating on adjoining area.*



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 28 of 61

*For operating temperature up to 90°C; damaged areas of un insulated surfaces shall be touched up after cleaning with one or two coats of surface tolerant high solids epoxy coating compatible with previously applied coats of different nature. The repair coat shall overlap sound coating.*



*For operating temperature above 90°C, a suitable heat resistant coating shall be used for touch up:*

- Epoxy phenolic coatings shall be repair by themselves (temperature up to 200°C),*
- Inorganic zinc (zinc silicate) primers and silicate based coatings shall be repaired by application of silicone based product up to the original dry film thickness. In this regard paint manufacturer procedure has the higher priority to be followed.*

*Galvanized steel presenting damages exposing the steel substrate shall be repaired. Prior to touch up, the damaged surface shall be cleaned by mechanical wire brushing to ST3. Touch up shall be with zinc rich epoxy coating and shall match original grey colour of galvanized steel. Minimum dry film thickness of zinc rich epoxy repair coat shall be 80 microns.*

ITEM		
PIPING & VALVE	COLOR	RAL
General		
-temperature below 90°C	Grey	7038
-temperature above 90°C	Aluminium	9006
Piping containing caustic soda, sulphuric acid.	Golden yellow	1004
Hydrochloridric and chromic acid,	White (note 1)	9002
Hydrogen sulphide. Sulphur dioxide.		
Ammonia, etc. including flanges and gate valves. Safety valves on pumps. Including valves prior to and after safety valves.	Golden yellow	1004

SAFETY		
Fire fighting piping and equipment	Red	3020
Safety equipment as safety showers.	Green	6024
Eye wash showers, Safety shower cabins	White (note	9002
Pipes. Columns. Supports and	Golden	1004
Metallic parts of equipment	White (note 3)	9002
Represented a hazard in walkway areas		
As guards for rotating		
Or moving components		
Boxes containing breathing apparatus.	Green	6010
Respirators. Masks and other safety equipment.		

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p>BINA EPC Contractor Co. (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 29 of 61

## INSTRUMENTS

*Field instruments*

*Control panels, cabinets, distribution boards*

*Operator console, FCS and ESD auxiliary panels*

*Vendor's standard*



*Green 6021*

*Vendor's standard*

<i>ITEM</i>	
<i>OTHER ITEMS</i>	<i>COLOR</i>
	<i>RAL</i>
<i>Storage tanks</i>	<i>Pure White</i>
<i>Machinery</i>	<i>Medium Grey</i>
<i>Electric Motors</i>	<i>Blue</i>
<i>Electrical Statuc Machinery</i>	<i>Medium Grey</i>
<i>Electrical &amp; Instrument Panel</i>	<i>Green</i>
<i>Junction Boxes (EEx-i)</i>	<i>Light Blue</i>
<i>Junction Boxes (Without EEx-i)</i>	<i>Grey</i>
<i>Warehouses</i>	<i>Green</i>
<i>Shelters</i>	<i>Green</i>

## Notes for colour schedule

1. 150 mm wide diagonal bands in alternative colours golden yellow and white.
2. 150 mm wide diagonal bands in alternative colours green and white.
3. 150 mm wide diagonal bands in alternative colours golden yellow and white.



	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	Document Title : General Painting Specification		
	Document No. : EI027-000-EB-PI-SPC-014		Rev. R3

## 9. COLOUR CODING OF PIPING SYSTEMS

<i>Fluid identification</i>	<i>Fluid</i>	<i>Base colour band</i>	<i>RAL code</i>	<i>Code colour band</i>	<i>RAL code</i>
<b>KER</b>	<b>Kerosene</b>	<b>White</b>	<b>9010</b>	<b>Bright Red Red</b>	<b>2008</b>
<b>G.O</b>	<b>Gasoil</b>	<b>White</b>	<b>9010</b>	<b>Bright Red Red</b>	<b>2008</b>
<b>GSL</b>	<b>Gasoline</b>	<b>White</b>	<b>9010</b>	<b>Bright Red Red</b>	<b>2008</b>
<b>FW</b>	<b>Fire Water</b>	<b>Red</b>	<b>-</b>	<b>White</b>	<b>9010</b>
<b>OW</b>	<b>Oily Water</b>	<b>Green</b>	<b>6010</b>	<b>White</b>	<b>9010</b>
<b>PW</b>	<b>Potable water</b>	<b>Green</b>	<b>6010</b>	<b>White</b>	<b>9010</b>
<b>FF</b>	<b>Foam</b>	<b>Red</b>	<b>-</b>	<b>White</b>	<b>9010</b>
<b>A.T.K</b>	<b>ATK</b>	<b>White</b>	<b>9010</b>	<b>Bright Red Red</b>	<b>2008</b>
<b>OWA</b>	<b>Process Drain</b>	<b>Silver grey</b>	<b>7001</b>	<b>Blue</b>	<b>5012</b>
<b>UW</b>	<b>Utility water</b>	<b>Green</b>	<b>6010</b>	<b>Orange</b>	<b>2008</b>
<b>VT</b>	<b>Vessel trim</b>				

