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PAINTING OF MACHINED AND UNMACHINED SURFACES OF WATER TURBINES BY BRUSHING

1. **GENERAL :**

This standard details the process to be followed in obtaining a protective coating on the machined as well as unmachined surfaces of Water Turbines.

2. **MATERIALS :**


- 2.1 High Build Black Coal Tar Epoxide Paint - AA 56135
- 2.2 Oil Resistant Air Drying Synthetic Enamel - AA 56132 (Jasmine Yellow)
- 2.3 Chemical Resistant Epoxide Priming Paint - AA 56105
- 2.4 Chemical Resistant Epoxide Finishing Paint - AA 56131
- 2.5 White Spint Gr. 145 / 205 - AA 56701
- 2.6 Special Thinner for AA 56135 (HE 5043) - AA 56709
- 2.7 Thinner for AA 56105 & AA 56131 - AA 56708
- 2.8 Xylol-Industrial Solvent Grade - AA 56703
- 2.9 Stearic Acid Jelly - BP 55192 (HE 1605)
- 2.10 Rust Preventive Hard Film Black (TRP) - AA 55154
- 2.11 Latex Emulsion for Cement Wash - Proprietary item of M/s Shalimar Paints.
- 2.12 Polyvinyl Acetate Based Adhesive - AA 55302

3. **PREPARATION OF THE PAINTS :**

3.1.1 **Removal of the skin from the paint**

Before application, any skin formed on the paint in the tin shall be carefully removed. Any settled pigment broken up and loosened, and the paint thoroughly stirred to ensure complete and uniform mixing of the constituents. Care shall be taken to avoid entraining air in to the paint while stirring. The paint shall be strained through a muslin cloth or 60 mesh sieve before use.

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3.1.2 Preparation of the paint AA 56135 (HE 5043)

This paint has a short pot life of 4 hours only. Hence it is important to note that only sufficient paint be mixed for immediate requirements and the paints be used within 4 hours from the completion of mixing of base and accelerator. Shortly before mixing and use, these shall be thoroughly stirred. The base and accelerator shall then be accurately mixed together in the following proportions.

Supplier	Base	Accelerator
	(by volume)	
Asian Paints	4	1
Bombay Paints	4	1
Berger Paints	3	1
Shalimar Paints	1	1

The accelerator shall be added to the base slowly with continuous stirring. After the addition of all the accelerator, contents shall be stirred continuously until a uniform consistency is obtained. The mixing of paint can be done by hand or mechanical stirring.


3.1.3 Preparation of the paints to AA 56105 &c AA 56131

Both these paints as supplied, consist of two separate ingredients; namely base and accelerator.

Shortly before mixing and use, these shall be thoroughly stirred. The base and the accelerator shall be accurately mixed together in the proportions as given below for material supplied by different suppliers.

Supplier's Name	Paint Specification	Mixing Ratio in parts by Volume	
		Base	Accelerator
Shalimar Paints	X AA 56131	3	1
Berger Paints	X AA 56131	3	1
	X AA 56105	3	1
Alkali & Chemicals	X AA 56131	4	1
	X AA 56105	6	1
Goodlass Nerolac	X AA 56131	3	1
	X AA 56105	3	1
Garware Paints	X AA 56131	3	2
	X AA 56105	5	1
Asian Paints	X AA 56131	4	1
	X AA 56105	3	1

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Accelerator should be added to the base and not the base to the accelerator. The paints shall be mixed with continuous stirring until a uniform consistency is obtained.

NOTE : After mixing, these paints shall be used within 4 hours.

3.2 Consistencies of the paint

The paints shall be used at the following consistencies measured in flow cup No.4 under the normal shop temperature.

Sl.no.	Paint	Consistency
i)	Chemical Resistant Epoxide Priming Paint to AA 56105	30 to 50 sees
ii)	Chemical Resistant Epoxide Finishing Paint to AA 56131	40 to 60 sees
iii)	Oil Resistant. Air drying Synthetic Enamel to AA 56132	60 \pm 5 sees
iv)	High build Black Coal Tar Epoxide Paint to AA 56135 (HE 5043)	See note-1 below

Note:- 1) For AA 56135 the maturing time for mixture of base and accelerator before actual use shall be 30 minutes. Thinning of AA 56135 (HE 5043) is not recommended. If there is problem in application of paint, TSD should be consulted.
The mixed paint shall be used within 4 hours.

2) Thinning of AA 56132 to be done by white spirit to AA 56701.


3) Thinning of AA 56131 & AA 56105 is to be done by its special thinner.

4. BRUSHING :

4. 1 General

It is necessary that a full, uniform coat of paint to be applied, free from voids such as brush marks and pin holes, and from contamination such as dirt and dried paint left in brushes. Accordingly no paint shall be left in a brush at the end of a working shift, but instead the brushes shall be cleaned as follows:

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4.2 Cleaning of Brushes

In case of painting with AA 56132 cleaning of brush to be done by means of white spirit to AA 56701. In case of painting with AA 56135, cleaning of brush to be done by means of Xylol to AA 56703, while that with AA 56131/ AA 56105 cleaning is done by means of epoxy thinner.

