Doc No: AA/CQ/GL/013 Rev:00

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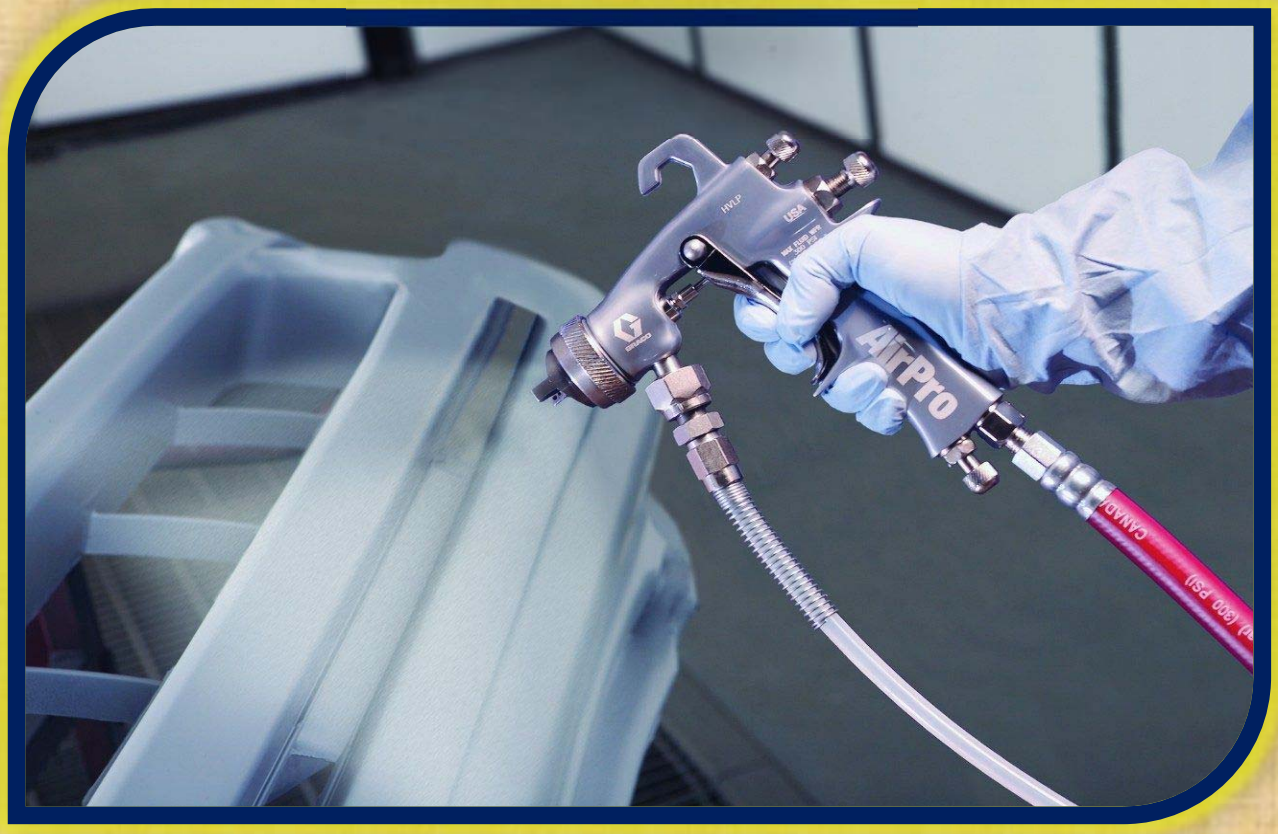
PAINTING MANUAL FOR POWER SECTOR SITES



बी एच ई एल
BHEL

कार्पोरेट गुणता एवं व्यावसायिक उत्कृष्टता
CORPORATE QUALITY & BUSINESS EXCELLENCE
भारत हेवी इलेक्ट्रिकल्स लिमिटेड, नई दिल्ली
BHARAT HEAVY ELECTRICALS LIMITED, NEW DELHI

PAINTING MANUAL FOR POWER SECTOR SITES

DOCUMENT NUMBER : AA/ CQ/ GL/013, R00 Dated 28.05.18

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RECORD OF REVISIONS

MANUAL	REV. NO.	DATE	CLAUSE NO.	DETAILS OF REVISION / REMARKS
Painting Manual for Power Sector Sites: AA/CQ/GL/013	00	28/05/2018	--	This manual supersedes the earlier manual issued vide reference number PSQ-PNT-COM, dated 27/03/2002 and is being reissued with major updations under new document number

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Limited

MESSAGE

BHEL has always stood for Quality in its products and services. In our journey of creating a BHEL of tomorrow, we need to relentlessly pursue globally accepted standards of quality in our products and services.