*Painted bands shall be compatible with the underlying paint system or insulation jacketing and shall be provided at the following significant points of plant:*

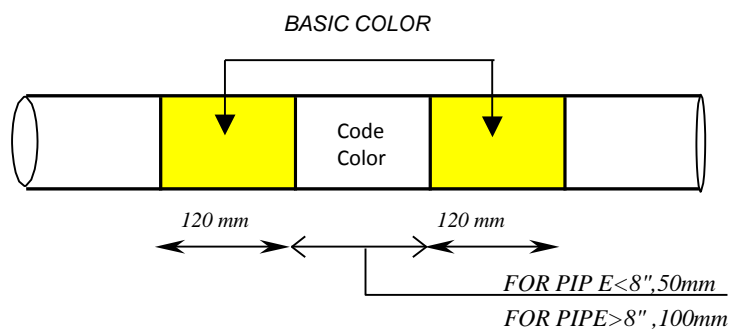
- Every 20 meter intervals of the straight runs.
- Commencement and termination of pipe run.
- Branches.
- On either side of each wall penetration, fitting & valve.
- 1.5 m away from connection to equipment.

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p>BINA EPC Contractor Co. (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 31 of 61

*The width of the basic colour band shall be 2 x 120 mm and marked on two opposite sides of piping.*

*The code colour band shall be positioned in the center of the basic colour and shall be of the following widths:*

- Pipes up to NPS 8": 50 mm wide.
- Pipes NPS 10" and above: 100 mm wide.



## 10. MARKING WITH LETTERING AND SYMBOLS

*Equipment and piping can be additionally marked with lettering (e.g. vessel non identification of volume), colour bands (e.g. fluid marking), or symbols (e.g. arrows for indicating the flow direction).*

### Colours for Lettering and Symbols

<b><i>SURFACE</i></b>	<b><i>LETTERING/SYMBOL</i></b>
<b><i>Yellow RAL 1012</i></b>	<b><i>Black RAL 9005</i></b>
<b><i>Orange RAL 2000</i></b>	<b><i>Black RAL 9005</i></b>
<b><i>Red RAL 3000</i></b>	<b><i>White RAL 9002</i></b>
<b><i>Blue RAL 5009</i></b>	<b><i>White RAL 9002</i></b>
<b><i>Green RAL 6011</i></b>	<b><i>White RAL 9002</i></b>
<b><i>Grey RAL7023</i></b>	<b><i>Black RAL 9005</i></b>
<b><i>Grey RAL 7030</i></b>	<b><i>Black RAL 9005</i></b>
<b><i>Grey RAL 7032</i></b>	<b><i>Black RAL 9005</i></b>
<b><i>Grey RAL 7935</i></b>	<b><i>Black RAL 9005</i></b>
<b><i>White RAL 9002</i></b>	<b><i>Black RAL 9005</i></b>
<b><i>Black RAL 9005</i></b>	<b><i>White RAL 9002</i></b>

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-che Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>
	<p>Document Title : General Painting Specification</p>	
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3 <span style="float: right;">Page 32 of 61</span></p>

*The blank space between lettering, colour bands, and symbols (e.g. arrows) should be 150mm. Pipelines of < 3m in length shall not have lettering.*

*Lettering for equipment shall be placed on each item of equipment at a clearly visible location. The letters should have the following height.*

