



OIL & GAS DEVELOPMENT COMPANY LTD

SPECIFICATION FOR  
PAINTING

DOCUMENT NO. : 2895-SP-004

Consultant:



PETROCHEMICAL ENGINEERING CONSULTANTS

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**TABLE OF CONTENT**

1.0 PAINT WORK .....	2
1.1 GENERAL .....	2
1.2 CODES & STANDARDS .....	2
1.3 CONDITIONS OF DELIVERY .....	2
1.4 COMPOSITION OF THE PAINT PRODUCTS USED .....	2
1.5 IDENTIFICATION .....	3
1.6 SURFACE PREPARATION STANDARDS .....	4
1.7 PREPARATION OF THE SURFACES .....	5
1.8 CARRYING OUT THE PAINTWORK .....	10
1.9 GROUND-LEVEL TRANSITION POINT .....	26
1.10 QUALITY CONTROLS AND GUARANTEE .....	26

## 1.0 PAINT WORK

### 1.1 GENERAL

- 1.1.1. This specification defines the requirements for surface preparation, selection and application of paints on external surfaces of equipment, piping, etc.

When a particular part of work is being carried out. the painting system should be chosen in accordance with the environment in which the material to be painted will be located. Indeed, the degree of aggressiveness of the atmosphere that will be encountered in the environment of the work can range from an environment, which is not very aggressive to an extremely aggressive environment, depending on whether the location is in a rural area. a non-industrial built-up area, ventilated workshops, in the vicinity of the sea, at chemical plants, in humid rooms or in the vicinity of sources of cold or heat.

### 1.2 CODES & STANDARDS

The following codes and standards shall be followed for the work covered by this contract.

BS 4232	: Specification for Painting requirement, surface preparation
SSPC –Pittsburg. U.S.A.	: Good Painting Practice and Surface specification SP 1 to 10 Manual volume-1
DIN Standard 55928	: Specification for paint requirement for field painting work
BS 4593 sec.4	: Specification for Inspection of finished painting.

### 1.3 CONDITIONS OF DELIVERY

#### a) Packaging

Every recipient will be fitted with a hermetically-sealed lid with an opening that is sufficiently large to allow the contents to be stirred: the outside and inside are protected against oxidation, and, like the lid, are marked with a strip of colour identical to the contents.

### 1.4 COMPOSITION OF THE PAINT PRODUCTS USED

#### a) Quality

The composition and quality of the products may not differ from batch to batch. A batch is all of the products of a specified manufacture. If the analyses of products bring to light that the composition does not conform to the specifications of the paint manufacturer, the Employer / Owner's Engineer may refuse to use this batch of products. The paint products must comply with the following conditions:

- They must have the viscosity necessary for the described use and the established condition ; use of the brush – paint roller (spray gun for special cases and in the workshop)

b) Quality control - Sampling

While the works are in progress on the construction site, the Employer / Owner's Engineer may carry out sampling on the paint being used for the purpose of checking conformity. The paint products must be made available free of charge to the laboratory or the approved supervisory body in sufficient quantities so that all the tests can be carried out on the same batch.

If the analyses reveal a non-conformity in the composition of the products used (tolerance of +3 % of the dosage of every component), the Employer / Owner's Engineer may refuse application of the product under consideration, halt the work / and have the non-conforming product already applied removed.

Before proceeding with the work a product data sheet with its test certificates & batch certificate is to be submitted to Employer / Owner's Engineer's approval stating that products offered is conform to the required specification. The only Purpose of the analyses is to reveal any nonconformity of the composition of the products. Their purpose is therefore not to assess the quality of the different components. The analyses concerned are not acceptance tests of the products supplied and in no way affect the obligations of the Contractor specified in the contract towards the Employer / Owner's Engineer.

## 1.5 IDENTIFICATION

Every recipient will bear the following information:

- Name of the manufacturer;
- Date and number of manufacturer;
- Name of the product type;
- Batch no. with Test certificate

- Net weight of the product or the contents of the recipient;
- Date of the expiry.

At the time of delivery, this packaging must bear labels in conformity with the legal stipulations in force.

After completion of a job a general clean up shall be carried out by the Contractor to remove all debris, materials or irregularities that his work has brought to the site so that it is left tidy.

The restoration work includes among other things:

- the removal of abrasives;
- the removal of the different protective coverings;
- the Contractor will make the required repairs to any damage after refitting the supports;
- the removal of paint and cleaning of the stains on the floor.

## 1.6 SURFACE PREPARATION STANDARDS

Following standards shall be followed for surface preparations. :

- 1 Swedish Standard Institution- SIS-05 5900-1967
  - 2 Steel Structures Painting Council, U.S.A. (Surface Preparation Specifications (SSPC-SP)
  - 3 British Standards Institution (Surface Finish of Blast-cleaned for Painting) BS- 4232.
  - 4 National Association of Corrosion Engineers, U.S.A. (NACE).
- a) The contractor shall arrange, at his own cost to keep a set of latest edition of above standards and codes at site.
  - b) The paint manufacturer's instruction shall be followed as far as practicable at all times. Particular attention shall be paid to the following:
    - Proper storage to avoid exposure as well as extremes of temperature.
    - Surface preparation prior to painting.
    - Mixing and thinning.
    - Application of paints and the recommended limit on time intervals between coats.
  - c) Any painting work (including surface preparation) on piping or equipment shall be commenced only after the system tests have been completed and clearance for

taking up painting work is given by the Employer / Owner's Engineer, who may, however, at his discretion authorize in writing, the taking up of surface preparation or painting work in any specific location, even prior to completion of system test.