"Painting" is considered as a "Special Process" which needs to be performed with utmost care. Painting work at site is enormous, especially for Boiler structural items, piping and several other equipment. Painting work includes surface preparation; application of primer, intermediate & finish coats; painting of colour bands & marking signs etc. It has to be ensured that uniform and standard practices are followed at construction sites for painting of structures & equipment in conformance to the specified requirements.

This manual provides a basic guideline to all construction personnel in ensuring process management of painting activities. It is based on relevant Plant, National and International Standards.

I am sure this "Painting Manual for Power Sector Sites" shall help in ensuring better process control and prevention of non-conformances at construction sites. This shall also facilitate in improvement in quality & aesthetics of our products and enhancement of customer satisfaction.

(Kishore Purswani)
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Date: 28th May, 2018

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ANNEXURES:

1.0 Objective:

To ensure that uniform and standard practices are followed at construction sites for painting of structures and equipment in conformance to the specified requirements.

2.0 Scope and Extent of Painting work involved at site

This system covers equipment which are supplied by BHEL Manufacturing Units (MU) for erection at Power sector sites and where painting at site is involved including primer, intermediate and final coating as per painting schedule specified by customer/BHEL. It does not cover painting of equipment to be done at shop floor before dispatch of the equipment.

Every item dispatched from MU to site is sent with at least one coat of primer paint. Equipment/items dispatched from MUs to site can be classified in the following two categories: -

A. <u>Equipment / items dispatched with only one primer coating:</u>

In this case, depending upon the condition of primer paint on equipment/ item after receipt at site, either re-painting or intermediate & final coating may be required to be done at site.

B. <u>Equipment / items dispatched with finished painting:</u>

In this case, depending upon the condition of paint on equipment/ item after receipt at site, either touch up painting or complete painting may be required to be done at site.

In some cases, even if the finished equipment (after final paint) from MU is supplied to site, the paint may have deteriorated or peeled off during transportation, storage, erection or due to aging. In those cases, wherever required, touch up painting or re painting is to be done.

Normally, at site, painting work includes surface preparation, application of primer, intermediate & finish coats, painting of color bands, marking signs of direction of flow/rotation, legends, identification/ names etc. as per contract.

3.0 Painting Specification:

For every product, a painting specification is issued by corresponding MU. It contains type of surface preparation, type of primer, intermediate and finish coat paint (equipment wise), thickness of each type of coat, number of coats etc. The color & shade of paint shall be as per “Color coding scheme” (Refer clause 6.)

Exhibit of a typical painting scheme in the painting specification is shown below:

Equipment	Surface preparation grade/surface profile	Primer Coat			Intermediate coat			Finish paint			Total DFT in µm
		Primer paint	No. of coats	DFT in µm	Intermediate paint	No. of coats	DFT in µm	Finish paint	No. of coats	DFT in µm	

If the "Painting scheme" is provided by customer for the entire range of power plant equipment, the same shall be followed.

However, if customer does not provide painting scheme, BHEL painting scheme/Painting specification as issued by MU/Engineering Center & duly approved by Customer, if required, shall be followed.

At sites, painting process shall commence only after availability of painting scheme and color coding scheme agreed between Customer & BHEL.

4.0 Painting Process

Any Painting Process essentially involves the following basic steps:

1. Paint Procurement and its Storage & Handling
2. Painting procedure Qualification/ Painters skill test
3. Tools & Tackles for painting
4. Surface Preparation
5. Application of primer
6. Application of paint
7. Inspection, testing & records during Paint application

The details of each of the above aspects are as under

4.1 Paint Procurement

Depending upon the area to be painted and number of coats, appropriate paint as mentioned in the "Painting scheme" shall be purchased from approved supplier along with appropriate thinner, as prescribed by the paint manufacturer.

PS regions may use the list of approved suppliers of MUs or may prepare their own list.

Note: Preferably Single brand of paint shall be used for whole structure as different brand may have difference in shade for the same color code.

4.1.1 Qualification of paint: -

For each type of paint received from supplier, tests are to be carried out. These tests have been categorized in two categories

- Type test
- Routine test

4.1.1.1 Type test of Paint:

This type test is done for qualification of vendors for the first time or when a new type of paint is procured from existing vendor or as a periodic monitoring of an existing approved vendor.