- |  |              |
|--|--------------|
| <input type="checkbox"/> <b>For equipment with dimensions of &lt; 1m</b>         | <b>80mm</b>  |
| <input type="checkbox"/> <b>For equipment with dimensions of &gt; 1m to 5m</b>   | <b>100mm</b> |
| <input type="checkbox"/> <b>For equipment with dimensions of &gt; 5m to 15m</b>  | <b>300mm</b> |
| <input type="checkbox"/> <b>For equipment with dimensions of &gt; 15m to 50m</b> | <b>600mm</b> |
| <input type="checkbox"/> <b>For equipment with dimensions of &gt; 50m</b>        | <b>900mm</b> |

*Lettering for pipelines shall be clearly visible near the points where the pipelines leave the ground or the pipe-rack.*

*Decisions about any further lettering required shall be taken on Site. The letters should have the following height.*

- |   |              |
|---|--------------|
| <input type="checkbox"/> <b>For pipes of &lt; = DN 25</b>             | <b>10mm</b>  |
| <input type="checkbox"/> <b>For pipes of &gt; = DN 25 to DN 80</b>    | <b>20mm</b>  |
| <input type="checkbox"/> <b>For pipes of &gt; = DN 80 to DN 150</b>   | <b>30mm</b>  |
| <input type="checkbox"/> <b>For pipes of &gt; = DN 150 to DN 1000</b> | <b>50mm</b>  |
| <input type="checkbox"/> <b>For pipes of &gt; = DN 1000</b>           | <b>100mm</b> |

*The blank space between the letters should be 10% of the letter height. The type of letters shall be determined on Site, for the color of the letters, table 3 shall apply.*

*Lettering of tanks shall be placed at a height of approx. 4/5 of the shell height.*

*Lettering for horizontal vessels, spherical vessels, and pipelines shall be placed at the height of the centerline.*

### **10.1. Flow direction**

*Symbols (paint or colour foils) should be place at points significant for plant operation, preferably near to colour bands, the foils shall be white RAL 9002 and the symbols black RAL 9005.*

*For the size of arrows for indicating flow direction, figure 1 and table in 12.1 shall apply:*





Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 33 of 61

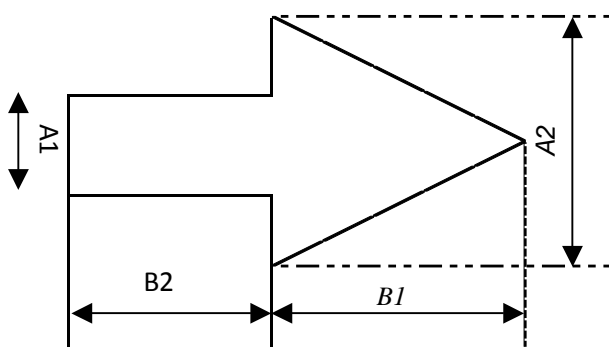


Figure 1 – Arrows for indicating flow direction



Table 12.1-Dimensions of arrows for indicating flow direction

NOMINAL SIZE		DIMENSIONS OF ARROW IN MM			
DN	Inch.	A1	A2	B1	B2
□ □ □ □ □ □ □ □ □ □ □ □ 20	□ □ <sup>3</sup> / <sub>4</sub>	3	9	8	20
20 to 40	<sup>3</sup> / <sub>4</sub> to 1 ½	5	15	13	35
50 to 80	2 to 3	10	30	26	65
100 to 150	4 to 6	15	45	40	100
200 to 250	8 to 10	30	90	80	200
300 to 400	12 to 16	50	150	130	325
450 to 600	18 to 24	80	240	210	525
LARGER 600	LARGER 24	100	300	260	650

Application of the self-adhesive foil markings shall be applied on surfaces which shall be clean, smooth and free from grease.

Prior to the application of lettering and color band by paint a surface preparation is required. Coated surfaces shall be free from any contamination (e.g. dust, oil, grease, salts). The surfaces should be troughened with abrasive paper to improve adhesion of the marking.