Before the paint in the brush has dried, the bristles shall be “worked” in a small amount of white spirit to AA 56701/ Xylol to AA 56703/ epoxy thinner in a can. The bristles shall then be lifted clear from white spirit to AA 56701/ Xylol to AA 56703/ epoxy thinner, and the brush “twirled” by rolling the handle vigorously between the palms of the hands. This procedure shall be repeated until the brush shall be seen free from paint inside the head. The brush shall then be rinsed, with the same working as before, in a small amount of white spirit to AA 56701/ Xylol to AA 56703/ epoxy thinner and the excess thinner AA 56701/ AA 56703/ epoxy thinner finally removed either by vigorous "twirling" as before, or by blowing out with clean compressed air.

4.3 Use of brush

The brush shall be dipped into the prepared paint of brushing grade (clause 3.2 above) to a depth corresponding to about half the length of the bristles, and the brush then lightly squeezed out against the side of the container, so that the bristles are thoroughly wetted but not overloaded. The paint shall then be brushed on in all directions so as to cover completely the surface to be painted, and finally laid off in two directions. The laying off shall be done quickly, deftly and with uniform pressure of the brush tip.


5. **SURFACE PREPARATION :**

5.1 For Machined Surface

All machined surfaces shall be cleaned and degreased with white spirit to AA 56701, any rust or staining being carefully removed by abrasive paper of 220 No. and again cleaned with white spirit to AA 56701.

The surface shall then be thoroughly dried by a blast of air or dry cloth.

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5.2 For Unmachined Surfaces.

Preparation shall be carried out after stress relieving, annealing and where necessary, after rough machining.

- 5.2.2 All scale and corrosion residues shall be completely removed by shot blasting. The shot blasted surface shall conform to Grade SA 2.5 of Swedish standard SIS 055900. First coat of primer paint shall be applied within 24 hours of completion of shot blasting, to control on-set of corrosion on the surface. Before application of the paint, condition of the surface shall be visually examined. In case of any deficiency the surface shall be cleaned by suitable means (Wire brushing/ shot blasting.)

In rare cases of fabrications too large for the shot blast chamber:, all plates etc. before welding shall be shot blasted. After welding they shall be treated with stearic acid jelly to BP 55192 as temporary protective within 24 hours. After stress relieving the soft scale formed on such large jobs shall be removed by wire brushing, welding scale by vacublast or by careful chipping and scraping followed by wire brushing prior to painting within 24 hours of the cleaning.


- 5.2.3 The following sequence shall be followed for Air receivers. The inside surface of end bells shall be shot blasted before fabrication. All weld spatter shall be removed, the receivers stress relieved and the surfaces prepared by brushing with hand or mechanical wire brush.
- 5.2.4 Immediately prior to painting or treatment all dust, loose scale, rust shall be removed and degreasing done by using white spirit to M 56701.

5.3 For Concrete Embedded Surfaces

All concrete embedded surfaces shall be treated with cement wash as below.

- 5.3.1 Oil and grease shall be removed by using white spirit to AA 56701. Thereafter all dust, loose scales, rust etc. shall be removed by sand/ shot blasting to Swedish Standard SIS 05500 Gr SA 2.5.
- 5.3.2 Cement wash shall be prepared by mixing 15 to 20 Kg of latex emulsion (2.11) or 30 Kg of Polyvinyl Acetate Based Adhesive (2.12) with 100 Kg of dry cement. In order to make the process easier cement shall be made into slurry by adding 40-50 litres of water and then latex emulsion or Polyvinyl Acetate Base Adhesive is added. This shall be applied to the surface by brush

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5.3.3 After 8 hours of application, water shall be sprinkled on the coated surface to facilitate curing of cement. Setting time for the cement wash is 24 hours.

6. APPLICATION OF' PAINTS :

6.1 The paints prepared as per Clause 3.1 and 3.2 shall be applied as shown in the schedule in Clause 6.4.

In case of machined surfaces the paint shall be applied immediately after the surface preparation as per Clause 5.1 while in case of unmachined surfaces the paint shall be applied within 6 hours of preparation of surfaces as per Clause 5.2. For unmachined surfaces in the event of more than six hours elapsing, before application of paint is done, the preparation as detailed in Clause 5.2 above shall be repeated in full.

6.2 Drying Time :


The following drying schedule should be followed after the application of the paints.

Sl.No.	Paints	Drying Time
i)	High Build Black Coal Tar Epoxide Paint to AA 56135	18 hours
ii)	Oil Resistant, Air Drying Synthetic Enamel to AA 56132	16 hours
iii)	Chemical Resistant Epoxide Priming paint to AA 56105	16 hours
iv)	Chemical Resistant Epoxide Finishing paint to AA 56131	16 hours

6.3 Sanding :

Between any two successive coatings. immediately after the former coat of painting is dried as per Clause 6.2 sanding to be done on this coat by using water proof abrasive paper 220. The loose dust shall now be wiped off by a blast of air or dry clean cloth and then the later coat of paint be applied.