S. No.	Characteristic	S. No.	Characteristic
1	Color	12	Flash Point
2	Finish	13	Lead content
3	Freedom from defect	14	Scratch hardness
4	Chemical composition	15	Flexibility & adhesion
5	Consistency	16	Resistance to salt spray
6	Spreading capacity	17	Chemical resistance test
7	Mass per ten liters	18	Compatibility
8	Drying/Curing time	19	Date of Manufacture & expiry
9	Dry Film thickness (DFT)	20	Accelerated weathering test
10	Heat resistance test	21	Leafing property
11	Resistance to transformer oil		

These Type tests **need not be carried out at site**. However, it shall be ensured at site that the supplier submits the "Test certificates" consisting of all applicable information from the above table, conforming to IS101 (Unless otherwise specified).
The requirement of test certificates shall necessarily be included in Purchase Order (P.O.)

4.1.1.2 Routine test of Paint:

The following routine tests shall be carried out for every batch/ type of paint received from supplier at Site.

Number of containers to be selected as sample, from a lot of specified volume, shall be in accordance with **Annexure-I.**

Sl.	Routine test to be carried out at site	Type of check	Procedure
1	Freedom from defects	Visual	Visual
2	Color/shade	Visual	IS-5
3	Curing/Drying time	Measurement	Paint Data Sheet
4	Dry Film thickness (DFT)	Measurement	Annex-II

4.1.1.3 Besides above, paint containers shall necessarily have the following minimum information

1. Supplier name
2. Type No. / brand name/ Shade/ Indian Standard Color no. (ISC No.)
3. Expiry date
4. Mixing ratio (if any)
5. Special instructions (if any).

4.1.2 Storage and Handling of paints & consumables

All the paint & consumables (i.e. thinner, cleaning agent, solvent etc.) shall be stored in well ventilated, dust free closed storage and in a manner so that they are easily retrievable. Their records w.r.t. type of paint, ISC no. (Indian Standard

Color no.), expiry date & place of location shall be maintained. They shall be handled with care so as to prevent any damage or loss either to the paint or to the floor where they are stored.

Recommendations of Paint manufacturer to be followed for its storage and preservation

Place where paints are stored shall display caution boards like “No smoking Area”, “Inflammable”, “Danger” etc. Fire extinguisher must be available in storage area.

Issue of the paint shall be done in a manner that the one with earlier expiry date will be issued first. It shall be ensured that all the paints & consumables are applied before the expiry date only.

4.2 Painting Procedure & Painters Skill test

4.2.1 Painting procedure test:

As referred earlier in clause 3 above, for every project there is a painting scheme” agreed between BHEL & Customer which details out type of surface preparation, type of primer, intermediate and finish coat paint, thickness of each type of coat, numbers of coat etc. for each type of equipment/item to be erected at site**. Painting Scheme itself determines the painting procedure to be followed.**

4.2.2 Painter Qualification: -

It is suggested that each painter shall be subjected to a test initially for each type of painting scheme and for each type of painting methods (i.e. Brush painting & Spray Painting).
For this, an area of 300 mmx300 mm shall be painted by painter either on a separate test piece or on the job after mixing the paint with thinner (if applicable), in the prescribed ratio. Painting shall be done as per painting scheme of that particular equipment.

DFT for each of the primer, intermediate & finished coat shall be checked as prescribed in the painting scheme to ensure that painter has understood & applied requirements of painting scheme

After the finished paint film is dried, it shall be checked for the following criteria: -

1. Finish (Absence of brush marks, evenness of coating- visual check
2. DFT (as per procedure mentioned in **Annexure-II**)
3. Adhesion

Painter shall be permitted to do painting only after fulfilling the above criteria satisfactorily, as per the requirements of the painting scheme.
Painter skill records shall be kept at site as per **Annexure-III** for all the painting schemes applicable and for all the painters.

Validity of certification of painters may vary as per "Type of painting" for which Painter is qualified.

Qualified painters may be issued Photo ID with mention of Painter details including type of painting for which he is certified and the validity period for the same, prior to recertification.

Refer **Corporate standard AA0462804** for details of the Painter's Qualification Test.