Surfaces of galvanized steel, allowed steel, aluminum and other non-ferrous metals shall be

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>	 <p>BINA EPC Contractor Co. (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
		Document Title : General Painting Specification	
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	Page 34 of 61

*slightly roughened with abrasive paper.*

*In the case of plastic surfaces, self-adhesive foils should be used for marking.*

## **11. GUARANTEE**

*The painting SubContractor and the Coating Manufacturer will jointly guarantee the coating systems applied for a period of five (5) years from the date of shipment.*

*During this period, no coating failures such as cracking, peeling, delaminating, loss of adhesion, etc. shall occur in the intended service conditions.*

## **12. APPROVED SYSTEMS**

*The painting systems approved by owner. It is emphasized that these painting systems, where relevant, have been subject to certification by ACQPA, according to owner policy and have therefore been subject to extensive corrosion testing. For painting systems with cannot be certificated through the ACQPA procedures (especially high temperature painting systems) the approved painting systems are the result of owner experience and operational feedback.*

## **13. SUBSTITUTION RULE**

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

## **14. ITEMS NOT TO BE PAINTED**

### **14.1. Item not to be painted**

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

- *Plastic and plastic coated materials, provided their resistance to UV has been demonstrated, and colure coding is not necessary*

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-che Park Sanati Gohar Ofogh Petrochemical Co. <b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p><b>BINA EPC Contractor Co.</b> (Executor of Oil, Gas, Petrochemical &amp; Power Industries)</p>	
	<p>Document Title : General Painting Specification</p>			
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>	<p>Rev. R3</p>	<p>Page 35 of 61</p>	

- *Non ferrous material such as 90-10 and 70-30 copper nickel alloys, monel, aluminum bronze, and nickel alloys when not thermally insulated.*

#### **14.2. Case of stainless steels**

*No zinc containing paints shall be used on stainless steels.*

#### **14.3. Machined surfaces**

*Machined and threaded surfaces shall be protected with temporary rust preventative paint.*

#### **14.4. Bolting**

*Carbon steel bolting and low grade stainless steel bolting (except ceramic coated bolts) shall be painted with the paint system used for painting the surrounding piping or structure after tightening. On stainless steel surfaces only zinc free points shall be used. The bolting shall be degreased and have its surface prepared before paint application. The bolting which is to be unscrewed frequently, say up to once a year, may be coated with a rust preventative primer such as VIGOR EP 167, then with a coat of lanolin based soft coating such as EUREKA auid film gel B.*

*After one or two days this film hardens enough to allow to be over coated with the paint system applied on the surrounding piping.*



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 36 of 61

## APPENDIX 1

**System No.: P01**

*Non-insulated Carbon Steel Surfaces (Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves) ( $T \leq 120^\circ\text{C}$ )*

### 1. Surface properties:

*Grade of Cleanliness: SA 2 ½*

*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	EPZ	Poly Amide Epoxy	30
3	Mid Coat	EPM	High Build Mid Coat Ep.	125
4	Top Coat	PUR	Acrylic Polyurethane	50

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	EPM	High Build Mid Coat Ep.	-
3	Top Coat	PUR	Acrylic Polyurethane	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 37 of 61

## APPENDIX 2

**System No.: P02**

*Submerged Areas C.S. (Carbon Steel  $T \leq 80^{\circ}\text{C}$ )*

### 1. Surface properties:

*Grade of Cleanliness: SA 2 1/2*

*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	-	Zinc Silicate Sealer	45
3	Mid Coat	EPGF	Glass Flake Epoxy	200
4	Top Coat	-	-	-

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	EPGF	Glass Flake Epoxy	-
3	Top Coat	-	-	-



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 38 of 61

## APPENDIX 3

**System No.: P05**

*Non-insulated Galvanized Surfaces (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $T \leq 120^\circ\text{C}$ ), Galvanized Ladder, handrail, Platform, Grating and Floor Plate (All Temperatures)*

### 1. Surface properties:

Etching

Rinsing

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	VE	Wash primer	10-15
2	Tie Coat	-	-	-
3	Mid Coat	EPM	High Build Mid Coat Ep.	125
4	Top Coat	PUR	Acrylic Polyurethane	50

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	VE	Wash primer	-
2	Mid Coat	EPM	High Build Mid Coat Ep.	-
3	Top Coat	PUR	Acrylic Polyurethane	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 39 of 61

## APPENDIX 4

System No.: P06

*Cadmium or Zinc-Plated Bichromate Surfaces (All Temperatures)*

### 1. Surface properties:

*Solvent Cleaning, Sand Paper  
 Degreasing*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	VE	Wash primer	10-15
2	Tie Coat	-	-	-
3	Mid Coat	EPM	High Build Mid Coat Ep.	100- 125
4	Top Coat	PUR	Acrylic Polyurethane	50