## 1.7 PREPARATION OF THE SURFACES

### 1.7.1 General Specifications

The cases that occur in practice on building sites, with regard to painted surfaces, can be broken down as follows:

- material of which the oxide content disappears by natural oxidation;
- material that has already been covered with a layer of paint in the workshop;
- material that is covered with old paint layers that show different degrees of weathering.

Good preparation of the surface is the best guarantee for good anti-corrosion protection.

Paintwork shall never begin until the surface to be treated is dry and is independent of the base coat and cleared of dirt, dust, rust, scale, grease, salt attack, cement powder, cement mud-scale, sand, oil, etc.

The method of preparation of the surface will be implemented in accordance with the preparation methods described below:

- cleaning (bright blast-cleaning):
- mechanical cleaning;
- manual de-rusting.

The Contractor should have the required material at his disposal to clean the surfaces to be coated thoroughly in accordance with the preparation methods, regardless of the form or the condition of such surfaces. The cleaning devices that might be damaged during the surface preparation shall be screened off by the Contractor.

### 1.7.2 Sandblasting

The blasting grits or sand to be used for blasting operation shall be tested for chloride content or the Contractor / manufacturer shall issue the certificate showing there is no chloride content in the product.

Before beginning cleaning by blasting, the person carrying out the work will take the following measures:

- clear the steel surface of oil and/or grease;
- ensure that each flange collar (section where the sealing is applied) is properly screened off against the blasting and the subsequent works;
- check that no blasting grains can get into the pipes during this process. Any openings not sealed off must be screened off;
- where there are valves, regulators and other devices, the manufacturer's identification plate will be dismantled so that all surfaces can be treated. The plate will then be put back again or if removal of above is not possible then these items shall be covered & protect so that application of paint on main unit doesn't spoil above said parts.
- screen off all non-metal structures such as rubber where there is a filter;
- with valves operators and other devices care should be taken to ensure that no metal filings or paint get into the apparatus:

To prevent rust forming quickly as the result of humidity on the blasted surface, cleaning by blasting may only be carried out when the temperature of the steel surface is at least 3°C higher than the dew point of the ambient air.

Blasting may not be carried out if the relative degree of humidity exceeds 80%. The choice of the type of blasting medium used depends on local circumstances such as the possible presence of gas and the material to be blasted - e.g. INOX (stainless steel)., The abrasive to be used must conform to the local law i.e. it may contain no carbon and less than 1% free silicon dioxide. The Sa 3 will always be requested and must at least reach Sa 2½ during the initial stage of the paintwork. For blasting followed by metallization, the surface preparation degree to be achieved is always Sa 3. The degree of cleanliness to be obtained will be inspected in accordance with the Swedish standard SVENSK STANDARD ISO 8501-1-1988 SS 05.5900.

- Sa 3: surface blasted down to the bare metal; when the surface is inspected with a magnifying glass, scale, rust and foreign bodies must be completely removed and it should be possible to raise a metallic -shine on the treated surface, the surface roughness shall be at least 75 µ.
- Sa 2 1/2: blasted very carefully. Scale, rust and foreign bodies must be removed in such a way that anything left behind will only be visible as nuances (shading) or strips.

The blast-cleaning will be carried out by means of compressed air free of water and oil. After the blasting and before painting, the surface should be completely cleaned of blasting material and so forth with a soft brush, a dry cloth or dry compressed air.

### 1.7.3 Mechanical cleaning

If sandblasting is not permitted or if the metal structures are not easily accessible for blasting or blasting for one reason or another is technically unfeasible, mechanical de-rusting can be used instead. With mechanical cleaning by means of chipping, rotating steel brushes and sanding discs, a degree of cleanliness St 3 should be reached.

- St.3 : removal of the old paint layers of which the adhesion leaves something to be desired and / or of which the paint layer no longer fulfils the requirements.

If parts are present that are so corroded that St 3 is difficult to achieve, this should be notified to the Employer / Owner's Engineer prior to the start of the works.

N. B :

St 3 : means removal of every old paint layer. Retouching means local polishing with St 3 or Sa 3 followed by application of the desired painting system.

After mechanical cleaning, the surface should be made dust-free with a cloth or a soft brush. washed with an organic solvent and thoroughly dried off with a dry cloth (e.g. with 1.1.1. Trichloroethane such as Solvethane, Chlorothene NU).

### 1.7.4 Manual de-rusting

Manual de-rusting with the aid of scrapers, steel brushes; sandpaper etc. shall only be permitted in exceptional cases for local repairs. Any deviation there from must be requested from the Employer / Owner's Engineer.

With manual de-rusting, a surface preparation degree St 3 must be obtained. The length of the handles of the equipment used may not exceed 50 cm.