4.3 Tools & Tackles for painting

Besides consumables like paint, thinners etc., painting work requires lot of other material like painting equipment, supporting structure etc. The suggested list of T&P to be made available at site is given below. It should be ensured that Painting contractor has the following minimum requisites before start of painting work at site: -

1. Spray painting nozzle with hose pipe & portable air compressor (for Spray painting)
2. Paint brushes of different sizes (for brush painting)
3. Wire brushes
4. Grinding wheels/Rotating steel wire brush
5. Shot blasting equipment (as needed)
6. Ladders, Scaffolding pipes & Clamps (Steel)
7. Polyamide ropes for fall arrestors
8. Fire extinguisher
9. Flood lights fittings & bulbs
10. Safety equipment (such as mask, Gloves, Apron etc.)
11. Step down transformer 24 V
12. Lighting distribution boards with switches, plugs, fuses etc.

The above list is only indicative and not exhaustive. Contractor may also require other equipment /materials depending upon the painting techniques used at site. Necessary dust protection initiative must be taken during in-situ painting.

4.4 Surface Preparation

Surface preparation is necessary before applying paint on the surface, for better adhesion of paint. Surface preparation has two dimensions**:**

1. **Surface Cleaning:**
   It involves removal of oil, grease, dirt etc. followed by removal of rust & scale. The requirement of surface cleaning profile, invariably forms a part of painting scheme.
   Surface cleaning profiles (in case of shot blasting) are normally mentioned as SA2, SA21/2, SA3 etc.

2. **Surface Roughness profile** (in case of shot blasted surface)
   Refer **Corporate standard AA0674101 and AA0674106** for details of the surface preparation along with the specifications of manufacturing units.

4.5 Application of Paint

As described earlier, details of type of primer, intermediate coat, finish coat, number of coats, thickness of coat etc. are provided in painting scheme.

Paint shall be applied as per paint manufacturer's product data sheet which shall include the mixing ratio, maturation time (for two pack paint application), method of application, use of thinners and drying time between coating intervals.
However, thinner quantity to be added in the paint should not exceed more than 5% of the paint, by volume.

When the containers of air drying paints are opened, the material is observed for contamination/skin formation/agglomeration. The formed skin shall be carefully removed and settled pigments has to be broken up and loosened by vigorous stirring, preferably mechanically, to ensure uniform mixing of constituents. The paint, if required may be strained through muslin cloth or 60 mesh sieve.

Extra coats of paint shall be applied on the areas where the shape and/or plane of application results in thinly applied coatings e.g. at edges, welds, etc. To compensate this effect, stripes coats of paint shall be applied so that they will be covered by full coat.

NOTE: For painting at sites, mainly Brush application is adopted. However, conventional air spray or airless spray application is also applied at few places.

Following four main application procedures can be adopted:

1. **Brush application**
   This method is adopted where the use of spray method would increase the loss in paint material. However, in brush application it is difficult to achieve higher thickness in one coat. The process is relatively slow and may sometimes result in poor finish.

2. **Conventional spray**
   A widely accepted painting method where liquid paint is atomized by an air stream. A correct combination of air pressure, air volume and fluid flow has to be selected to achieve full atomization and a paint film free of defect.
   Main disadvantage is that high build coatings cannot be applied by this method, as most paints have to be thinned to a suitable viscosity for satisfactory atomization.

3. **Airless spray**
   This is by far the fastest and most versatile method because it enables application at various thicknesses. The equipment utilizes an electric or air driven motor and a high pressure fluid pump to compress the paint material through extreme pressures. The paint is made to pass through a special tip that atomizes it and thus controls the application process.

The advantages of Airless spray application are:

a. High build coatings can be applied
b. Fast rate of application
c. Reduced pollution & environment friendly
d. Reduced wastage of material
e. Less air consumption and saving of power.

Special tips used in the spray gun and the pressure control enables one to monitor application of very low to very high viscosity products. Similarly, different slot angles produce spray fans of different widths. The selection of a particular fan width depends upon the shape & size of the structure to be painted. The choice of fan width is also related to orifice size. For the same orifice size, the paint applied per unit area will be less, wider the spray fan. The general indication of orifice sizes is given below, to help in choosing the proper orifice size for painting.

Wet film thickness	Orifice size (in mm)
Up to 50 microns	0.02-0.03 mm
100-200 microns	0.03-0.04 mm
>200 microns	0.04-0.07 mm
Mastics	0.1-0.15 mm

4.5.1 Maturation time:

Maturation is an important criterion for two pack products where curing takes place through chemical reaction when two components are mixed before application. Normally, the mixed paint is matured for about 30 minutes, unless otherwise specified, to initiate the reaction process, which ensure thickness build-up and proper drying of the paint film.
Refer **Corporate standard AA0674123** for details of “Process of painting of metal components and steel surfaces”.