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6.4 Schedule of paint Application :

Description of surface	Category of paint	Typical Example	Preparation	Painting or Treatment
Machined surfaces Un-mated and not water immersed	A	Full return motion gear.	As detailed in para 5.1	Apply two coats of AA 56105 & 2 coats of AA 56131.
Un-mated, water immersed machined surfaces	B	Discharge ring (Runner envelope). Francis runner, Top cover, Pivot ring and liner faces.	As detailed in para 5.1	Apply two coats of AA56105 followed by 2 coats of AA 56135
Direct water passages and other water immersed unmachined surfaces	C	Draft tube (internal), Guide Vane, Spiral Casing (internal), stay ring (internal) Runner passages, Sph. & B.F. Valve bore, Foundation ring (internal), Pivot ring, Top cover (Part)	As detailed in para 5.2	Apply two coats of AA56105 followed by 2 coats of AA 56135
Un-mated surfaces in contact with oil	D	Main bearing housing oil sump interior, servo pistons, interior of governor servomotor and components, Kaplan hubs (internal).	As detailed in para 5.2	Apply two coats of AA56132 Jasmine yellow)
Note :- For the components which are in contact with oil no other paint is to be used.				
Concrete embedded surfaces	E	Draft tube (external), Foundation ring (external), Pit liner (external), Stay ring	As detailed in para 5.3	Liberal application of Cement wash

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		(external), Spiral casing (external)		
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Description of surface	Category of paint	Typical Example	Preparation	Painting or Treatment
All other unmachined surfaces	F	Pressure Receivers (external), Regulating Ring, Regulating gear, Sph. & B.F.Valve (external), Non Embedded Spiral Casing (external), Governor Servomotors and components (external), Top Cover (external).	As detailed in para 5.2	Apply two coats of AA 56105 and 2 coats of AA 56131
Mated machined surfaces and polished metal	G	Pivot ring, Foundation ring, Top cover, Regulator ring, Stay ring Top and bottom faces and bore, Screw Threads, Guide Vane bedding faces, G.V. stem shaft journal	As detailed in para 5.1	To be coated with liberal coat of rust preventive to AA 55154 to get jet black finish.

- Note 1: Complete painting of the machines as per Clause 6 shall be done in the factory only. An extra coat of finishing paint can be applied at site if felt necessary by PPD.
- Note 2: After receipt of machines at site, patch repair on any damaged area shall be done immediately with paint, temporary rust preventive as the case may be.
- Note 3: In case of machines to be stored for prolonged period, a schedule of checking for paint damage after every six months shall be carried out and damaged area if any shall be repainted.
- Note 4: During despatch of a machine, suitable protection such as tarred felt, water proof paper or polythene sheet must be provided between machined surface and packing wood to avoid corrosion due to., exudation of chemicals from wood.

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Note 5: If any special thickness of AA 56135 (HE 5043) is required then more than 2 coats of AA 56135 (HE 5043) are required. The same to be mentioned on the drawing.

Note 6: The journal and other critical surfaces shall be finally wrapped with a soft metal sleeve for protection against mechanical damage.

Note 7: Customers be advised to repaint the machinery as soon as they notice that top coat of the paint has been damaged to avoid surface getting corroded. Repainting on corroded surface does not afford any protection unless rust is again thoroughly removed before repainting.

6.5 Thickness of finished paint film

The thickness of dried paint film after 4 coats shall be as below, when measured by using a suitable instrument for non- destructive measurements of coats as detailed in IS: 6012 - 1971.

Category of paint	Thickness of finished paint film (Microns)
A & F	90 to 140
B & C	170 Min.

Note :- In case specified thickness of paint film is not achieved then additional coats of finishing paint shall be applied.

6.6 Thickness of Cement wash :

Average built up thickness - 200 Microns Min.
(Dry film thickness)


Note - At some isolated areas lower thickness up to 15 % of average built up is allowed.

6.7 Adhesion by Tape Test (For C,D & F Category of Paint) :

6.7.1 Adhesion By Tape Test

This test is carried out by applying & removing pressure sensitive adhesive tape over cuts made in the paint film to ensure that adhesion of paint film to metallic substrate is adequate.

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The test shall be carried out generally in line with ASTM D 3359 except that Transparent Pressure Sensitive Adhesive Tape of 25 mm width, shall conform to IS : 2880 or should bear ISI mark.

Method A of ASTM D 3359 shall be followed in case thickness of film is greater than 125 microns & acceptance criterion shall be "4A" Viz trace peeling or removal along incisions, and method B of ASTM D 3359 shall be followed when thickness of paint film is between 50 to 125 microns and acceptance shall be "4B", viz small flakes of coating are detached at intersections, less than 5 % of the area is affected.

NOTE : This Product Standard is issued based on letter . no. TSD/SM/400 dated 16/03/1994 of TSD & replaces Plant Standard no. BP C67 4180.

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