### 1.7.5 Preparation of a surface covered with a layer of paint in the workshop.

This layer is in general applied by the manufacturer for example on valves, Regulators etc. Layers of this kind will be checked for their proper adhesion in accordance with ASTM D3359, method A. The adhesion should be at least 4A.

If the paint layer shows less adhesion or is incompatible with the rest of the system it should be completely removed. If the paint layer is not removed, the Contractor



accepts, it in the state in which the coating is found and the guarantee remains in force.

The Contractor, who must provide for the protection on the construction site. Must therefore obtain the information regarding the treatment of the surface and the quality of the paint that was used and must, moreover, examine the adhesion of the layer on the construction site, the percentage of damage and weathering as well as the value of the preparation of the surface in the workshop together with the thickness thereof that must be supplemented if necessary.

a) Galvanized surfaces

Galvanized surfaces, both old and new will be carefully roughened up. Every foreign body (concrete splatters, chalk marks, grease and oil stains, etc.) will be removed. Thereafter, rub the surfaces with abundant water and, if necessary, with cleaning products.

To this end, nylon brushes will be used for every kind of dirt as well as for removing zinc salt residue. Thereafter, the surfaces will be treated in accordance with system 21. Where the zinc layer is lacking, it will be de-rusted manually to a degree of cleanliness St 3, after which a Primer coat will be applied in accordance with system 22.

b) Metalized surfaces treated with an impregnation layer

- Degrease with the desired degreasing product:
- Clean under high pressure or with a product prescribed by the paint supplier.

If the paint layer adheres well and is applied on a clean base, the painting system described may be continued. If the percentage of damage and weathering does not exceed 5 % / m. retouching may be considered. These partial repairs will be carried out.

If on the other hand, the percentage of damage does exceed 5 %/m or if the layer applied in the workshop comes loose, the Contractor must draw the attention of the Employer / Owner's Engineer to this and carry out the complete application system.

1.7.6 Preparation of surfaces covered with earlier paint layers that show different degrees of weathering.

If the surfaces do not show deep weathering limited to the spread of rust by small pitted areas or non-penetrative rust in spots, it will very often be sufficient to clean the surfaces with abrasives or with an abrasive disc. Then to rub them down with steel

wool, remove the dust and wash off. If thick rust appears, in spots scale rust and active rust canker, this should be removed with needle hammers or stripped away directly by blasting, removing the dust and washing off.

#### 1.7.7 Preparation of concrete or cement plaster surfaces

Remove unsound paint layers and loose components with scrapers, blades or rotating steel brushes, Thoroughly clean the entire surface with water containing ammonia. Thoroughly remove moss, algae and fungal growths. Where these growths have been removed, treat the area with a fungicide in accordance with the instructions for use.

Once the entire area is completely dry, brush off the dead residue of moss, algae and fungus with a hard brush. In the case of reinforcement steel that has been laid bare, remove as rust, dust and grease as possible and treat with a primer coat. When painting concrete surfaces, they must first be checked for cracks. Cracks larger than 0.3 mm Must be repaired with an appropriate system in accordance with the type and extent of the repairs (e.g. injection with epoxy mortar). Repair damage such as cracks and bursts to concrete parts with a two-component mortar or preferably with micro-mortars. Finally, check the alkalinity of the surface with the aid of litmus paper and neutralize it if necessary.

#### 1.7.8 Use of solvents

It is sometimes necessary to use solvents when the surfaces to be painted are streaked with grease or oil. In this case a suitable organic solvent should be applied. The operation should be carried out with the aid of clean brushes or rags and clean solvent.

All the legal specifications in connection with solvents etc. must be adhered to. The Employer / Owner's Engineer shall be informed in advance of any toxicity or flammability. All measures must be taken to prevent any risk of fire and to rule out any Possibility of poisoning (ventilation). The Contractor will provide drip collectors to keep the environment free of pollution.

#### 1.7.9 Condition of the metal after stripping

The Contractor must call in Employer / Owner's Engineer for checking the condition of the metal during stripping and inform Employer / Owner's Engineer immediately of any damage that he might have noticed.

- Deep corrosion of the plates – rivets – bolts

- Faulty welding
- Fittings that appear to be dangerous because of their age.

#### 1.7.10 Removing coating from surface pipelines

The Contractor must have the equipment necessary for the removal of asphalt from the pipe without damaging the latter (scratching, impact, etc.). The Contractor undertakes to carry out the work in accordance with an approved procedure.

### 1.8 CARRYING OUT THE PAINTWORK

#### 1.8.1 Conditions for carrying out paintwork

Painting may not be carried out in unsuitable conditions.

All preparatory work and painting may only be carried out in dry weather and at a minimum temperature of 10°C, except for special cases requested by the Employer / Owner's Engineer.

Unless otherwise stipulated in the specifications of the paint supplier, application of the paint is forbidden if it is forecast that the temperature will fall to below 0°C before the paint is dry. The temperature of the surface to be painted must be at least 3°C higher than the dew point of the ambient air. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

The work must be stopped:

- If the temperature of the surface to be painted is higher than that described by the supplier:
- If it is raining, snow, mist or fog or when the relative humidity is higher than 80 %.