4.6 Inspection, Testing & Record During Paint Application

Visual inspection & testing of surface preparation, application of primer, intermediate and finished coat & measurement of DFT are to be conducted.

Painting material is either procured by contractor or provided by BHEL, depending upon the ‘painting contract’ finalized with the contractor. In either case, type of paint and shade of paint (equipment wise) shall be as per painting scheme agreed between BHEL & customer.
Inspection shall be carried out on the prepared surface, for freedom from rust, stain, oil or grease before application of primer paint. Records of surface cleanliness (extent of cleaning) & surface profile shall also be maintained.

It shall also be ensured that shot blasting surface shall be subjected to application of primer paint within 4 hours except for those jobs that need pressure testing due to code requirement.

A log sheet having critical quality requirements, which are to be measured & recorded before, during & after painting of equipment, has been prescribed in the "Field Quality Plan for painting in Power Sector erection sites".
The requirements mentioned shall be recorded by Task performer in this log sheet at site, for each type of painting and for each equipment.

All paint coatings are to be inspected for the following criteria:

1. **Dry film thickness (DFT):**
DFT shall be measured with an appropriate calibrated instrument as per **Annexure-II**. The DFT measurements for primer, intermediate and final coating shall be checked and recorded in the log sheet of FQP.

2. **Adhesion**:
The adhesion of primer to steel substrate and the 'inter-coat-adhesion' of the subsequent coat(s) after curing, shall be determined by the application of a cross-cut test as given in **Annexure-II**.

3. **Shade**:
As per IS-5 RAL or any other standards as per contractual requirement (Visual Check).

4. **Visual checks:**
Painted surface shall be smooth and uniform and there shall be no visible porosity, pot holes or any other painting defects. If runs and sags, dry spray and over spray are present, these should not cover more than 5% in any given area and cumulative not more than 2% of the total surface area.

5.0 Monitoring and Measurement Resources (MMRs) & their operating procedures

Following MMRs must be available at site for measuring above characteristics:

Sl. No.	Type of Instrument	Range
1	Elcometer (Preferably Digital)	0 -1000
2	IS 5 / RAL / other contract spec (To compare shade)	--
3	SSPC Visual standards (To assess degree of cleanliness of surface to be painted)	SP7,SP6,SP10,SP5
4.	Thermometer/Hygrometer	---

Operating Procedures of MMRs and methods of measurements are mentioned in **Annexure-II**

6.0 Color Coding:

It covers application of color on equipment, piping & ducting as final coat, over & above the protective coating, for the purpose of identification.

The color coding shall be as per customer specification or as per **Corporate Standard AA0400302** whichever is applicable.

7.0 Safety Norms

7.1 During removal of oil, grease, rust & scale from surface:

Appropriate apron, gloves, respirators, safety glasses & Safety Life lines shall be used by the operator

7.2 During Painting:

1. Etch primer and epoxy paints are liable to cause irritation to the skin. This may transpire into inflammation, swelling, rash or pustules on the hands, arms & occasionally whole body. Therefore, task performers should wear hand gloves & aprons during painting.
2. Work place & storage rooms should be adequately ventilated.
3. Before starting work, hands should be washed with soap and water and good barrier cream applied.
4. Utmost care should be taken to avoid splashes on the skin.
5. Splashing on the skin should be immediately washed with soap & water
6. After the work, hands, arms & face should be washed with soap & water followed by through drying with a clean cloth

7.3 General

1. Do Not smoke while painting
2. Do Not paint close to a welding area.

8.0 List of References- Painting Specifications

1. Corporate standards

S. No.	Standard No.	Description
1	AA0674101	Surface preparation and pretreatment of ferrous surface before painting
2	AA0674106	Log sheets for Surface preparation and painting
3	AA0674123	Process for painting of metal components and steel surfaces
4	AA0400302	Color coding for power plant equipment, piping and ducting
5	AA0462804	Procedure for Qualification of Painters

2. Manufacturing Unit (MU) painting specification product wise are

Sl	MU	Description of components	Document No.
1.	HPBP, Trichy	Boiler, Valves & Oil filled Equipment's	SIP:PP:22
2.	BAP, Ranipet	APH, Fans, ESP, Gates, Dampers and Chimney	PRQA:590
3.	HPEP, Hyderabad	BFP	HY 0674162
4.	TP, Jhansi	Transformer	TR1005 P
5.	EDN , Bangalore	Panels	ED 085 17 99
6.	CFP, Rudrapur	Bus Duct	RU0674199
7.	HEEP, Hardwar	Steam Turbine	ST33004
		Turbo Generator	0912-015
		Condenser	HE77001
		Heat Exchangers	HE77005
8.	HEP, Bhopal	Motors	AM 54173
		Hydro Generator components	HG12007
		Transformer	TR10005P
		Transformer tank & accessories	TR10257P
		Traction Machines	TM94217
9	PEM, Noida	Structural Steel	PE-TS-999-600-C017,Vol IIB, Sec D, Sub section D17
		Civil & Concrete structure	PE-TS-999-600-C011,Vol IIB, Sec D, Sub section D11