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	VE	Wash primer	-
2	Mid Coat	EPM	High Build Mid Coat Ep.	-
3	Top Coat	PUR	Acrylic Polyurethane	-



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 40 of 61

## APPENDIX 5

*System No.: P11*

*Non-insulated Carbon Steel (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support)(120<T≤400°C)*

### 1. Surface properties:

*Grade of Cleanliness: SA 2 ½*

*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat	ZSI	Aluminium Silicone	2*20

### 4. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	ESI	Zinc Silicate	-
2	Mid Coat	-	-	-
3	Top Coat	ZSI	Aluminium Silicone	2*20





Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



**BINA EPC Contractor Co.**  
(Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 41 of 61



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 42 of 61

## APPENDIX 6

*System No.: P12*

*Carbon Steel Insulated Surfaces (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $T \leq 90^\circ\text{C}$ )*

### 1. Surface properties:

*Grade of Cleanliness: SA 2 1/2*

*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	-	Inorganic Zinc Rich	75
4	Final Coat	-	Epoxy Phenolic Poly amine	150

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EPPH	Zinc Rich Epoxy	-
3	Final Coat	-	Epoxy Phenolic Poly amine	-



Toase-che Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 43 of 61

## APPENDIX 7

**System No.: P13**

*Carbon Steel Insulated Surfaces (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support)(  $90 < T \leq 270^{\circ}\text{C}$ )*

### 1. Surface properties:

*Grade of Cleanliness: SA 2 1/2*

*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ESI	Zinc Ethyl Silicate	70
2	Tie Coat	-	-	-
3	Mid Coat	ASI	Aluminum Silicone	20
4	Top Coat	ASI	Aluminum Silicone	20

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ESI	Zinc Silicate	-
2	Mid Coat	ASI	Aluminum Silicone	-
3	Top Coat	ASI	Aluminum Silicone	-



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 44 of 61

## APPENDIX 8

### System No.: P14

Motors, turbines, compressors, pumps, mixer, etc. "Manufacture's standard coating which

shall be suitable for expected operating temperature and site environment (severe industrial/marine atmosphere) shall be subject to review and approve by Company.

(All  
 Temperatures)

### 1. Surface properties:

a) Grade of Cleanliness: SA 2 1/2

b) Roughness: Grit-Medium (G) (ISO 8503-2:1988)

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	EPZ	Zinc Silicate Sealer	45
3	Mid Coat	EPM	High Build Mid Coat Ep.	125
4	Top Coat	PUR	Acrylic Polyurethane	50

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	EPM	High Build Mid Coat Ep.	-
3	Top Coat	PUR	Acrylic Polyurethane	-



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



**BINA EPC Contractor Co.**  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 45 of 61

## APPENDIX 9

**System No.: P15**

*Open Rooms (Open Work Shop), (Bulkhead, Ceiling) (Carbon Steel;  $T \leq 80^\circ\text{C}$ )*

### 1. Surface properties:

- a) Grade of Cleanliness: SA 2 1/2
- b) Roughness: Grit-Medium (G) (ISO 8503-2:1988)

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	EP	Zinc Silicate Sealer	45
3	Mid Coat	EPM	High Build Mid Coat Ep.	125
4	Top Coat			

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	EPM	High Build Mid Coat Ep.	-
3	Top Coat	-	-	-



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 46 of 61

## APPENDIX 10

**System No.: P16**

*Air Conditioned Rooms (Walls, Ceiling) (Carbon Steel;  $T \leq 80^{\circ}\text{C}$ )*

### 1. Surface properties:

- a) Grade of Cleanliness: SA 2 1/2
- b) Roughness: Grit-Medium (G) (ISO 8503-2:1988)

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat	-	-	-

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	-	-	-
3	Top Coat	-	-	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 47 of 61

## APPENDIX 11

*System No.: P17*

*Sub Concrete Floors*

### 1. Surface properties:

- a) Grade of Cleanliness: SA 2 ½
- b) Roughness: Grit-Medium (G) (ISO 8503-2:1988)

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	EP	Epoxy	30
2	Tie Coat	-	-	-
3	Mid Coat	Tar EP	Coal tar Epoxy	150
4	Top Coat	Tar EP	Coal tar Epoxy	150