Coats that have not yet dried and have been exposed to frost, mist, snow or rain and might thereby be damaged must be removed after drying and the surfaces must be repainted at the expense of the Contractor.

Working in direct sunlight or in hot weather must be avoided.

The first coat of paint must be applied maximum 3, hours after the preparation of the surface if the relative humidity of the air is between 50 % and 80 %. This time span may be increased to 6 hours if the relative humidity is less than 50 % in all cases, the

preparation of the surface must exhibit degree Sa 3 and at the very least the appearance of degree Sa 2½ at the time of painting.

The coats of paint may only be applied on carefully cleaned surfaces that must be dry and free of grease and dust.

### 1.8.2 Special conditions

Painting may be carried out when the Contractor can be sure that the instructions of the paint supplier have been scrupulously followed with regard to the parameters in the following (non-exhaustive) list:

- Ambient temperature
- Surface temperature
- Relative humidity
- Dew point
- Drying times

The Contractor must in this respect be able to produce the instructions for the paint on the site.

In addition, the paintwork may only be carried out to a minimum ambient temperature of 5°C and / or to a maximum relative degree of humidity of 85 %. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

Hand mixing of the paint shall be permitted for up to 5 liters only, the large quantity shall mixed by mechanical agitators and shall be maintained continuously during paint work to avoid quick pigment separation.

### 1.8.3 Paint Materials

Manufacturers shall furnish the characteristics of all paints indicating the suitability for the required service conditions. Paint material should withstand lower up to -10°C. Primer and finish coats shall be of class-I quality and shall conform to the following:

#### a) Primer (P-1)

Redoxide Zinc Chromate Primer

Type and Composition: Single pack. Modified phenolic alkyd medium pigmented with redoxide and zinc chromate.

Volume solids                      30 – 35%

- |    |  |                       |
|----|--|-----------------------|
|    | DFT  | 25 microns/coat (min) |
| b) | Covering capacity<br>Primer (P-2)  | 12-13 M2/Lit/coat     |
|    | High build chlorinated rubber zinc phosphate primer  |                       |
|    | Type and Composition: Single pack, Chlorinated rubber medium plasticized with unsaponifiable plasticiser pigmented with zinc phosphate   |                       |
|    | Volume solids  | 35- 40%               |
|    | DFT  | 50 MICRONS/COAT (MIN) |
|    | Covering capacity  | 7-8 M2/Lit/Coat       |
| c) | Primer (P-3)   |                       |
|    | High build zinc phosphate primer   |                       |
|    | Type and Composition: Single Pack, Synthetic medium. pigmented with zinc phosphate.  |                       |
|    | Volume solids  | 40-45%                |
|    | DFT  | 35-50 microns/coat    |
|    | Covering capacity  | 10-12 M2/LIT/coat     |
|    | Heat resistance  | Upto 100 C (dry)      |
| d) | Primer (P-4)   |                       |
|    | Etch Primer/ Wash Primer   |                       |
|    | Type and Composition: Two pack Poly vinyl butyral resin medium cured with phosphoric acid solution pigmented with zinc tetroxy chromate. |                       |
|    | Volume solids  | 7-8%                  |
|    | DFT  | 8-10 microns/coat     |
|    | Covering capacity  | 7-8 M/lit/coat        |
| e) | Primer (P-5)   |                       |
|    | Epoxy Zinc Chromate Primer   |                       |
|    | Type and Composition: Two pack, Polyamide cured epoxy resin medium pigmented with zinc chromate.   |                       |
|    | Volume solids  | 40%(min)              |

- |  |                   |                      |
|--|-------------------|----------------------|
|  | DFT               | 35 microns/coat(min) |
|  | Covering capacity | 11-12 M/lit/Coat     |
- f) Primer (P-6)  
Epoxy Zinc Phosphate Primer
- Type and Composition: Two pack, Polyamide cured Epoxy resin medium pigmented with zinc phosphate.
- |  |                   |                       |
|--|-------------------|-----------------------|
|  | Volume solids     | 40%                   |
|  | DFT               | 35 microns/coat (min) |
|  | Covering capacity | 11-12 M / lit/coat    |
- g) Primer (P-7)  
Epoxy high build M10 Paint (Intermediate Coat)
- Type and composition: Two pack. Poly Polymide cured epoxy resin medium pigmented with micaceous iron oxide.
- |  |                   |                        |
|--|-------------------|------------------------|
|  | Volume solids     | 7- 8%                  |
|  | Volume Solids     | 50%                    |
|  | DFT               | 100 microns/coat (min) |
|  | Covering capacity | 5.0 M/lit/coat         |
- h) Primer (P-8)  
Epoxy Red Oxide zinc phosphate primer
- Type and Composition: Two pack, Polyamine cured epoxy resin pigmented with Red oxide and Zinc phosphate.
- |  |                   |                       |
|--|-------------------|-----------------------|
|  | Volume solids     | 42%                   |
|  | DFT               | 30 microns/coat (min) |
|  | Covering capacity | 13-14 M/lit/coat      |
- i) Primer (P-9)  
Epoxy based tie coat (suitable for conventional alkyd based coating prior to application of acrylic polyurethane epoxy finishing coat)
- Type and Composition:Two pack , Polyamide cured epoxy resin medium suitably

pigmented.