Note: 1. Latest revision of above documents to be obtained from concerned unit.
2. For the products, which are not mentioned in above list, site shall contact MU for obtaining details of painting specification.

9.0 Field Quality Plan for Painting Process at Site

Field Quality Plan shall consist of painting requirements as described in this manual to take care of critical quality checks and recording as per log sheets L-01 of FQP.

Standard FQP for painting process is attached as **Annexure-IV.**

Project wise FQP shall be prepared by respective Region based on customer requirements.

Annexure-I

Sampling Criteria for carrying out Routine Test on Paint, received from Supplier (Ref, IS-101)

Volume of supply in a lot (in liters)	No. of containers to be sampled for size of containers				
	Above 20 Liters	20 Liters	10 Liters	4-5 Liters	2 Liters or less
Up to 50	1	1	1	1	1
51 to 100	1	1	1	1	3
101 to150	1	1	1	2	3
151 to 200	1	2	2	2	3
201 to 300	1	2	2	2	4
301 to 400	1	2	2	3	5
401 to 500	1	2	3	3	5
501 to 600	1	2	3	3	5
601 to 750	1	2	3	3	6
751 to 1000	2	3	3	4	6
1001 to 1500	2	3	3	4	7
1501 to 2000	2	3	4	5	8
2001 to 2500	2	3	4	5	9
2501 to 3000	2	4	4	5	9
3001 to 3500	2	4	5	5	10
3501 to 4250	3	4	5	6	10
4251 to 5000	3	4	5	6	11
5001 to 6000	3	5	6	7	12
6001 to 7500	3	5	6	7	13
7501 to 10000	3	5	6	8	14
10001 to 15000	4	6	7	9	15
15001 to 20000	4	7	8	10	17
20001 to 25000	5	7	9	11	19
25001 to 30000	5	8	9	11	20
30001 to 35000	5	8	10	12	21
35001 to 42500	6	9	11	13	22
42500 to 50000	6	9	11	13	24

Annexure-II
Sheet- 1/2

METHOD OF ROUTINE TEST

1. Measurement of Dry Film Thickness (DFT Measurement):

1.1 Painting the Test Panel:

Check the steel panels of size 300 mm x 300 mm x 1.25 mm (length, width & thickness respectively) for freedom from surface imperfection and suitable for high standard of surface finish, before use, degrease the panel with suitable hydrocarbons solvents like petroleum, ether, toluene or Xylene. Burnish uniformity with IS grit no,180 emery paper. So as to get circular burnishing marks superimposed one upon another. Remove the emery dust, swab the panel with linen rug soaked in hydrocarbon solvents, dry and cool to room temperature.

Apply the paint material on the panel, note the time and allow to dry in vertical position, shielded from air current, in absence of direct sunlight, at room temperature.

1.2 Calibration of Elcometer:

The Calibration of instrument to be done as per the guidelines of the instrument manufacturer.

1.3 Measurement of Dry Film Thickness:

After calibration, place the Elcometer over the coated test specimen and note the reading display on the screen.
Take sufficient number of readings to characterize the sample (minimum of five readings).
Curing, drying and testing will be done under existing ambient conditions.
Tolerance on DFT measured should be within +-10% of the DFT required.

2. Adhesion Test – X – Cut tape test (as per the latest ASTM-D3359):

Select an area clean, dry, free of blemishes and minor surface imperfections. For specimens which have been immersed, after immersion, clean and wipe the surface with an appropriate solvent which will not harm the integrity of the coating. Then dry or prepare the surface, or both, as agreed upon.
Make two cuts in the film each about 40mm long that intersect near their middle with a smaller angle of between 30 & 45^0. When making the incisions, use the straight edge and cut through the coating to the substrate in one steady motion.
Inspect the incisions for reflection of light from the metal substrate to establish that the coating film has been penetrated. If the substrate has not been reached make another X in a different location. Do not attempt to deepen a previous cut as this may affect adhesion along the incision.