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	EP	Epoxy	-
2	Mid Coat	Tar EP	Coal tar Epoxy	-
3	Top Coat	Tar EP	Coal tar Epoxy	-





Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 48 of 61

## APPENDIX 12

*System No.: P20*

*Non-insulated Stainless Steel (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $T \leq 120^{\circ}\text{C}$ )*

### 1. Surface properties:

*a) Sa1*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EP	Metal Free Epoxy	30
2	Tie Coat	-	-	-
3	Mid Coat	EPM	High Build Mid Coat Ep.	125
4	Top Coat	PUR	Acrylic Polyurethane	50

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EP	Metal Free Epoxy	-
2	Mid Coat	EPM	High Build Mid Coat Ep.	-
3	Top Coat	PUR	Acrylic Polyurethane	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 49 of 61

## APPENDIX 13

*System No.: P21*

*Non-insulated Stainless Steel (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $120 < T \leq 200^{\circ}\text{C}$ )*

### 1. Surface properties:

*Sal*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ACSI	Zinc Silicone	60
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat	ACSI	Acrylic Silicone	40

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ACSI	Acrylic Silicone	-
2	Mid Coat	-	-	-
3	Top Coat	ACSI	Acrylic Silicone	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 50 of 61

## APPENDIX 14

*System No.: P22*

*Non-insulated Stainless Steel (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $200 < T \leq 600^{\circ}\text{C}$ )*

### 1. Surface properties:

a) Sa1

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ASI	Aluminum Silicone	25
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat	ASI	Aluminum Silicone	25

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ASI	Aluminum Silicone	-
2	Mid Coat	-	-	-
3	Top Coat	ASI	Aluminum Silicone	-



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 51 of 61

## APPENDIX 15

*System No.: P23*

*Insulated Stainless Steel (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $T \leq 120^\circ\text{C}$ )*

### 1. Surface properties:



a) Sa1

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EPPH	Phenolic Epoxy	150
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat	EPPH	Phenolic Epoxy	150

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	EPPH	Phenolic Epoxy	-
2	Mid Coat	-	-	-
3	Top Coat	EPPH	Phenolic Epoxy	-

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## APPENDIX 16

*System No.: P24*

*Insulated Stainless Steel (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $120 < T \leq 250^{\circ}\text{C}$ )*

### 1. Surface properties:

a) Sa1

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ACSI	Acrylic Silicone	40
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat	ACSI	Acrylic Silicone	40

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ACSI	Acrylic Silicone	-
2	Mid Coat	-	-	-
3	Top Coat	ACSI	Acrylic Silicone	-



Toase-che Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 53 of 61

## APPENDIX 17

*System No.: P25*

*Fire Proof Steel Structure (All temperature)*

### 1. Surface properties:

- a) *Grade of Cleanliness: SA 2 1/2*
- b) *Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Mid Coat	-	Epoxy Phenolic	150

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	-	Zinc Rich Ep.	-
3	Mid Coat	-	Phenolic Epoxy	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 54 of 61

## APPENDIX 18

*System No.: P26*

*Steel Structure, Pipe Support, Non-galvanized Ladder, handrail, Platform, Grating and Floor Plate (All Temperatures)*

### 1. Surface properties:

- a) *Grade of Cleanliness: SA 2 ½*
- b) *Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	EPRZ	Zinc Rich Epoxy	75
3	Mid Coat	-	MIO Epoxy	150
4	Top Coat	PUR	Acrylic Polyurethane	50

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	EPM	High Build Mid Coat Ep.	-
3	Top Coat	PUR	Acrylic Polyurethane	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 55 of 61

## APPENDIX 19

*System No.: P28*

*Embedded Structures at Non Industrial Building (All Temperatures)*

### 1. Surface properties:

- a) *Grade of Cleanliness: SA 2 1/2*
- b) *Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	EPZ	Tie Coat Ep.	30
3	Mid Coat	-	-	-
4	Top Coat	-	-	-

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	-	-	-
3	Top Coat	-	-	-





Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 56 of 61

## APPENDIX 20

System No.: P29

*Exposed Structures (Except Open Work Shop) at Non Industrial Building (All Temperatures)*