Volume solids	50-60%
DFT	50 microns/coat (min)
Covering capacity	10-12 M/lit/coat

j) Finish Coats (F-1)

Synthetic Enamel

Type and Composition: Single pack, Alkyd medium pigmented with superior quality water & weather resistant pigments.

Volume solids	30-40%
DFT	20-25 microns/coat
Covering capacity	16-18 M/lit/coat

k) Finish coat (F-2)

Acrylic Polyurethane paint

Type and Composition: Two pack , Acrylic resin and isocyanate hardener suitably pigmented.

Volume solids	40% (min)
DFT	30-40 microns/coat
Covering capacity	10-12 M / lit / coat

l) Finish Coat (F-3)

Chlorinated Rubber Paint

Type and Composition: Single pack, Plasticized chlorinated rubber medium with chemical & weather resistant pigments.

Volume solids	30%
DFT	30 microns / coat (min)
Covering capacity	1 0.0 M / lit /coat

m) Finish Coat (F-4)

High build chlorinated rubber M10 paint.

Type and Composition: Single pack Chlorinated rubber based high build pigmented with micaceous iron oxide.

Volume solids	40-50%
DFT	65-75 microns/coat
Covering capacity	6.0-7.0 M / lit / coat

n) Finish coat (F-5)

Chemical Resistant Phenolic based Enamel

Type and Composition: Single pack phenolic medium suitably pigmented.

Volume solids	35-40%
DFT	25 microns/ coat
Covering capacity	15.0 M /lit/ coat

o) Finish Coat( F-6)

Epoxy High Building Coating

Type and Composition: Two pack. Polyamide cured epoxy resin medium suitably pigmented.

Volume solids	60-65%
DFT	100 microns/coat (min)
Covering capacity	6.0-6.5 M / lit / coat

p) Finish Coat (F-7)  
High build Coal Tar Epoxy

Type and Composition: Two pack, Polyamine cured epoxy resin blended with Coal Tar.

Volume solids	65% (min)
DFT	100-125 microns/coat
Covering capacity	6.0-6.5 m / lit / coat

q) Finish Coat (F-8)

Self priming epoxy high build  
coating (complete rust control coating)



Type and Composition: Two pack. Polyamide-amine cured epoxy resin suitably pigmented. Capable of adhering to manually prepared surface and old coatings.

Volume solids	65-80%
DFT	125-150 microns/coat
Covering capacity	4-5 M / lit / coat

r) Finish Coat (F-9)

Inorganic Zinc Silicate coating

Type and Composition: Two pack , Self cured Ethyl silicate solvent based Inorganic Zinc coating.

Volume solids	60% (min)
DFT	65-75 microns/coat
Covering capacity	8-9 M / lit / coat

s) Finish coat (F-10) High build Black

Type and Composition: Single pack. Reinforced bituminous composition phenol based resin.

Volume solids	55-60%
DFT	100 microns/coat (min)
Covering capacity	5.50-6.0 M / lit / coat

t) Finish Coat (F-11)

Heat Resistant Aluminum Paint Suitable up to 250°C.

Type and Composition: Dual container (paste & medium). Heat resistant spec varnish medium combined with aluminum flakes.

Volume solids	20-25%
DFT	20 microns/coat (min)
Covering capacity	10-12 M / lit/ coat

u) Finish Coat ( F-12)

Heat Resistant Silicon Paint suitable up to 400° C.

Type and Composition: Single pack Silicone resin based with aluminum flakes.

Volume solids	20-25%
DFT	20 microns/coat (min)
Covering capacity	10-12 M/lit/coat
v) Finish Coat (F-13)	
Synthetic Rubber Based Aluminum Paint Suitable up to 150° C.	
Type and Composition: Single Pack, Synthetic medium rubber medium combined with leafing Aluminum,	
DFT	25 microns/coat
Covering capacity	9.5 M /lit/ coat

### Notes

1. Covering capacity and DFT depends on method of application. Covering capacity specified above are theoretical. Allowing the losses during application, min specified DFT should be maintained.
2. All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation quality and workmanship should be ensured.
3. Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine environment,
4. All primers and finish coats should be cold cured and air-drying unless otherwise specified.
5. Technical data sheets for all paints shall be supplied at the time of submission of quotations.
6. In case of use of epoxy tie coat, manufacturer should demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat (P-9) alternate system may be used taking into the service requirement of the system.
7. In case of F-6, F-9, F-11 & F-12 Finish Coats, No Primer is required.

The paints shall conform to the specifications given above and Class-I quality

### Painting material

Type	Designation
1. Inorganic zinc, silicate	Ameron Dimetcote 11 or approved equivalent
Thinner	Ameron A65 or approved equivalent
2. High-build polyamide epoxy	Ameron A383HS or approved equivalent
Thinner	Ameron A65 or approved equivalent
3. Acrylic silicone	Ameron 1999 or approved equivalent
Thinner	Ameron 65 or approved equivalent
4. Silicone aluminium	Ameron A878 or approved equivalent
Thinner	Ameron A65 or approved equivalent
5. Epoxy primer-1	Ameron 71Tc or approved equivalent
Thinner	Ameron A65 or approved equivalent
6. Epoxy finish aluminium	Ameron 72 or approved equivalent
Thinner	Ameron 9HF or approved equivalent

## Notes:

- (a) Amercoat 65 or an approved equivalent thinner shall be used for cleaning stainless steel surfaces prior to printing.
- (b) Amercoat 12 or an approved equivalent thinner shall be used for cleaning tools and equipment used for painting in accordance with this specification.