Annexure-II
Sheet- 2/2

At each day of testing, before initiation of testing, remove two complete laps of tape from the roll and discard. Remove an additional length at a steady rate and cut a piece about 75 mm long.

Place the center of the tape at the intersection of the cuts with the tape running in the same direction as the smaller angles. Smooth the tape into place by finger in the area of the incisions taking care not to entrap any air under the tape. Rub firmly over the surface of the tape with the pressure application device until the color is uniform in appearance. This indicates good, uniform contact between the tape's adhesive and the coating surface.
Within 90±30 s of the application, remove the tape by seizing the free end and pulling it off rapidly (not jerked) back upon itself at as close to an angle of 180^0 as possible.

Inspect the X-cut area for removal of coating from the substrate or previous coating and rate the adhesion in accordance with the following scale:
5A No peeling or removal
4A Trace peeling or removal along incisions or at their intersection
3A Jagged removal along incisions up to 1.6 mm on either side
2A Jagged removal along most of incisions upto 3.2 mm on either side
1A Removal from most of the area of the X under the tape, and
0A Removal beyond the area of the X

For large structures make sufficient tests to ensure that the adhesion evaluation is representative of the whole surface.

Acceptance Criteria: 4A Scale with10% maximum peeling/ removal OR 5A Scale

After making several cuts examine the cutting edge and if necessary, remove any flat spots or wire edge by abrading lightly on a fine oil stone before using again. Discard cutting tools that develop nicks or other defects that tear the film.

Note: Adhesion test as per any other National/ Inter-national standard can also be considered with mutual agreement with customer

ANNEXURE- III

Paste latest pass port size photo

RECORD OF PAINTER SKILL TEST

Name of Painter	
Type of Paint	
Method of Painting (Brush/Spray)	
Test Results	
Date of certification	**Next due date of certification**
Finish of Painting : Ok / Not Ok (Visual)	
Dry Film Thickness: Standard ……. Actual ……..	
Adhesion Test : Ok/ Not Ok (Visual)	
Result : Satisfactory / Not Satisfactory	

Date:

Signature
In- charge (Painting) - BHEL

ANNEXURE-IV

BHEL	**FIELD QUALITY PLAN FOR PAINTING PROCESS**	**Doc. No.: AA/CQ/SFQP/Painting** **Rev. No.: R00** **SHEET 1 / 4 SHEETS**

Capacity/Type : Common

System : Common

Sub-System : Common

Area : Painting

Classification of Checks :

Symbol	Description	Inspection Agency	Clearing Agency
A	Critical	Task performer & surveillance by QAE (if available)	HOS
B	Major	Task performer	HOS
C	Minor	Task performer	Task performer

Legend: HOS: Head of Section

QAE: Quality Assurance Engineer

Note:

1. **Quantum of check shall be 100% for all characteristics unless otherwise mentioned in the reference documents.**
2. **QAE is also authorized to carry out surveillance in any of the 'B' and 'C' category of checks at his discretion.**
3. **In case of non-conformity, before accepting, clearing agency shall ensure dis positioning and the same shall be reflected in Log sheets/protocols.**
4. **Instruments with valid calibration to be used for measurements**

	STATEMENT OF CHECKS	Doc. No.: AA/CQ/SFQP/Painting Rev. No.: R00 SHEET 2 / 4 SHEETS

System: Common | **Sub-System: Common** | **Area: Painting**

Sl No.	CHARACTERISTICS	CLASS	QUANTUM/ FREQUENCY OF CHECK	REFERENCE DOCUMENT/ ACCEPTANCE STANDARD	FORMAT OF RECORD	REMARKS
1.	Painters' skill test on mock plate of size 300 mm x 300 mm separately for brush painting & spray painting the following criteria: a) DFT of Primer Intermediate, Final coat & total DFT, as applicable. b) Finish (Painting scheme (As agreed between Customer & BHEL)	B	100%	Clause 4.2.2 Annexure- II Visual	Annexure-IV	
2.	Check that storing of paints & thinners done in covered and ventilated places. Check that these are issued in a way that one having earlier expiry date is being issued first.	C	100%	Clause 4.1.2		
3.	Check that surface to be painted is free from dust, oil, grease, rust & scale.	A	Randomly, as agreed between Customer & BHEL	Clause 4.4.1 & Clause 4.4.2		
4.	Check proper surface preparation, as per painting scheme.	B	-do-	Clause 4.4		
5	Check that appearance of the surface after cleaning should correspond to pictorial standard, as mentioned in the painting scheme. (Applicable for shot blasted surface)	B	-do-	Clause 4.4.2		
6	Check that blasted surface is painted within 4 hours after blasting.	B	100%	Clause 4.1.2		
7	Check validity of shelf life of paint before use. Check use of specified thinner and proper mixing ratio, as prescribed by supplier. **Note: Never use kerosene as thinner.**	B	100%	Clause 4.5		