*Surface properties:*

**a) Grade of Cleanliness: SA 2 ½**

**b) Roughness: Grit-Medium (G) (ISO 8503-2:1988)**

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	ESI	Zinc Ethyl Silicate	75
2	Tie Coat	EPZ	Tie Coat Ep.	30
3	Mid Coat	-	-	-
4	Top Coat	PUR	Acrylic Polyurethane	75

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	EPRZ	Zinc Rich Ep.	-
2	Mid Coat	-	-	-
3	Top Coat	PUR	Acrylic Polyurethane	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 57 of 61

## APPENDIX 21

*System No.: P30*

*Carbon Steel & Stainless Steel Insulated Surfaces (Steel Structure, Vessel, Heat Exchanger, Exterior of Storage Tanks, Piping, Valves, Support) ( $270 < T \leq 600^{\circ}\text{C}$ )*

### 1. Surface properties:

*Grade of Cleanliness: SA 2 1/2*

*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ASI	Aluminum Silicone	25
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat	ASI	Aluminum Silicone	25

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T ( $\mu$ )
1	Primer	ASI	Aluminum Silicone	-
2	Mid Coat	-	-	-
3	Top Coat	ASI	Aluminum Silicone	-



Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
(Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 58 of 61

## APPENDIX 22

*System No.: P31*

*Internal surface of Styrene Storage Tanks*

### 1. Surface properties:

*Grade of Cleanliness: SA 2 ½*

*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

### 2. Main Coating System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	-	Coal Tar Epoxy	200
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat		Coal Tar Epoxy	200

### 3. Repair System:

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	-	Coal Tar Epoxy	-
2	Mid Coat	-	-	-
3	Top Coat	-	Coal Tar Epoxy	-



Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN**  
**ENGINEERING OF STYRENE PARK OFFSITE**



BINA EPC Contractor Co.  
 (Executor of Oil, Gas, Petrochemical & Power Industries)

Document Title : General Painting Specification

Document No. : EI027-000-EB-PI-SPC-014

Rev. R3

Page 59 of 61

*System No.: P32*

*External surface of Styrene Storage Tanks*

**4. Surface properties:**

*Grade of Cleanliness: SA 2 1/2*



*Roughness: Grit-Medium (G) (ISO 8503-2:1988)*

**5. Main Coating System:**

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	-	Bitumen	200
2	Tie Coat	-	-	-
3	Mid Coat	-	-	-
4	Top Coat		Bitumen	200

**6. Repair System:**

Item	Constitution	Binder	Type Of Paint	D.F.T (μ)
1	Primer	-	Bitumen	-
2	Mid Coat	-	-	-
3	Top Coat	-	Bitumen	-

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	Document Title : General Painting Specification		
	Document No. : EI027-000-EB-PI-SPC-014	Rev. R3	

## PAINTING, INSULATION & FIREPROOFING EQUIPMENT DATA

*SHEET (2 PAGES)*



### 1. EQUIPMENT DATA

<b>Equipment type:</b>			
Configuration: <i>O vertical</i> <i>O horizontal</i> <i>O in-line</i> <i>O other: ..... Supports</i> : <i>O skirt</i> <i>O legs</i> <i>O saddles</i> <i>O brackets</i> <i>O skid</i> <i>O other...</i>			
Surface to be coated : <i>O external</i> <i>O internal</i> : <i>O atmospheric</i> <i>O immersion</i> <i>O underground</i> <i>O other... O indoors</i> <i>O water</i> <i>O outdoors</i> <i>O other:</i> <i>O splash zone .....</i>			
Nature of substrate : <i>O carbon steel</i> <i>O galvanized</i> <i>O stainless steel</i> <i>O other... Outside</i> diameter (mm) : Operating temperature : .....°C   Tracing:   YES/NO Maximum temperature : .....°C   (Case of cyclic service, regeneration, steam out, etc.) External temperature : .....°C   (if different from operating or maximum temperature, e.g. furnace)			

### 1. INSULATION

Surface to be insulated	Insulation type	Thickness (mm)	Notes

**Notes:**

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	<p>Document Title : General Painting Specification</p>		
	<p>Document No. : EI027-000-EB-PI-SPC-014</p>		<p>Rev. R3</p>

## 1. FIREPROOFING

<i>Surface to be insulated</i>	<i>Fireproofing material</i>	<i>Thickness (mm)</i>	<i>Notes</i>
<p><b>Notes:</b></p>			