## STORAGE

All paints and painting material shall be stored only in rooms to be provided by contractor and approved by Employer / Owner's Engineer for the purpose. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent, building. A signboard bearing the words ' PAINT STORAGE No NAKED LIGHT highly -inflammable shall be clearly displayed outside.

## COLOUR CODE FOR PIPING

- i) For identification of pipelines, the colour code as per Table -1 shall be used.
- ii) The colour code scheme is intended for identification of the individual group of the pipeline. The system of colour coding consists of a ground colour and colour bands superimposed on it
- iii) Colours (Ground) as given in Table-2 shall be applied throughout the entire length of un-insulated pipes, on the metal cladding & on surfaces, ground colour coating of

minimum 2m length or of adequate length not to be mistaken as colour band shall be applied at places requiring colour bands. Colour band(s) shall be applied as per approved procedure.

#### IDENTIFICATION SIGN

- i) Colours of arrows shall be black or white and in contrast to the colour on which they are superimposed.
- ii) Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by Employer / Owner's Engineer.
- iii) Size of arrow shall be either of the following.

- a) Colour Bands

Minimum width of colour band shall be as per approved procedure.

- b) Whenever it is required by the Employer / Owner's Engineer to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal stripes of black and golden yellow as per IS:2379 shall be painted on the ground colour.

#### IDENTIFICATION OF EQUIPMENT

All equipment shall be stenciled in black or white on each verses, column, equipment after painting as per approved procedure.

#### INSPECTION AND TESTING

- i) All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable.
- ii) The painting work shall be subject to inspection at all times. In particular, following stage wise inspection will be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage.

In addition to above, record should include type of shop primer already applied on equipment e.g. Red oxide zinc chromate or zinc chromate or Red lead primer etc.

Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Employer / Owner's Engineer before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, Contractor shall be responsible for making good any defects found

during final inspection / guarantee Period / defect liability period as defined in general condition of contract. Dry film' thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint should be applied to make-up the DFT specified without any extra cost to Employer.

#### PRIMER APPLICATION

- i. The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.  
Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detector and protector whenever required for checking in case of immerse conditions.
- ii. At the discretion of Employer / Owner's Engineer, contractor has to provide the paint manufacturer's expert technical service at site as and when required. For this service, there should not be any extra cost to the Employer.
- iii. Final Inspection shall include measurement of paint dry film thickness, check of finish and workmanship. The thickness should be measured at as many points / locations as decided by Employer / Owner's Engineer and shall be within + 10% of the dry film thickness.
- iv. The contractor shall produce test reports from manufacturer regarding the quality of the particular batch of paint supplied. The Employer / Owner's Engineer shall have the right to test wet samples of paint at random for quality. Batch test reports of the manufacturer's, for each batch of paints supplied shall be made available by the contractor.

#### PAINT SYSTEMS

- i. The paint system should vary with type of environment envisaged in and around the plants. The types of environment as given below are considered for selection of paint system. The paint system is also given for specific requirements.
  - a) Normal Industrial Environment, Table 2.
  - b) Corrosive Industrial Environment, Table3
  - c) Coastal & Marine Environment, Table 4

Notes 1. Primers and finish coats for any particular paint systems shall be from same manufacturer in order to ensure compatibility

**Table – 1 (Colors of Top Coats)**

The colors of top coats in accordance with this specification shall be as follows:

<b>Transmission line block valve accessories</b>		
1.	Above ground valves	:Off White / Blue
2.	Above ground pipes	:Off white
3.	Valve handle	:black
<b>Metering and regulating stations</b>		
1.	Ball valves	:Off white / Blue
2.	Bypass valves	:white enamel (epoxy)
3.	ESD valves / Off take	:Red
4.	Gate vale / Plug valves	:Blue / Grey
5.	Relief valves	:Red / Green
6.	3 way Valve	:Red / blue
7.	Valve actuators	:Red
8.	Valve wheels	:Black
9.	Pipes ( A/G)	:Grey
10.	Meter run(including regulator)	:Grey
11.	Vessels(scrubber/heater)	:Aluminium
12.	Insulating Joint.	:Yellow
13.	K.O.Drum / Filter	:Grey
14.	Pig Launcher / Receiver / flange	: Off White
15.	Fencing	: Aluminium

**Table 2**  
**Normal Industrial Environment (Above Ground)**

Sl. No.	Description	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	External surface of equipment's and piping.						
1.1	- do -	-10° C to 20°C	SSPC-SP-3	One coat P-2 50 microns/coat (min.)	One coat F-4 65 Microns/Coat (Min.) Two coats F- 3, 30 Microns/coat (min.)	175	Primer and Finish coat can applied at Ambient temp.