System: Common | **Sub-System: Common** | **Area: Painting**

Sl No.	CHARACTERISTICS	CLASS	QUANTUM/ FREQUENCY OF CHECK	REFERENCE DOCUMENT/ ACCEPTANCE STANDARD	FORMAT OF RECORD	REMARKS
8	Check availability of following documents: a) Painting scheme (As agreed between Customer & BHEL) b) IS-5 / RAL / Contractual Spec (For checking the shade of colour) c) Corporate standard AA 040 03 02 (Colour coding for Power Plant Equipment, Piping & Ducting), as applicable. **Note: Painting work should be taken up only after painting scheme is available.**	A	100%			
9	Check availability of following MMRs besides other tools & tackles required for painting: a) Elcometer (To measure Dry Film Thickness –DFT) b) SSPC Visual standard (To assess the degree of cleanliness of surface to be painted)	B	100%	Clause 5 & Clause 4.3		
10	Check that all the paint material is procured from approved suppliers and information on test certificate/containers are as per requirement.	B	Every PO	Clause 4.1		
11	Check that following routine tests on paints are conducted satisfactorily, as per sampling Plan (Annexure- I), for required criteria.		Sampling Plan-Ann-I			
	a) Freedom from defects (i.e; freedom from contamination/skinning/agglomeration)	B		Visual		
	b) Consistency	B		Annexure- II		
	c) Colour/Shed	B		ISC		
	d) Curing/Drying time	B		Paint Data sheet		
	e) Adhesion	B		Annexure- II		

System: Common | **Sub-System: Common** | **Area: Painting**

Sl No.	CHARACTERISTICS	CLASS	QUANTUM/ FREQUENCY OF CHECK	REFERENCE DOCUMENT/ ACCEPTANCE STANDARD	FORMAT OF RECORD	REMARKS
12	Record Dry Film thickness (DFT) of primer, intermediate and final coats (as applicable) as well as total DFT after final coat. Check proper drying time between two coats & record: **Note: . Ensure that touch up painting & finish painting is carried out (wherever required) on equipment which comes finish painted from MUs (exclusively as per MUs' painting spec.)**	A	Randomly, as agreed between Customer & BHEL	Clause 4.6 & Clause 2	L-01	
13	Check colour coding during painting of pipelines and relevant identification. (Colour band on piping shall be of min. 300 mm width. at a min. gap of every 500 mm.)	B	100%	Clause 6 & Corporate standard AA0400302		

LOG SHEET L-01

Drawing No.	Description of the Job:	WO No.: P.O. No.
Customer:		Name of item to be painted:
Quality Plan No.	Customer specification:	Painting Scheme:

1. Surface Preparation:	Start Date:		Finish Date:
Degreasing & shot blasting	Chemical Cleaning	Surface roughness	Zinc Phospheting

2. Painting process					
Painting Scheme:				Deviation, if any	
2.1 Stripe coat	Start Date:			Finish Date:	
Method of application					
Type of paint	Thinner	Make	Batch No.	Carried out by:	DFT
Temperature (WET Bulb)		Dry Bulb:	Humidity		Surface Temp:
2.2 Primer coat	Start Date:			Finish Date:	
Method of application					
Type of paint	Thinner	Make	Batch No.	Carried out by:	DFT
Ist Coat					
IInd Coat					
Temperature (WET Bulb)		Dry Bulb:	Humidity		Surface Temp:
2.3 Intermediate coat	Start Date:			Finish Date:	
Method of application					
Type of paint	Thinner	Make	Batch No.	Carried out by:	DFT
I st Coat					
II nd Coat					
Temperature (WET Bulb)		Dry Bulb:	Humidity		Surface Temp:
2.4 Final coat	Start Date:			Finish Date:	
Method of application					
Type of paint	Thinner	Make	Batch No.	Carried out by:	DFT
Ist Coat					
IInd Coat					
Temperature (WET Bulb)		Dry Bulb:	Humidity		Surface Temp:
2.5 Total DFT:					

3. Quality Checks: inspected/tested by:	Painting In charge	Third Party Inspection
Visual Inspection		
Adhesion test		
Finish		
Shade		