1.2	- do -	21°C to 60°C	SSPC-SP-6	Two coats P-1, 25 Microns/ coat (Min.)	Two coats of F-1, 20 Microns/Coat (min.)	90	-
1.3	- do -	61°C to 80°C	SSPC-SP-6	Two coats P-3, 50 microns / coat (Min.)	Two coats of F-13, 25 Microns/Coat (min.)	150	-
1.4	- do -	81°C to 250°C	SSPC-SP-6	Covered in Finish coat	Three coats of F-11, 20 Microns/Coat (min.)	60	Paint application at ambient temp. curing at elevated temp. during start-up.
1.5	- do -	251°C to 400°C	SSPC-SP-10	Covered in Finish coat	Three coats of F-12, 20 Microns/Coat (min.)	60	- do -

**Table 3  
Corrosive Industrial Environment (Above Ground)**

Sl. No.	Description	Temp. Range	Surface preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	External surface of un-insulated and other equipment						
1.1	- do -	- 10°C to 20°C	SSPC-SP-3	Two coat P-2, 50 microns/ coat(Min.)	Two coat F-3 30 microns / coat(min.)	160	Primer and paint application at ambient temp.
1.2	- do -	21°C to 80°C	SSPC-SP-10	Two coats P-5, 35 microns / coat(min.)	Two coats F-6, 100 microns/ coat (min.)	270	Paint application at ambient temp.
1.3	- do -	81°C to 400°C	SSPC-SP-3	Covered in finish coat	Three coats F-12, 20 microns /coat (min.)	60	Paint application at ambient temp. and curing at 250°C for 4 hours,

**Table 4**  
**Coastal and Marine Environment (Above Ground)**

Sl. No.	Description	Temp. Range	Surface preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	External surface of equipment's and piping.						
1.1	- do -	-10°C to 60°C	SSPC-SP-3	Two coats P-2, 50 microns/ coat (min.)	Two coats F-3, 30 Microns/coat (min.)	160	Primer and Finish coat application at Ambient temp.
1.2	- do -	61°C to 80°C	SSPC-SP-10	Two coats P-5, 35 Microns/ coat (Min.)	Two coats of F-6, 100 Microns/Coat (min.)	270	-do-
1.3	- do -	81°C to 400°C	SSPC-SP-10	One coat F-9, 85 microns / coat (Min.)	-	85	Paint application at Ambient temp.  Primer is acting as primer cum finish coat.
1.4	- do -	i) Upto 80°C	SSPC-SP-10	One coat F-9, 65 microns / coat (Min.)	One coat of F-2, 30 Microns/Coat (min.)	95	Paint application at ambient temp.
		ii) 81°C to 400°C	SSPC-SP-10	-do-		85	Paint application at ambient temp.  Primer is acting as primer cum finish coat.

#### 1.8.4 Precautions to be taken

Neither (the environment of the site, nor the marking labels of devices) may be covered with paint and they must be kept free of paint splashes. To this end it is advisable to use removable masking tape.



Paint splashes, leaks. etc. on any adjacent installations such as measuring apparatus, valves, pipes, sources of light, insulation, heat insulators, walls, concrete, etc. must immediately be wiped up and the damage repaired before the paint is dry.

Otherwise, the Employer / Owner's Engineer will be obliged to have the cleaning carried out at the expense of the Contractor. The paint recipient will only be opened at the time of use (unless otherwise specified by the manufacturer).

The product will be mixed in the recipient with the aid of suitable tools and thus homogenized.

#### 1.8.5 Method of application

Normally, three methods of application will be used on the construction site for the paint products - i.e., with a brush, with a roller or with a spray gun.

- The brush method makes it possible to obtain good penetration of the paint over irregularities in the metal.
- Only (this method will be used for application of the base coats, for retouching and for protrusions, welded areas, riveted joints or bolted joints:
- The roller method may be used on large flat surfaces for (the intermediate and topcoats.
- The spray gun method must be used in accordance with the instructions of the manufacturer and carried out by qualified personnel.
- The final / finish coat shall be applied with airless spray gun to achieve smooth and glossy finish.

The Contractor must guarantee that all safety measures have been taken for such work. The spray gun method may only be used on site for places that are difficult to reach with the brush. In this case, a request must be made to the Employer / Owner's Engineer for a deviation.

All paint work will be carried out with good brushes or rollers that are suitable for the type of paint being used and for (the form of the material to be painted and fitted with short handles. The maximum length of the brush and roller handles will be 50 cm; longer handles may only be used for places that are absolutely inaccessible. The maximum width of a brush will be 13 cm.

### 1.8.6 Application of the coating

Application of the paint shall be carried out in accordance with best practice in order to obtain a homogeneous and continuous layer. The Employer / Owner's Engineer demands that painting of a layer will only be started after acceptance by them of the surface preparation or of the previous layer of paint.

The layers of paint must have a uniform thickness. They must be spread in such a way that all concave parts are dried out and that the surface is completely covered and has a glossy appearance without leaving brush marks and without exhibiting bubbles, foam, wrinkles, drips, craters, skins or gums that arise from weathered paint.

Each layer must have the colour stipulated in the tables of the present specifications, which clearly differs from the previous layer, taking account of the colour of the top layer. All of which for the purpose of being able to identify the number of coats and their order of sequence. If the colour of the coats is not mentioned in the tables the colour difference in consecutive coats must, if possible, be at least 100 RAL. The colour of the top layer is given in the table.

The coating power should be such that the underlying layer is not visible. Only 1 layer per day may be applied, unless otherwise specified by the Employer / Owner's Engineer.

The drying times prescribed by the paint manufacturer must be strictly observed in relation to the environmental conditions before proceeding with the application of the next layer.

The dry coating thickness indicated in the description of the paint systems, are minimum thickness. In this connection, the Contractor is obliged to contact the paint manufacturer and conform to his guidelines. The Contractor must respect the thickness specified by the supplier.

### 1.8.7 Transporting treated items

In the case of works being carried out in a workshop, the metal structures will be surrounded by ventilated contraction film that prevents damage during transportation. This film may only be applied after complete polymerisation of the paint.

## 1.9 GROUND-LEVEL TRANSITION POINT

### 1.9.1 Polyester protection system

The Contractor will provide system 02 over the entire length of the pipes above ground and below ground and up to a height of 30 cm and a depth of 40 cm. perpendicular to the ground level mark. In each case, he must ensure that the jointing below the asphalt is in good condition and assures' faultless adhesion. He will apply the following products over the entire surface area, prepared in accordance with Sa 3:

- 1) The primer of system 01A
- 2) Reinforced polyester  $\pm$  20 cm above the ground level marker and  $\pm$  5 cm on the asphalt cleaned beforehand. (application of reinforced polyester is carried out in accordance with the work method prescribed by the manufacturer). Moreover, in the case of PE, in contrast to asphalt, he will apply a polyken primer to PE immediately before applying the reinforced polyester.
- 3) He will then apply the other coats of system 01a to the surface section and thus cover the reinforced polyester with about 5 cm.
- 4) For new constructions, the polyken primer will be applied to PE and then subsequently processed as described under point 2.

### 1.10 QUALITY CONTROLS AND GUARANTEE

1.10.1 The Contractor is responsible for checking the weather conditions to ascertain whether the paint work can be carried out within the technical specifications.

The Contractor should have the required calibrated monitoring apparatus for this purpose on site (with calibration certificates). The personnel who will have to use this apparatus should have the training for this purpose.

The Employer / Owner's Engineer may maintain supervision during the works and inspect the works with random checks. A daily report shall be drawn up in relation to the department that maintains supervision of these works.

The supplementary inspection and the supervision by the Employer / Owner's Engineer do not diminish in any way the liability of the Contractor. The proper execution of the work and the materials used may be checked at any time.

### 1.10.2 Reference Surfaces

At the start of the works, the Employer / Owner's Engineer will indicate a few surfaces that the Contractor will prepare and cover in accordance with the recognized method of operation under the inspection and to the satisfaction of all parties; the Employer / Owner's Engineer or his representative, the approved supervisory body, the contractor and possibly the paint manufacturer. These reference surfaces will serve as a point of comparison for the good adhesion of the paint on the installations as a whole. The parties will together work out a system for the identification of these surfaces in order to be able to monitor the condition of the coatings over time. If the paintwork on a section of the installations is in a worse condition than the reference surfaces, the Contractor may be obliged to treat these parts again.

### 1.10.3 The Employer / Owner's Engineer will use the following standard as a base of assessment of quality

- The Swedish standards ISO 8501-1 1988 SS 05.5900 concerning the degree of cleanliness of the areas de-rusted by blasting, by machine or by hand.
- The wet film thickness of the paint will be measured in accordance with ISO 2808 or ASTM D1212
- The dry layer thickness of the film will be measured electronically, will complete statistical information, in accordance with ISO 2808 or ASTM D 1186
- The thickness of each layer will be measured in accordance with ISO 2808, ASTM 4138 or DIN 50986
- Adhesion tests will be carried out in accordance with ISO 2409, ASTM 3359 or DIN 53151
- Traction tests will be carried out in conformity with ISO 4624 or ASTM D 4541
- The rugosity will be measured electronically in accordance with DIN 4768;
- The non-porosity will be measured with a test tension depending on the type of coating, the layer thickness and after consultation with the Paint manufacturer;
- Any defects in the paint film may be inspected visually by means of a magnifying glass or microscope. If necessary a photographic report may be drawn up in accordance with ASTM Standard D 4121-82.

The final judgment of Employer / Owner's Engineer is irrevocable and binding for the Contractor. In the event of non-conformity of the works with the criteria of these

specifications, all costs arising from the inspection by Employer / Owner's Engineer shall be borne by the Contractor.

#### 1.10.4 Guarantee

##### a) General Principles

The Contractor declares that he is aware of:

- The maximum operating temperature of the surfaces to be covered;
- The maximum permitted degree of humidity of the bearing surface;
- The properties of the environment to which the surfaces to be covered are subject.

##### b) Summary of the Guarantee

The contractor fully guarantees the following without reservation:

- The observance of all stipulations of the specifications for paint work regarding, among other things ;
- The preparation of the surfaces;
- The thickness of each layer
- The total thickness of the covering.
- The uniformity of the materials used;
- The repair of all defects before delivery of the works.

The Contractor will carry out the requested repair work as promptly as possible.